EFFECTS OF A CARBON TAX ON THE MONGOLIAN ECONOMY

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Abstract: As a climate mitigation policy, carbon tax has proven to be an efficient measure for reducing carbon emissions by addressing the market failure of negative externalities. In this report, we evaluate the feasibility and effects of a carbon tax on the Mongolian economy. Based on international standards, we assess the impact of a baseline scenario and three alternative scenarios. Using the Climate Policy Assessment Tool (CPAT) from the IMF and the World Bank, we find that the baseline scenario with a low carbon price would ensure a carbon emissions reduction of 7.3% by 2035 and have substantial welfare effects (3.6% of GDP), while having a limited impact on GDP and inflation. However, it would fall short of achieving the NDCs, which require a much higher carbon price. The tax will be levies at point of extraction or importation and its revenues are distributed to low-income households via a lump-sum rebate. We also discuss the implementation and public communication policies for the carbon tax.

Keywords: Carbon tax, Energy prices, Redistribution policies, Impact on households
JEL classification: H21, H23, H31

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Executive Summary

This report assesses the feasibility and impact of implementing a carbon tax in Mongolia, aiming to support the country's commitment to reducing greenhouse gas emissions in line with its Nationally Determined Contributions (NDCs) under the Paris Agreement. The report evaluates various scenarios using the Carbon Pricing Assessment Tool (CPAT) from the IMF and the World Bank to analyse the economic, environmental, and social implications of a carbon tax.

The Mongolian economy is heavily reliant on coal, both as a major export and a primary source of energy, posing significant challenges for transitioning to a low-carbon economy. However, the carbon tax is identified as an efficient measure to address the market failure of negative externalities and to promote innovation in low-carbon technologies. The baseline scenario with a low carbon price projects a 7.3% reduction in carbon emissions by 2035, substantial welfare benefits, and limited impacts on GDP and inflation. Yet, this scenario falls short of achieving the NDCs, which require a higher carbon price.

The report also examines fiscal impacts, with revenue projections reaching 3.6% of GDP in the baseline scenario and higher in alternative scenarios. These revenues can be redistributed to low-income households through a lump-sum rebate to mitigate the regressive nature of the tax. Additionally, the share of renewable energy in total power production is expected to increase significantly under higher carbon price scenarios.

Key strategies for implementing the carbon tax include a gradual tax increase to allow adaptation, integrating redistribution mechanisms, and sector-specific considerations due to Mongolia's coal dependency. Public communication and support for complementary policies, such as promoting renewable energy, are necessary to ensure the effectiveness and public acceptance of the carbon tax.

Future research should focus on evaluating additional climate mitigation instruments and the potential for rapid renewable energy development. Regional cooperation in carbon pricing could also provide broader insights into effective climate policies.

The report is structured as follows; Chapter 2 provides a comprehensive literature review. Chapter 3 discusses the design of a carbon tax for Mongolia. Chapter 4 evaluates the expected impacts using the CPAT model, Chapter 5 addresses implementation strategies and policy implications, and Chapter 6 concludes with a summary of findings and future policy directions.

I. Introduction

Climate change poses a significant challenge globally, necessitating effective policies to mitigate its impacts. The *carbon tax* is found to be the most efficient climate mitigation policy to reduce greenhouse gas emission at least cost (Macaluso et al., 2018). By addressing the market failure of negative externalities, a carbon tax encourages innovation in low-carbon technologies and aligns economic activities with environmental sustainability. However, its implementation raises concerns about potential negative impacts on households, particularly through higher energy prices, which could disproportionately affect the most vulnerable households. Therefore, it is essential to design and implement redistribution policies alongside the carbon tax to mitigate these adverse effects.

This report has several objectives. First, it assesses the current state of Mongolia from an environmental and economic perspective. Second, it designs a carbon tax framework and evaluates its economic and environmental impacts. Third, it seeks to develop a comprehensive implementation framework tailored to the specific needs and conditions of the Mongolian economy. Finally, the report proposes effective redistribution policies to mitigate adverse effects on vulnerable households.

In the context of Mongolia, understanding the implications of a carbon tax is particularly crucial. Mongolia is a small open economy and heavily reliant on coal, as a major export and a primary source of energy. This dependency exacerbates the challenges of transitioning to a low-carbon economy. Nonetheless, Mongolia has committed to ambitious international climate agreements to significantly reduce carbon emissions. Through its Nationally Determined Contributions (NDCs) target set in 2019, the Government of Mongolia aims to reduce greenhouse gas emissions by 23.6% as of 2030 compared to 2010 levels.

At the world level, around 25% of the carbon emissions are covered by a carbon price. Except for Israel and Turkey, all OECD countries have implemented a carbon price. Carbon pricing instruments are divided into two main categories: carbon taxes and Emissions Trading Systems (ETS). Currently 73 carbon taxes or ETS exist around the world. Carbon taxes have been introduced in a total of 37 countries. Carbon taxes address the issue of negative externalities applying the “polluter pays principle”. It can also be an important tool for prompting innovative economic activities (Goulder & Hafstead, 2013; Williams III & Wichman, 2015).

The carbon tax generates revenue for the government to be redistributed, leading to better distributional outcomes than regulations (Fullerton & Muehlegger, 2019) and subsidies for renewable energy (Borenstein, 2017). Despite its advantages, the public and political support for carbon taxes is lacklustre (Sterner, 2012) mostly due to perceived fairness (Dietz & Atkinson, 2010; Maestre-André, Drews, & Van den Bergh, 2019; Douenne & Fabre, 2022). Another impediment to the promotion of the carbon tax is its potential impact on the economic activity and inflation. A negative impact on the economic activity could be compensated by large welfare effects and the impact on inflation by redistribution policies.

Using a rich set of data, we conduct in a first step a thorough assessment of the structure of the Mongolian economy about carbon emissions and reduction objectives, energy composition and price and its impact on inflation. In second step we use the Climate Policy Assessment Tool (CPAT), an advanced modelling framework developed by the IMF and the World Bank (Black et al., 2023) to design and evaluate climate mitigation policies. The model provides comprehensive estimates on the macroeconomic impacts, CO2 price trajectories, emission reductions, revenue generation, and redistribution effects. It also includes social welfare assessments.

We design a base scenario for a carbon tax implemented in 2025, with rates increasing from USD 1 to USD 10 per ton of CO2 by 2035. The base scenario aims to minimise the impact on the economy and households while having a significant impact on carbon emissions. Three alternative scenarios are also assessed, corresponding to a half-price scenario and two more extreme scenarios, in line with the NDCs and with global warming limited to 2°C, respectively. We target a large coverage of the tax by energy source, activity, and industry. All the revenue generated from the carbon tax will be redistributed to low-income households to mitigate any adverse economic impacts. Over a five-year period, we assume a phase-out of subsidies to energy producers, along with an end of price controls.

The CPAT results reveal significant findings for Mongolia's carbon tax implementation across different scenarios. While the Baseline and Alternative 1 scenarios are insufficient to meet the global 2°C warming limit, they have a significant impact on greenhouse gas reduction (7.3% and 4.2%) with a small impact on GDP and prices. The high tax of Alternative 2 can achieve notable emission reductions of 29.7% by 2035 and 23.6% in 2030 to align with NDCs.

The fiscal impact of the carbon tax is substantial, with revenue projections reaching 1.8% of GDP in the Baseline, 1.0% in Alternative 1, and significantly higher at 11.7% and 7.8% in Alternatives 2 and 3 by 2035. Moreover, the carbon tax is projected to promote renewable energy, increasing its share in total power production to 22% in the Baseline and to 40% in Alternatives 2 and 3. Welfare benefits, including reductions in infant mortality and air pollution-related deaths, are immediate and substantial. Finally, total welfare benefits range from 3.6% of GDP (Baseline) to 9.6% of GDP (Alternative 3) by 2035.

The implementation of a carbon tax in Mongolia requires a multifaceted approach to ensure its effectiveness and mitigate potential negative impacts on households and the economy. Key strategies include designing a gradual tax increase to allow businesses and consumers to adapt and integrating redistribution mechanisms to offset the regressive nature of the tax. This involves using tax revenues to fund direct rebates to low-income households. Additionally, sector-specific considerations are crucial, given Mongolia's heavy reliance on coal. The report also emphasizes the importance of public communication to ensure support. Implementing complementary policies, such as promoting renewable energy, further enhances the overall effectiveness of the carbon tax.

Future research on climate mitigation in Mongolia should focus on the evaluation of various instruments. Amongst them, one should evaluate the potential for a faster development of renewable energy sources. Investigating the social acceptance of carbon taxes and public awareness campaigns is also crucial. Additionally, research should consider the impacts on specific sectors, particularly those heavily reliant on coal. Finally, analysing the potential for regional cooperation in carbon pricing could provide broader insights into effective climate policies.

The report is organized as follows. Chapter 2 provides a comprehensive literature review. Chapter 3 delves into the design of a carbon tax. Chapter 4 evaluates the expected impacts of the proposed carbon tax using the CPAT model, highlighting economic, environmental, and welfare outcomes. Chapter 5 addresses implementation strategies and policy implications. The report concludes with a summary of findings and suggestions for future policy directions.

II. Literature Review

2.1 Carbon pricing around the world

OECD member countries have introduced carbon pricing instruments as a climate mitigation policy, except for Israel and Turkey. Several non-OECD countries have also implemented such instruments (e.g., Argentina, South Africa). According to World Bank, carbon pricing is an instrument that captures the external costs of greenhouse gas (GHG) emissions – the costs of emissions that the public pays for, such as damage to crops, health care costs from heat waves and droughts, and loss of property from flooding and sea level rise – and ties them to their sources through a price, usually in the form of a price on the carbon dioxide (CO2) emitted.

The concept of negative externalities and the Pigouvian tax was first addressed in *The Economics of Welfare* (Pigou, 1920) one hundred years ago, which brought on the widespread acceptance of the "polluter pays principle". This principle argues that those who produce the negative externality of pollution should be held liable for managing it to prevent damage to the environment and human health. Thus, it stands to reason that taxing carbon emissions leads to greater environmental and health benefits.

Carbon pricing instruments are divided into two main categories: carbon taxes and Emissions Trading Systems (ETS). Currently, 73 carbon taxes or ETS exist around the world (State and Trends of Carbon Pricing 2023). Most countries that have introduced both carbon taxes and ETS are high income countries in North America and the European Union. Carbon taxes have been introduced in a total of 37 countries, most of them in North and Latin America and Europe. Asian countries have introduced more ETS than carbon taxes. The implementation of ETS requires a large number of firms and diversity in terms of sectorial activity to trigger permits exchange between firms, polluting less than allowed and those polluting more.

According to World Bank, carbon pricing (carbon tax and ETS) in operation cover around 23% of global GHG emissions. The ETS in the European Union has reduced the carbon emissions by 14% to 16% with no detectable contraction of the economic activity (Colmer, Martin, Muûls, & Wagner, 2023). The carbon tax is the most efficient climate mitigation policy to reduce greenhouse gas emission (Macaluso, et al., 2018). It can also be an important tool for prompting innovative economic activities (e.g., Goulder and Hafstead, 2013; Williams, 2016). Yet, without redistribution policies, it can lead to higher inequality across sectors and population segments due to its regressive nature. If distributional implications are not sufficiently considered, the poorest and most vulnerable households could bear the heaviest tax burden. (Känzig, 2023), for example, documents using EU data that an increase in a carbon tax rate affects the poor relatively more than the rich, a distributional effect that can be offset by making the income tax schedule suitably more progressive. (Jia, Lin, & Liu, 2023) find that direct taxation at the household level without revenue redistribution policies increases inequality, while direct taxation at the firm level does not. The observed inequality at the household level is explained by the fact that energy (whose price increases due to the tax) costs as a share of total expenditure are higher for low-income households than for high-income households.

A relatively high tax on fossil fuels alone will cause firms that are highly dependent on such fuels to improve their technology. The higher fossil fuel price will work like an invisible tax on carbon footprint. So, the high carbon tax on energy production companies can indirectly meet the emission mitigation objective.

Aside from being an efficient way to reduce carbon emissions, there are many economic benefits to adopting a carbon tax. The most prominent advantage of such an instrument is that it achieves environmental goals at least cost (Baumol & Oates, 1988). The efficiency gains have static and dynamic dimensions (Gandhi & Cuervo, 1998). Static efficiency gains are achieved when firms reach cost effectiveness by reducing their emissions up to the point where the marginal cost of abatement equals the marginal cost of polluting. Dynamic efficiency gains result from the incentives provided by the price mechanism to pursue R&D in pollution abatement and energy efficient technologies.

Furthermore, the carbon tax generates revenue for the government to be redistributed. If this revenue is recycled progressively, carbon taxes have better distributional implications than regulations by efficiency standards (Fullerton & Muehlegger, 2019) and subsidies for renewable energy (Borenstein, 2017).

So, if a carbon tax is both efficient and potentially equitable (Sterner, 2012), why has public and political support for this instrument been lacklustre? An important reason for the lack of enthusiasm is that design flaws in carbon tax policies could result in major drawbacks. In general, perceived fairness is an important factor for public support of carbon pricing (Dietz & Atkinson, 2010; Maestre-André, Drews, & Van den Bergh, 2019; Douenne & Fabre, 2022). In reality, people differ, however, in what they think is fair (Haidt, 2007). For instance, different perceptions of fairness may imply allocations in which resources from the carbon tax are distributed to everyone (equality), the poorest or most vulnerable (equity) or those who create most value for society (merit) (Sommer, Mattauch, & Pahle, 2022).

Another impediment to the promotion of the carbon tax is its potential impact on the economic activity and inflation. Several studies explore the effects of a carbon tax on the economy, all with varying results. Mabey, Hall, Smith, & Gupta (1997) conducted a comprehensive review of the studies examining the effects of a carbon tax and show that results vary depending on underlying assumptions (Table 1 in the Appendix). More recent studies, such as (Goulder & Hafstead, 2013) calculate that imposing a carbon tax with an initial rate of USD 10 per ton and rising at 5% per year would result in GDP levels being 0.6% lower than the baseline level in 20 years. Williams III & Wichman (2015) find that a carbon tax will likely impose a small but significant long-term drag on the economy, but using the revenue in ways that promote long-run economic growth will offset most of that negative effect and potentially lead to a net economic gain.

Alonso & Kilpatrick, (2022) study the price impact of a carbon tax on households in countries in the Asia Pacific region. They find that, on a regional level, imposing a carbon tax of USD 50 per ton CO2, coal prices would increase by 214% in Australia, and electricity prices would rise by 300% in Mongolia, given its heavy dependence on coal. In terms of the tax burden of higher prices, of all selected countries, it is heaviest in Mongolia, where the poorest 20% of the population is affected most severely.

2.2 The Mongolian Context

Although Mongolia has long taken an active part in international agreements and global initiatives against climate change, it is only recently that serious attention is being directed towards this issue. Currently, the Government of Mongolia (GoM) and other relevant policy authorities are formulating policies targeted at reducing the adverse impacts of climate change and promoting green and sustainable businesses.

Mongolia has joined the United Nations Framework Convention for Climate Change (UNFCCC) in 1992 and later, the Paris Agreement in 2016. In line with the Paris Agreement, Mongolia approved its Nationally Determined Contributions (NDC) target in 2019, which sets the aim to cut GHG emissions by 22.7% by 2030 in a business as usual (BAU) scenario compared to 2010 levels (Ministry of Environment and Tourism of Mongolia, 2018). Within the context of its NDC target, significant policy actions have been lined up against mitigation scenarios at the national and sectoral levels. The total GHG reduction path projected until 2050 through policy measures is depicted in Table 1.

Table 1. Projected GHG mitigation potential by implementing sectoral policies by 2050

		2025	2030	2040	2050
	Sectoral actions				
	Total Emission Reductions, Mt CO2e	**8.536**	**14.937**	**20.369**	**26.65**
1	Energy	5.9	9.3	11.5	14
1.1	*Use of renewable energy*	*2.100*	*3.1*	*3.5*	*3.9*
1.2	*Energy efficiency improvement scenario*	*3.800*	*6.2*	*8*	*10.1*
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	5.445	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*	*0.02*	*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 Accounting for Forest Removals, Mt CO2e		**10.642**	**19.356**	**26.835**	**35.156**
5	Enhancement of forest removals	2.428	4.791	6.944	9.097
5.1	*Expansion of forest-covered area*	*2.428*	*4.791*	*6.944*	*9.097*

Source: Ministry of Environment and Tourism of Mongolia

In accordance with the above-mentioned international agreements and commitments, the GoM has taken the initiative to include ambitious climate change objectives in its long-term policies and strategies such as the Vision 2050 Long-Term Development Plan. Perhaps most relevant is Objective 6.4 of the Vision 2050, which states that the GoM shall facilitate the development of a low-carbon, productive, and inclusive green economy, and contribute to the global agenda to mitigate climate change. This objective is divided into three phases.

- *Phase 1* (2021-2030): To create and foster the development of a national green finance framework and to promote environmentally friendly, efficient, and clean technology and austere consumption.
- *Phase 2* (2031-2040): To promote smart consumption and efficient production, and to increase domestic and foreign sources of green and climate funding.
- *Phase 3* (2041-2050): To continuously strengthen climate change resilience, and to refine sustainable production and consumption.

Aside from such sizable efforts from the GoM thus far, it is perhaps noteworthy to add that in Mongolia, the green/sustainable finance agenda is spearheaded by the private sector. As the international landscape changes to introduce increasingly Paris-aligned requirements, domestic banks have moved quickly to introduce green initiatives into their operations. Such initiative by the private sector has laid the foundation for the green finance policy framework in Mongolia. In 2019, the Mongolian Sustainable Finance Association (MSFA), the Bank of Mongolia, and other relevant organizations developed the Green Finance Taxonomy for financial institutions to use in classifying green loans. Mongolia became the second country in the world after China to introduce a green finance taxonomy in the financial sector.

Banks and non-banking institutions classify green loans according to the Taxonomy, and report to their respective regulators. The Bank of Mongolia has started to issue banking sector's green loan report on a quarterly basis since 2020Q1. As of 2023Q4, the amount of green lending by banks stands at USD 237.1 million, which is a 154% growth over 2022Q4. The share of green loans in the total banking loan portfolio has reached 2.9%, up by 100 basis points over the previous quarter.

In March 2022, the National Sustainable Finance Roadmap was approved by the Financial Stability Committee, consisting of the Bank of Mongolia, the Financial Regulatory Commission, the Ministry of Finance, and the Depository Insurance Corporation of Mongolia. The approval of the Roadmap heightened the commitment of all relevant institutions and stakeholders in furthering the green finance and climate change mitigation agenda.

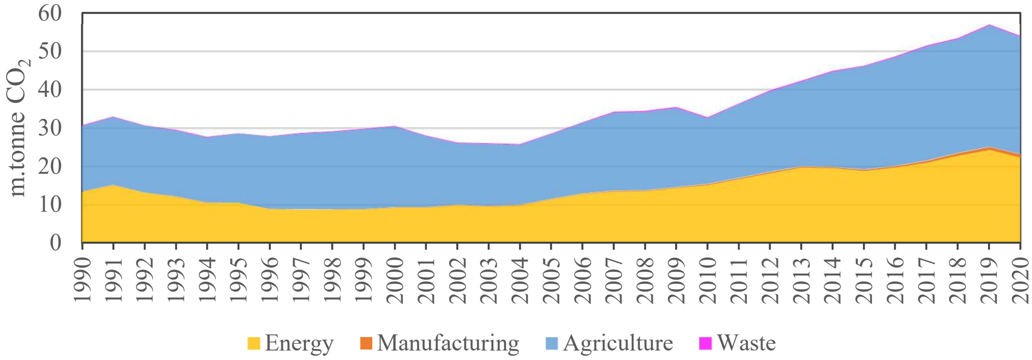
III. A Carbon Tax for the Mongolian Economy

3.1 *Assessment of the Mongolian Economy and Carbon Emissions*

As of 2020, Mongolia accounts for 0.04% of cumulative global GHG emissions. In 2020, the energy industry accounted for 41.3%, the agricultural sector for 56.6%, and other sectors for 2.1% of Mongolia's total GHG emissions (

Figure 1).

Figure 1. GHG emissions excluding land use change by sectors

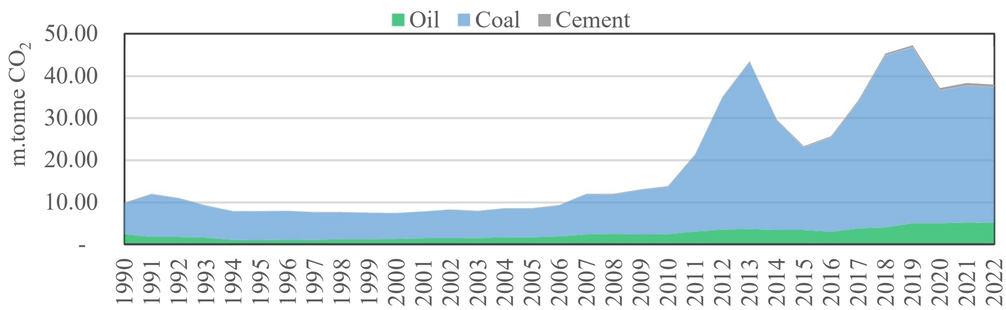


Source: World Resources Institute, 2023

The main fuel source of GHG emissions in Mongolia is coal. As of 2020, GHG emissions from coal accounts 85% of the total GHG emissions. Since 2011, Mongolia has been actively using its mining resources. As a result, since that year, the greenhouse gas emissions of Mongolia have started to increase significantly (

Figure 2).

Figure 2. GHG emissions by fuel type

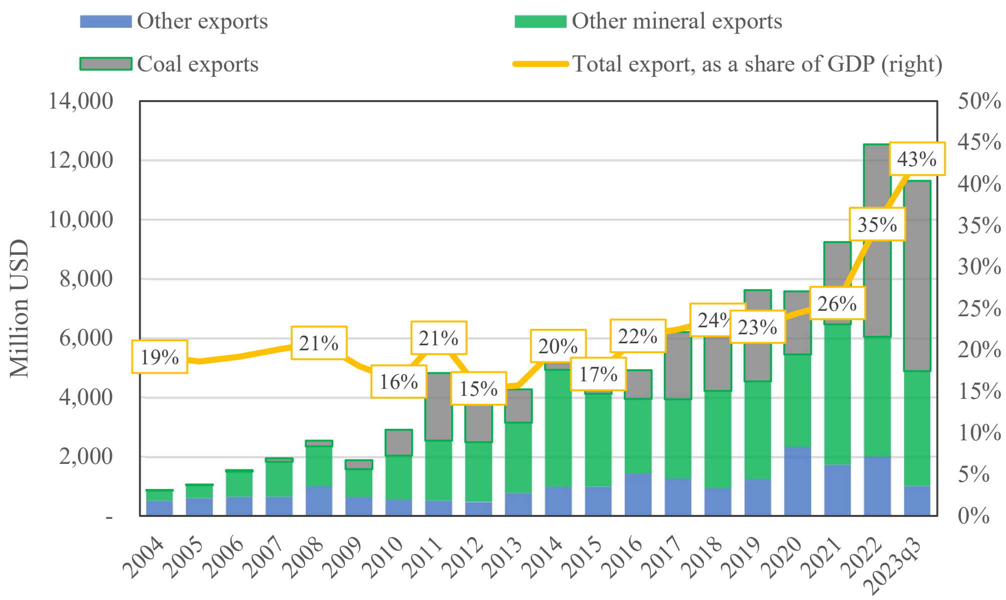


Source: *https://ourworldindata.org/*

Mongolia is a small, open economy, and its economy is heavily dependent on the mining industry. The mining sector accounts for over 90% of total exports, which is equal to 30–40% of GDP. In recent years, coal exports have been increasing, and as of the third quarter of 2023, coal exports alone accounted for 57% of total exports (

Figure 3).

Figure 3. Export dependency

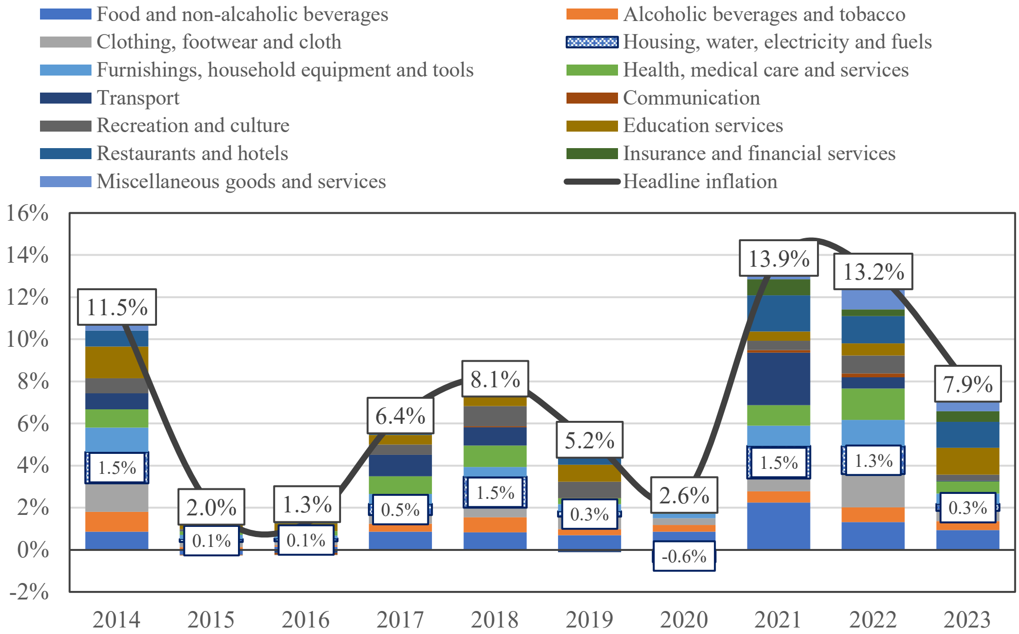


Source: General Customs Administration, National Statistics Office of Mongolia

Most businesses in the housing, water, and electricity sectors are state-owned. As a result, the price of heat and electricity varies less. Households pay less for electricity than its production costs. This restricts both the market potential for growing the supply of renewable energy and the ability to upgrade the technology of the power plants. This price rigidity was more evident during the COVID-19 pandemic. In particular, the comparatively low inflation rates of the Eurozone's housing, water, and energy sectors reached 4.1 percentage points annually in 2022, accounting for 39% of overall inflation at that time. However, the indicator peaked at 1.5% in Mongolia during the COVID-19 pandemic (Figure 4).

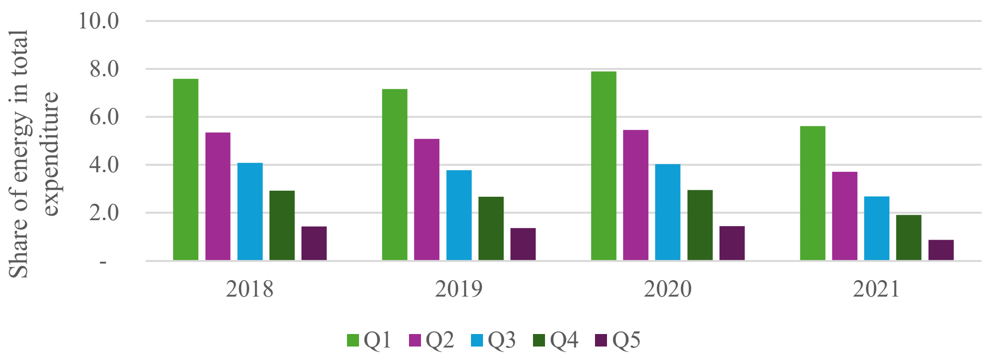
Households and firms need to shift to green energy usage. To facilitate this transition, Mongolia must reform the energy industry by removing energy price controls and halting subsidies from the government for the production of "brown" energy. if the carbon tax is imposed on the energy sector in Mongolia, the impact on inflation is likely to be relatively high.

Figure 4. Inflation composition



Source: National Statistics Office of Mongolia

Figure 5. Share of energy in household expenditure



Source: National Statistics Office of Mongolia

Mongolia is classified by the World Bank as a upper middle-income country. In Mongolia, the Gini coefficient is 0.34 and the poverty rate is 27% as of 2022. The National Statistics Office's Household Socio-Economic Survey yielded precise results that showed that the lowest-spending 10% of households had a percentage of energy costs in total expenditure of around 7%, while the highest-spending 10% of households had a share of about 1% (Figure 5).

A carbon tax levied on coal-burning activities would certainly result in a generalized increase in prices. A tax on CO2 emissions translates into higher costs for firms, especially those operating in the energy sector, and would ultimately lead to an overall increase in prices of goods as firms internalize the added cost of the tax. Therefore, the effects of a carbon tax on a country's inflation level vary depending on the structure of the economy. In Mongolia, a carbon tax would have a strong effect on inflation, as the country's energy production is heavily dependent on coal. Urgamalsuvd and Altanzul (2024) study the effects of changes in energy prices on overall price levels by using a Leontief price model for the input-output table for 2019 and find that a 28% rise in industrial energy prices would result in prices of goods increasing by 0.7 percentage points, of which 0.5 percentage points is direct and the remaining 0.2 percentage points is indirect. Energy prices in Mongolia are subject to heavy regulation by the government. In October 2022, the GoM raised industrial energy prices by 28%, which had until then remained fixed since 2019 in consideration of the COVID-19 pandemic. Thus, the baseline scenario was constructed to reflect this increase. The study proposes alternative scenarios, which are explored in detail in Chapter 4.

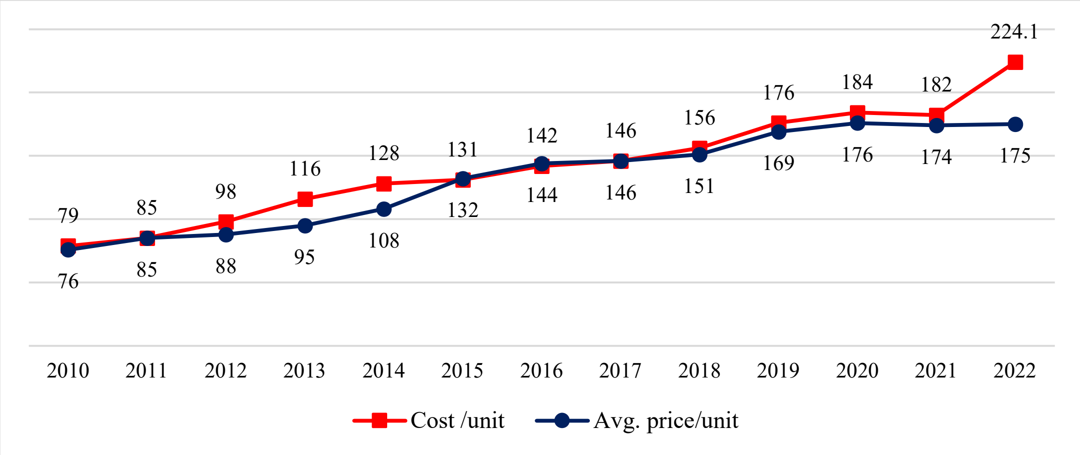
3.2 Assessment of the Mongolian Energy Sector

The energy sector in Mongolia is a strategically important and high development priority sector with implications for safeguarding national security and independence. The Mongolian energy sector consists of the Central Energy System (CES), the West Regional Energy System (WRES), the Altai-Uliastai Energy System (AUES), the Dornod Regional Energy System (DRES), and the South Regional Energy System (SRES).

As of today, there are nine power plants, the Durgun and Taishir hydropower plants, the Altai and Uliastai diesel power plants, and small-scale renewable energy sources producing energy domestically. Mongolia imports approximately 20% of its energy from Russia and the People's Republic of China.

Prices are regulated so that the power plants cannot recover the costs of producing energy (Figure 6).

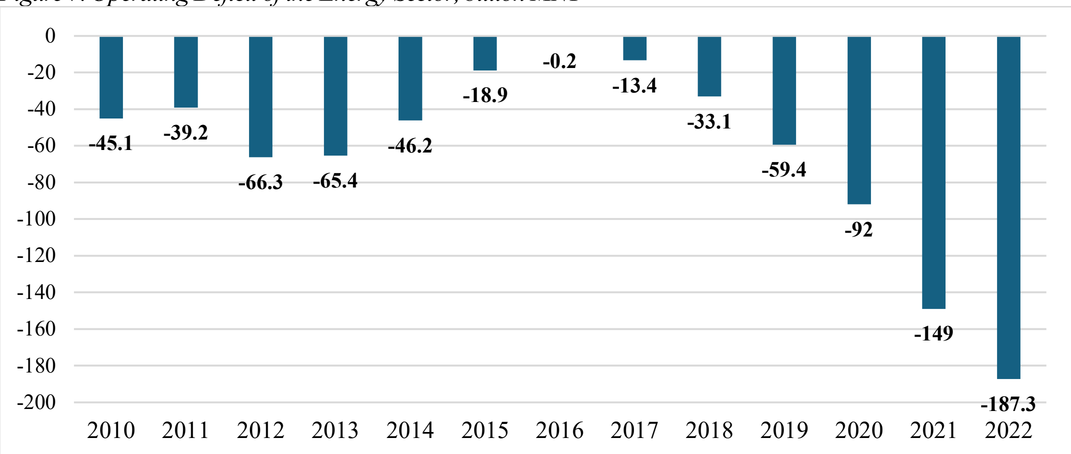
Figure 6. Production cost of electricity/unit and average sales price (central region), MNT/kWh



Source: Ministry of Energy of Mongolia

The GoM initiated and implemented various policy measures to alleviate the adverse economic effects of the COVID-19 pandemic on households and businesses, one of which was to fully cover the electricity and heating costs of all households and some private entities during the period from December 1, 2020 to June 1, 2022. For this reason, the electricity tariffs remained fixed from 2019 until 2022, when the average price jumped to MNT 224.1 per unit, up by 28% from 2019 price levels. Because electricity tariffs are set below costs, the energy sector has been operating at a significant loss (Figure 7). In recent years, the operating deficit of the energy sector has been increasing as the gap between cost and tariff has been widening. Thus, the operating loss of plants and companies operating in the sector reached MNT 187.3 billion at the end of 2022, entailing a budget subsidy of MNT 33.8 billion, which is 49.3% higher than that of 2019.

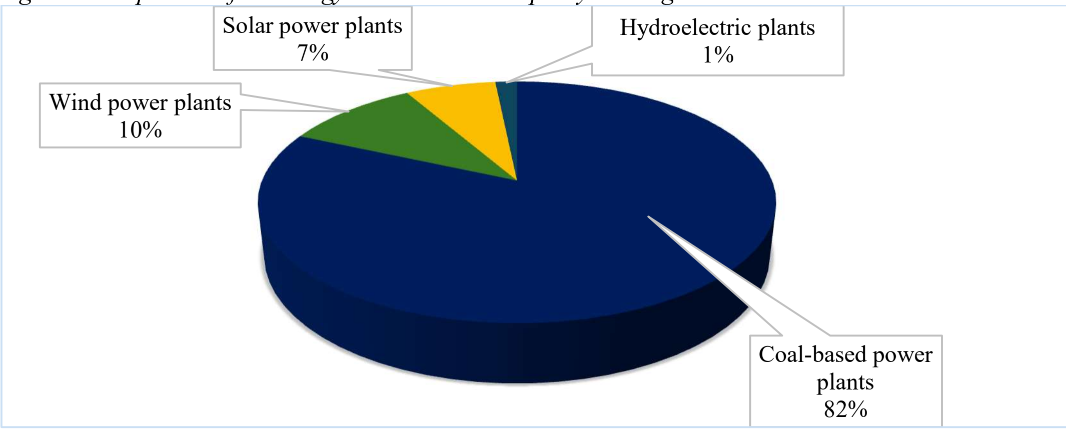
Figure 7. Operating Deficit of the Energy Sector, billion MNT



Source: Ministry of Energy of Mongolia

The installed capacity of the energy sector in Mongolia is mostly comprised of coal-based production, which accounts for 81.5% of total capacity as of 2022 (Figure 8). The GoM has set objectives to promote renewable energy production in the country through national policies and strategies such as the New Recovery Plan and Vision 2050.

Figure 8. Composition of the Energy Sector Installed Capacity in Mongolia



Source: Ministry of Energy

Production costs of renewable energy are approximately 3-5 times higher than traditional energy production costs, depending on the type of renewable energy being produced. For this reason, it is crucial to liberalize electricity prices for consumers in order to boost the competitiveness of renewable energy products. As the clean energy transition intensifies, R&D and innovation will push renewable energy prices down. At this juncture, it is crucial for policymakers to establish a competitive market-based energy pricing system in order to foster the efficiency of the sector and to attract private sector investments.

Furthermore, setting electricity prices at levels that are too low could reduce households' incentive to conserve energy and hinder the capacity to reduce carbon emissions, and ultimately, pose an impediment to the successful transition to a low-carbon economy.

3.3 Energy Price Liberalisation Effect

Before investigating the impact of a carbon tax for the Mongolian economy, it is worth considering the impact of the energy price liberalisation. Such a measure would on one hand help absorbing the public deficit due to energy subsidies and would on the other hand, allow for a more efficient use of energy, a critical step to reduce carbon emissions.

Urgamalsuvd and Altanzul (2024) has conducted a study on the direct and indirect impact of industrial energy price liberalisation on inflation using various scenarios. Table 2 summarises the results of a baseline scenario and two alternative scenarios on the energy price, CPI, GDP deflator and PPI.

Baseline scenario. *Electricity prices increase by 28% for firms.*

To release the burden from the pandemic the GoM froze electricity prices from December 2020 to June 2022, after which it decided to increase industrial electricity prices by 28%.

Alternative 1. *The cost of fossil fuel generation equals the cost of renewable energy generation.*

Renewable energy generation costs 3 to 5 times more compared to fossil fuel energy. To enhance the production from renewable sources, the price of fossil energy should at least match the price of energy from renewable sources. Such assumption would increase the cost of fossil energy by 3.45 times to 382.5 MNT / kWh. This would trigger a surge in electricity price by 104%.

Alternative 2. *Increase of the coal price to match production cost.*

The coal price used for energy production is controlled and set under the market price. The coal mining companies submitted a proposal to the Energy Regulatory Commission to increase the coal price by around 45% to better reflect the market price.

Table 2. Increase in energy price and inflation after industrial energy price liberalisation

Scenario	Energy price	CPI	GDP deflator	PPI
Baseline scenario	28%	0.76%	0.77%	0.78%
Alternative 1	104%	5.55%	3.58%	3.66%
Alternative 2	45% increase of the coal price	0.19%	0.21%	0.23%

Source: Urgamalsuvd and Altanzul (2024)

Overall, an energy price increase of around 1/3 triggers an increase of various measures of inflation of less than 1%. On the other hand, a fossil fuel energy price at the same level as renewable energies would impose a high burden on inflation (more than 5% in consumer price inflation). To enhance the production of energy from renewable sources, a gradual increase in the price of fossil fuels is advocated, along with improved technologies to reduce the cost of renewable energies.

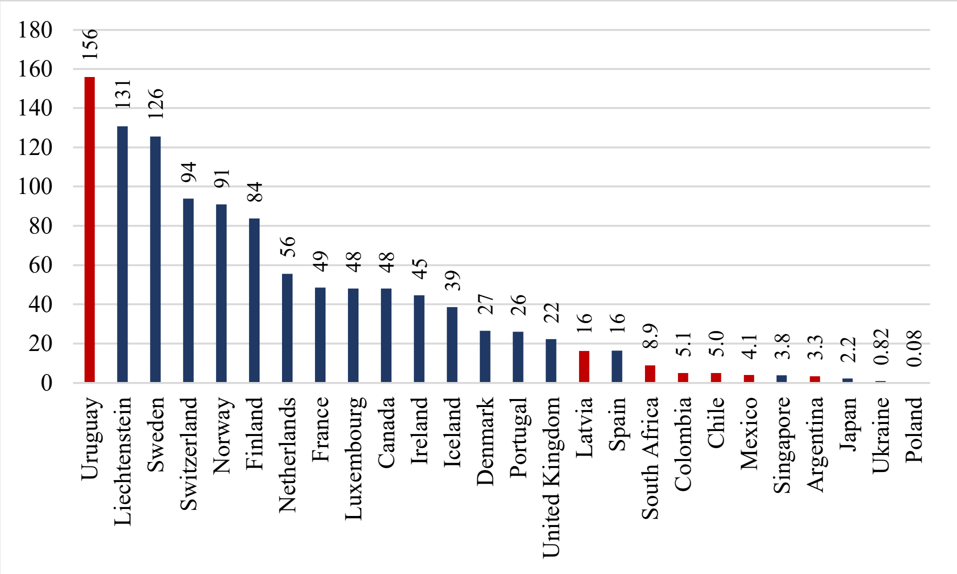
3.4 Design of a Carbon Tax for the Mongolian Economy

In designing a carbon tax, we need to draw on the experience of other countries. In March 2023, the average carbon price for 26 countries was USD 42.5 per metric ton, ranging from USD 156 for Uruguay to USD 0.08 for Ukraine (Figure 9). The average across emerging countries is USD 25 and USD 10 excluding Uruguay, which has a particularly high tax. In other Latin American countries, the carbon tax oscillates around 3 to 5 USD.

Table 3 provides more details for 34 countries (and regions), exhibiting the share of covered emissions and the price evolution in USD since 2018. The carbon tax covers on average 25% of the overall emissions with a large variation, from 2% in Spain to 80% in

Liechtenstein. The average price was USD 25 per metric ton in 2023, almost at the same level as in 2018 but with a different panel composition and considering currency variations. For instance, the average price reached USD 40 in 2022.

Figure 9. Carbon Price per Metric Ton for Countries with a Carbon Tax (USD per metric ton of CO_2 equivalent, as of March 2023)



Source: Statista

Table 3. Summary of Carbon Taxes Across the World (USD per metric ton)

	Jurisdiction	**Share of jurisdiction emissions covered**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
1	Argentina	20.0%	4.9	4.5	4.8	5.1	3.2	0.9
2	Canada	30.0%		15.4	23.6	31.7	36.9	49.4
3	*British Columbia*	*70.0%*	*25.7*	*30.9*	*31.4*	*35.6*	*36.9*	*49.4*
4	*New Brunswick*	*39.0%*			*23.6*	*31.7*	*36.9*	*49.4*
5	*Newfoundland and Labrador*	*47.0%*		*15.4*	*15.7*	*23.8*	*36.9*	*49.4*
6	*Northwest Territories*	*79.0%*			*15.7*	*23.8*	*29.6*	*49.4*
7	*Prince Edward Island*	*56.0%*		*15.4*	*23.6*	*23.8*	*22.2*	*38.0*
8	Chile	29.4%	0.0	0.0	0.0	0.0	0.0	0.0
9	Colombia	23.0%	4.9	5.0	5.1	0.0	3.9	6.0

10	Denmark	40.0%	38.6	26.4	29.1	26.9	25.7	26.9
11	Estonia	6.6%	2.4	2.2	2.1	2.1	2.1	2.2
12	Finland	36.0%	86.1	86.2	80.9	80.9	80.9	83.2
13	France	35.0%	52.6	50.0	46.8	46.8	46.8	48.2
14	Iceland	55.0%	32.3	36.0	34.2	34.4	32.2	36.2
15	Ireland	40.0%	23.6	22.4	27.3	35.2	43.1	52.4
16	Japan	75.0%	2.6	2.7	2.8	2.5	2.2	2.1
17	Latvia	5.0%	5.3	5.0	9.5	12.6	15.8	16.2
18	Liechtenstein	80.6%	97.3	99.1	108.6	105.5	129.8	142.7
19	Luxembourg	65.0%				35.9	41.2	44.7
20	Netherlands	52.0%				31.5	43.8	55.2
21	Norway	63.0%	59.2	62.1	74.4	67.0	77.9	93.7
22	Poland	3.8%	0.1	0.1	0.1	0.1	0.1	0.1
23	Portugal	40.0%	0.0	14.1	13.2	24.9	24.9	25.6
24	Singapore	80.0%	0.0	3.7	3.8	3.7	3.7	3.8
25	South Africa	80.0%			8.6	8.4	8.5	8.7
26	Spain	1.9%	23.6	16.8	15.8	15.8	15.8	16.2
27	Mexico	44.0%	2.7	2.9	2.9	2.9	3.3	4.0
28	*State of Mexico*	*50.0%*						*2.5*
29	*Queretaro*	*50.0%*						*34.3*
30	*Yucatan*	*50.0%*						*16.5*
31	*Zacatecas*	*50.0%*	*12.7*	*13.3*	*14.5*	*12.2*	*12.8*	*14.8*
32	Sweden	40.0%						113.9
33	Switzerland	33.0%	97.3	99.1	108.6	105.5	129.8	142.7
34	Ukraine	71.0%	0.0	0.4	0.4	0.4	0.8	0.8
35	United Kingdom	24.0%	22.9	23.9	24.7	24.4	21.7	22.9
36	Uruguay	11.2%						154.2
	Average	**25.9%**	**25.1**	**25.9**	**27.6**	**34.7**	**40.5**	**25.9**

Source: UNCTAD and national sources

To assess the impact of a carbon tax on the Mongolian economy, we build in Table 3 a baseline scenario and consider alternative scenarios, including the carbon price evolution scenario recommended by the IMF for emerging markets. To conduct the simulations, we use the *Climate Policy Assessment Tool* (CPAT) (Black, Parry, Mylonas, Vernon, & Zhunussova, 2023) a thorough *model of models* developed by the IMF and the World Bank. This tool was put in place to design climate mitigation policies, including carbon taxes and energy price liberalisation, and to assess their impact on the economy, on the environment and on social issues. The CPAT provides great flexibility in terms of the design on the carbon tax. The user can define the start and target year, the initial and target price, energy sources to be taxed, sectors and industries covered by the tax and various redistribution policies.

The outcome is a series of detailed estimations on the macroeconomic impact (e.g., GDP), CO_2 price trajectory and comparison with a scenario of global average temperature rise of 2 degrees Celsius, coverage of CO_2 emissions and reduction due to the tax, carbon emissions distribution by sector and by type of fuel, etc. The model provides estimates on revenue and redistribution effects. The tool also considers social welfare effects from the pollution reduction attaching a monetary value to it and providing the overall impact.

In order to assess the impact of a carbon tax on the Mongolian economy, we build several scenarios based on underlying assumptions. Table 4 describes these scenarios.

Common assumptions to all the scenarios

- *Introduction and target year:* We assume a short deadline for the introduction of the tax as of 2025 and the achievement of the target price by 2035. Th target year can vary for the scenario based on Mongolian NDCs.
- *Policy coverage:* Various studies find that carbon taxes require a large tax base and are more efficient when all fuels and all sectors are targeted. This also limits leakage to non-taxed fuels or sectors.
- *Redistribution policies:* CPAT offers various options to redistribute the revenue from the tax via labour and corporate tax reductions, public investment, current spending and transfers. As we aim for a neutral tax, we allocate all the revenue of the tax to direct transfers to households. CPAT also considers the potential presence of energy subsidies to consumers and producers or energy price control and offers the possibility to phase them out. We consider a 5-year period for the phase-out of price controls and subsidies to consumers.

Specific assumptions for each scenario

- *Base scenario:* We set a low price of USD 1 per ton of CO_2 and a target price of USD 10, which is the current average carbon for emerging markets having such a tax in place.
- *Alternative 1: Precautionary scenario.* Aims at limiting the impact for the Mongolian economy of the implementation of a carbon tax. The initial and target price are set as the *half* of the base scenario.
- *Alternative 2: Scenario based on Mongolian NDCs.* GoM has committed to a reduction of CO_2 emissions by around 23% by 2030 in a BAU scenario compared to 2010 levels. It has exposed a series of measures in energy efficiency, industrial and agricultural processes optimisation, and waste management, as detailed in Table 1. In this scenario we would like to evaluate what would be a target carbon

price by 2030 if these NDCs would need to be reached via a carbon tax. We start by a fairly low carbon tax of USD 10 and simulate the target price by 2030 compatible with NDCs.

- *Alternative 3: IMF scenario compatible with 2º C.* We seek to simulate the carbon price trajectory that would be compatible with the Paris Agreement in order to limit the temperature rise to 2º C.

Table 4. Scenarios for a carbon tax in Mongolia

Scenario	**Baseline scenario**	*Alternative 1.* **Precautionary scenario**	*Alternative 2.* **Scenario based on Mongolian NDCs**	*Alternative 3.* **IMF scenario compatible with 2º C**
Description	*Moderate price considering the tax as the main tool but to be combined with other tools to reach carbon neutrality*	*Lower price to limit the impact on the households*	*Reduction of GHG emissions by 23% by 2030, compared to 2010 levels*	*Price CO_2 such that the reduction required to limit the temperature rise to 2º C is met*
	Basic data			
Introduction year	2025	2025	2025	2025
Year to reach target level	2035	2035	2030	2035
Starting carbon price per metric ton	USD 1	USD 0.5	USD 10	USD 45
Target level of carbon price	USD 10	USD 5	USD 68	USD 68
	Policy coverage			
Fuels	All fuels (Coal, Natural gas, Gasoline, Diesel, LPG, Kerosene, Other oil products)	All fuels (Coal, Natural gas, Gasoline, Diesel, LPG, Kerosene, Other oil products)	All fuels (Coal, Natural gas, Gasoline, Diesel, LPG, Kerosene, Other oil products)	All fuels (Coal, Natural gas, Gasoline, Diesel, LPG, Kerosene, Other oil products)
Sectors	All sectors (Power, Road, Rail, Domestic aviation, Domestic shipping, Residential, Other energy use)	All sectors (Power, Road, Rail, Domestic aviation, Domestic shipping, Residential, Other energy use)	All sectors (Power, Road, Rail, Domestic aviation, Domestic shipping, Residential, Other energy use)	All sectors (Power, Road, Rail, Domestic aviation, Domestic shipping, Residential, Other energy use)
Industries	All industries (Food & forestry, Services, Mining & chemicals, Iron & steel, Other metals, Machinery, Cement, Other	All industries (Food & forestry, Services, Mining & chemicals, Iron & steel, Other metals,	All industries (Food & forestry, Services, Mining & chemicals, Iron & steel, Other metals, Machinery, Cement, Other	All industries (Food & forestry, Services, Mining & chemicals, Iron & steel, Other metals, Machinery, Cement, Other

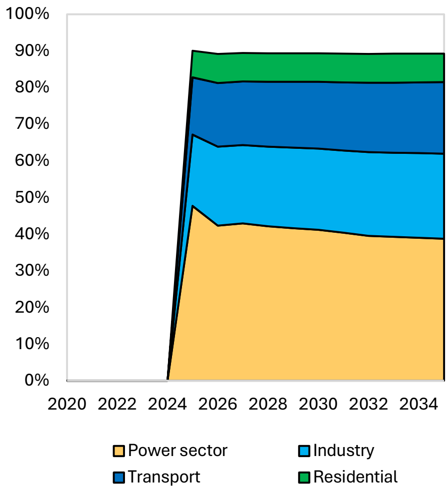
	manufacturing Construction, Fuel transformation & transportation)	Machinery, Cement, Other manufacturing Construction, Fuel transformation & transportation)	manufacturing Construction, Fuel transformation & transportation)	manufacturing Construction, Fuel transformation & transportation)
	Redistribution policies			
Phase-out of exemptions	-	-	-	-
Phase-out of fossil fuel subsidies to producers	-	-	-	-
Phase-out of fossil fuel subsidies to consumers	2025 (during 5 years)	2025 (during 5 years)	2025 (during 5 years)	2025 (during 5 years)
Phase-out of price control	2025 (during 5 years)	2025 (during 5 years)	2025 (during 5 years)	2025 (during 5 years)
USD / kwh feed-in subsidy	-	-	-	-
Labour tax reductions	-	-	-	-
Corporate tax reductions	-	-	-	-
Public investment	-	-	-	-
Current spending	-	-	-	-
Transfers	100%	100%	100%	100%
Of which	Targeted percentile: 100% Coverage rate: 100% Leakage rate: 0%	Targeted percentile: 100% Coverage rate: 100% Leakage rate: 0%	Targeted percentile: 100% Coverage rate: 100% Leakage rate: 0%	Targeted percentile: 100% Coverage rate: 100% Leakage rate: 0%

Notes. Targeted percentile: The user can choose the percentile up to which the revenue will be transferred. For instance, the target could be the 20% lowest in the income distribution. Coverage rate: Share of the population targeted and actually receiving the transfer. Leakage rate: The share of the untargeted population receiving the transfer. These transfers are all modelled as direct, per capita payments and averaged by deciles.

The CO2 emissions covered by the policy (Figure 10), energy prices (Figure 11), income elasticities of energy consumption (Figure 12), energy price elasticities (Figure 13) remain unchanged throughout the scenarios. CPAT is linked to datasets from the IMF and the World Bank. As a result, we implicitly use international energy prices data which is published by the IMF and the World Bank. Because of the administered price, the elasticities cannot be calculated by the empirical models. So we used the elasticities used in CPAT based on international average elasticities

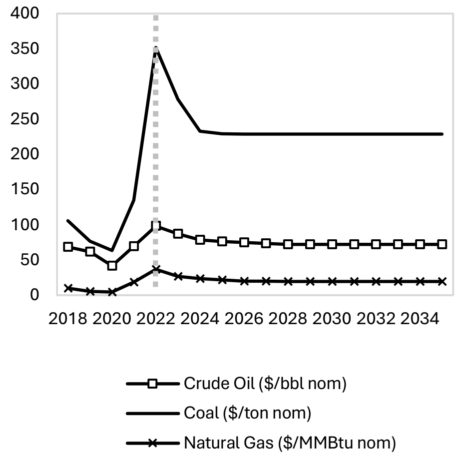
Given the large sectorial coverage in our scenarios, the policy design covers about 90% of national CO2 emissions (Figure 10). Around 45% of the emissions are generated by the power sector. The industry sector generates around 20%, the transport sector around 15% and residential the remaining 10%. In Figure 11, energy prices (oil, coal, natural gas) reached a peak in 2022 after the Covid crisis. They subsequently moderated and are expected to stabilise at higher levels than pre-Covid. The highest income elasticity of energy consumption is with respect to electricity (around 1). The income elasticity of motor fuels and other fuels is between 0.5 and 0.7. They slightly decrease over time. In Figure 13, the price elasticity of energy demand is higher for natural gas (-0.8), followed by coal and liquid fuels (-0.64). The elasticity is lower for electricity (-0.4) and biomass (-0.5).

Figure 10. Policy coverage: CO2 emissions covered (% of national total)



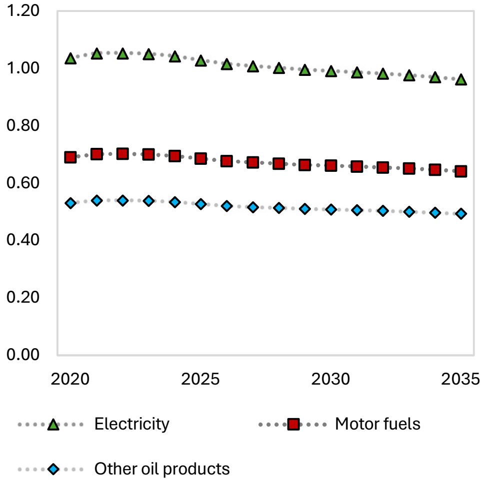
Source: CPAT

Figure 11. International energy prices (2018-2035)



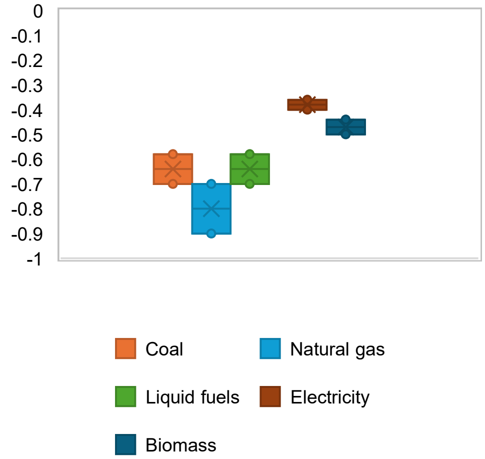
*Source: IMF-WB**

Figure 12. Income elasticities of energy consumption



Source: CPAT

Figure 13. Price elasticities of demand by fuel



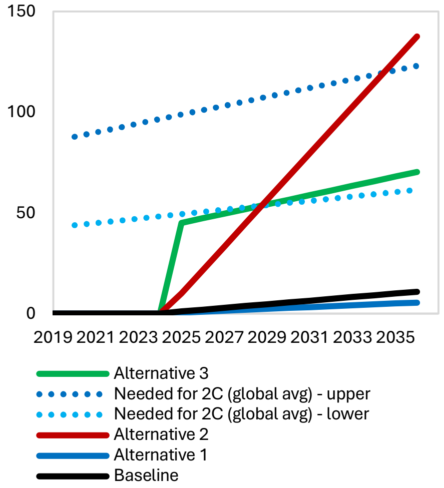
Source: CPAT

IV. Expected impacts

We depict the carbon price trajectory in Figure 14. It compares the various scenarios with the carbon price range compatible with a 2°C global warming. The CPAT's results indicate that the carbon price in both the Baseline and Alternative 1 scenarios is too low in comparison to the lower bound required to keep the increase in global temperature below 2°C. Yet, they would allow a gradual introduction of various carbon reduction policies while mitigating the energy price impact. The carbon tax in Alternative 3 is closer to the lower bound. In Alternative 2, the carbon tax starts at USD 10 per tCO2e and rises by USD 11.6 annually. The amount of the carbon tax in this scenario surpasses the lower upper bound in 2029 and the upper bound in 2035.

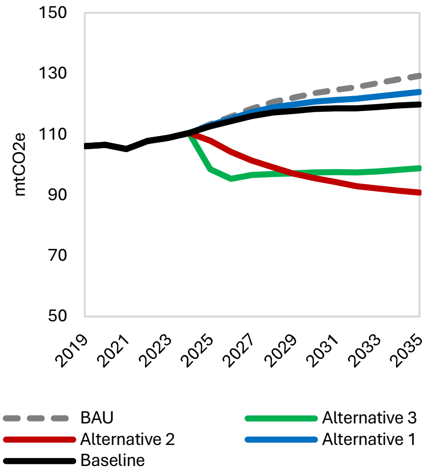
Therefore, as of year 2035, in the Baseline scenario emissions of GHG will be 7.3% lower than the BAU, 4.2% in the Alternative 1, 29.7% in the Alternative 2, 23.6% in the Alternative 3 scenario, respectively (Figure 15). If Mongolia implements a carbon tax without enacting any other policies, it will not be able to meet the NDC target, except for Alternative 2.

Figure 14. Carbon price trajectory-real (US$ per tCO2e, 2020-2035)



Source: Simulations from CPAT

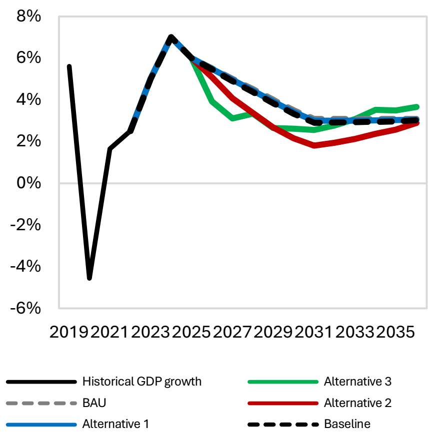
Figure 15. GHG emissions (BAU vs policy actions)



Source: Simulations from CPAT

Besides from the impact of the tax on carbon emissions we focus on its impact on growth (Figure 16) as the implementation of a carbon tax has an impact on aggregate demand. Table 5 shows the average GDP change under a carbon tax scenario as compared to business as usual. The carbon tax has barely any effect on GDP growth in Baseline and Alternative 1, but it has an average of 0.9% and 0.6% negative impact on growth in Alternative 2 and Alternative 3 scenarios, respectively, compared to BAU.

Figure 16. GDP growth forecast (BAU vs policy actions)



Source: Simulations from CPAT

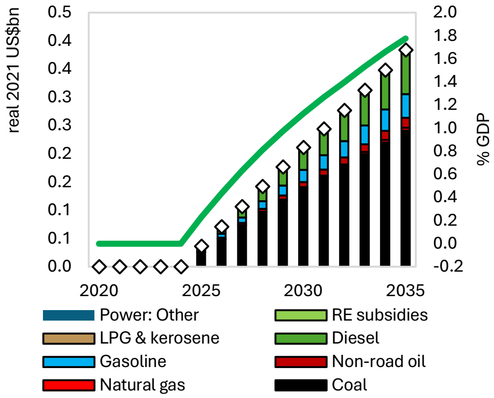
Table 5. GDP growth difference (average of 2025-2035)

Scenario	GDP growth difference with BAU
Alternative 3	-0.6%
Alternative 2	-0.9%
Alternative 1	-0.1%
Baseline	-0.1%

The impact on GDP is mitigated by fiscal revenues from the carbon tax. Figure 17 shows the revenue collected (USD bn and as % of GDP) for each year. As the main source of GHG emission is coal, the bulk of the revenue comes from this source. Total fiscal revenue in Baseline starts from around 0.1% and reaches 1.8% of the GDP in 2035. In Alternative 1, the fiscal revenue reaches 1.0% of the GDP. Alternatives 2 and 3 with significantly higher carbon prices ensure much larger revenues. In Alternative 2, the revenue reaches 11.7% of the GDP, in Alternative 3 it reaches 7.8% of the GDP in 2035.

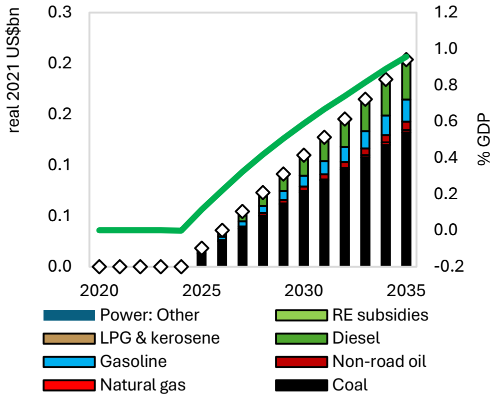
Figure 17. Fiscal revenues raised by fuel and total as % of GDP (right axis)

Baseline



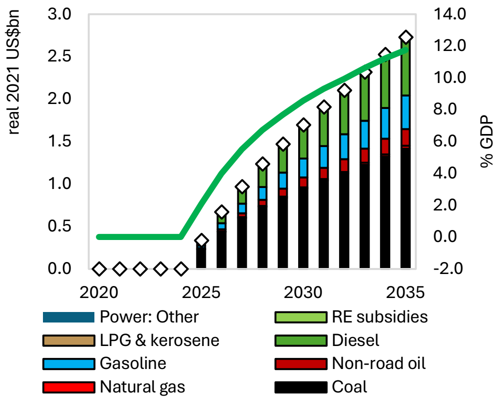
Source: Simulations from CPAT

Alternative 1



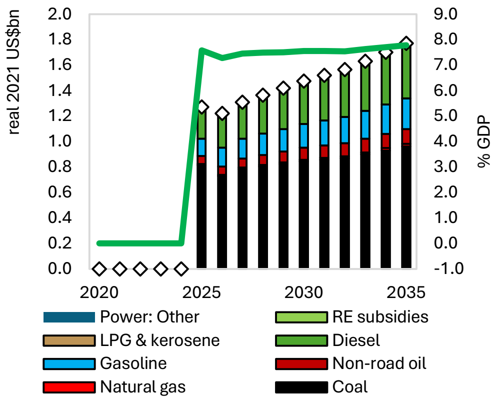
Source: Simulations from CPAT

Alternative 2



Source: Simulations from CPAT

Alternative 3

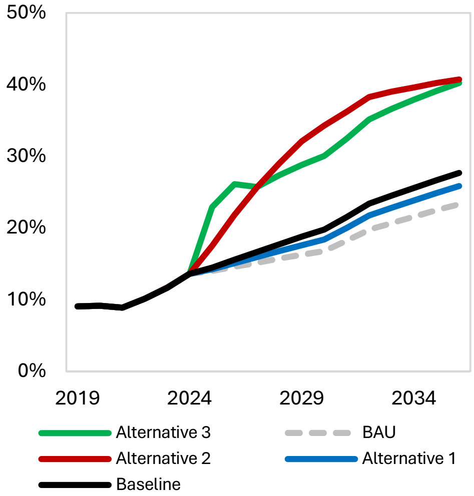


Source: Simulations from CPAT

The implementation of a carbon tax can significantly impact the supply of renewable energies by creating a more favourable economic environment for their development and adoption. By imposing a financial penalty on carbon emissions, the carbon tax increases the cost of fossil fuel-based energy production, thereby making renewable energy sources such as solar, wind, and hydroelectric power more competitive.

Figure 18 presents the proportion of renewable energy in total power provision. The renewable energy sector is growing in the BAU scenario from 14% in 2024 to 22% in 2035. Baseline and Alternative 1 scenarios have a moderate impact on the renewable energy share from the BAU. In 2035 this share should be 25% and 27%, respectively. In Alternatives 2 and 3, the proportion of renewable energy in total power production reaches 40%. In comparison to the BAU scenario, the shares of renewable energy in Alternatives 2 and 3 are around 18% higher.

Figure 18. Proportion of renewables in total power



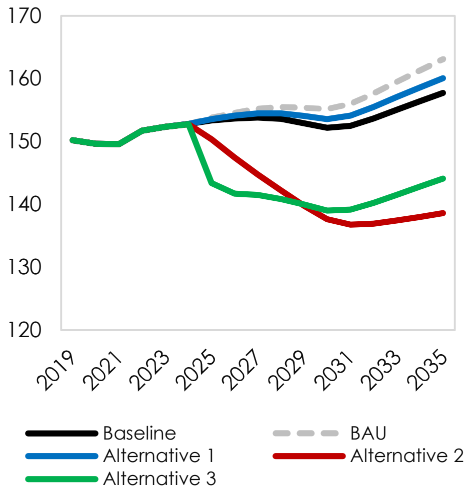
Source: Simulations from CPAT

The welfare effects of a carbon tax extend beyond environmental and economic benefits to substantial improvements in public health, including reductions in infant mortality and the number of averted deaths. In regions with high levels of pollution, studies have shown that even modest reductions in air pollution can significantly decrease infant mortality rates and avert numerous premature deaths annually. The CPAT provides neonatal air pollution mortality per 1000 persons using (Woodruff, Parker, & Schoendorf, 2006) methodology and the road accident deaths.

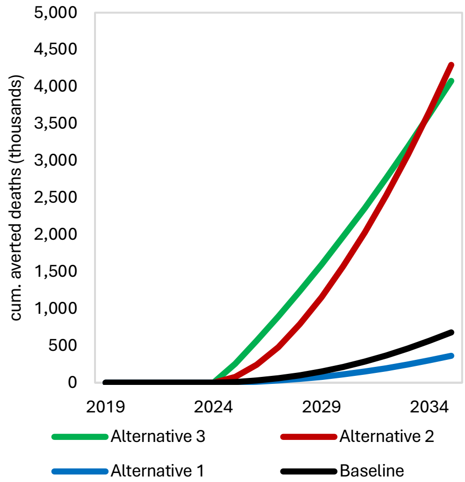
Figure 19 and Figure 20 show that the carbon tax in Alternatives 2 and 3 can significantly decrease infant air pollution mortality and road accident deaths. The policy has an immediate impact which rises over time.

Figure 19. Infant air pollution mortality

Figure 20. Number of averted deaths (air pollution + road accident deaths)



Source: Simulations from CPAT



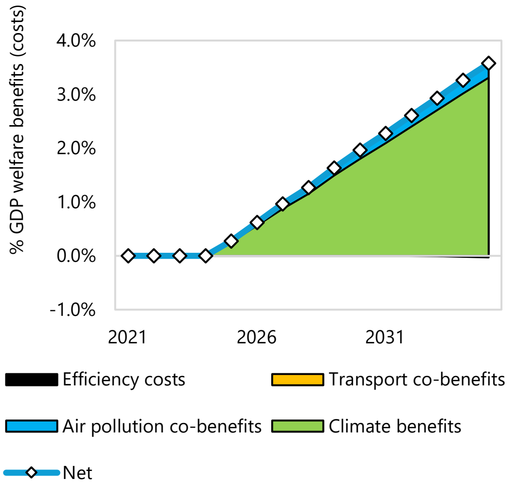
Source: Simulations from CPAT

CPAT also calculates total monetized welfare benefits of the policy actions. The monetized welfare benefit consists of efficiency costs (deadweight costs resulting from the carbon tax), transport co-benefits (in terms of lost wage because of road accident), air pollution co-benefits (calculated from reduced air pollution attributed to mortality and reduced days with inability to work) and climate benefits (difference between the total national global warming costs in the BAU and the policy scenarios).

Figure 21 shows the total welfare benefits for the four scenarios. Of the components listed above, climate change has the greatest impact; not acting on climate change generates large damage, however, improvements to welfare are mostly attributed to it as well. Although the carbon price in the Baseline scenario is low and has a limited impact on growth and prices, its welfare impact is substantial and reaches 3.6% of GDP in 2035, while also having an immediate impact in 2025 of 0.3% of GDP. In Alternative 1, the total impact ends at 2.1% of GDP in 2035. For Alternatives 2 and 3, the overall impact is much higher. For Alternative 2, the welfare impact in 2025 is at 2.5% of GDP, ending at 9.4% of GDP in 2035. For Alternative 3, the initial impact is even higher at 4.7% and then gradually increases to 9.6% in 2035. For these scenarios, negative efficiency costs partially cancel the positive impact from climate benefits, air pollution and transport co-benefits.

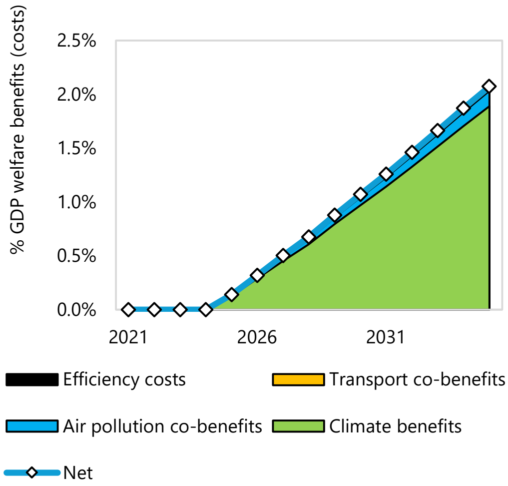
Figure 21. Total monetized welfare benefits (as % of GDP)

Baseline



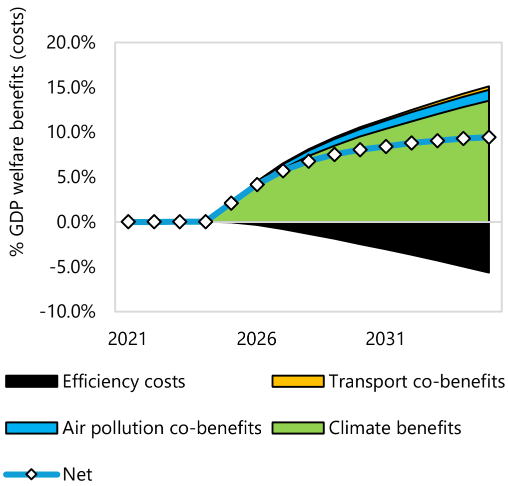
Source: Simulations from CPAT

Alternative 1



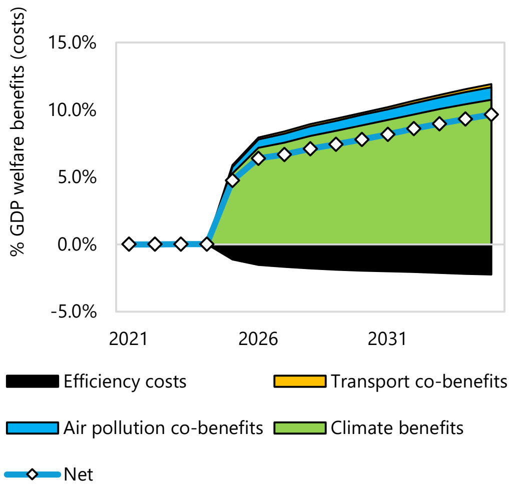
Source: Simulations from CPAT

Alternative 2



Source: Simulations from CPAT

Alternative 3



Source: Simulations from CPAT

In Table 6 we assess the impact of a carbon tax on energy prices, providing details for each source of energy and for electricity prices. The impact on fuel prices is modest at around 1%, except for oil (3%) and coal (8%). The ultimate impact on electricity price is 8%. Alternative 1 has also a moderate impact on prices; the coal and electricity price increase is cut by two. The more stringent Alternatives 2 and 3 lead to a more significant impact on fuel prices. The energy prices increase from around 15% to more than 100%. The price of electricity around doubles in both scenarios.

Table 6. Impacts on energy prices after carbon tax

Fuel	Unit	BAU	**Business As Usual (BAU) + carbon tax**							
			Baseline		*Alternative 1*		*Alternative 2*		*Alternative 3*	
			Δ	% change	Δ	% change	Δ	% change	Δ	% change
Gasoline	US$ per liter	0.67	0.68	1%	0.68	1%	0.79	18%	0.81	20%
Diesel		0.84	0.85	1%	0.84	1%	0.97	16%	0.99	19%
LPG		0.66	0.66	1%	0.66	1%	0.74	13%	0.76	15%
Kerosene		0.67	0.68	2%	0.68	1%	0.80	18%	0.82	21%
Oil	US$ per barrel	58.9	60.6	3%	58.8	1%	79.9	36%	83.3	41%
Coal	US$ per gigajoule (GJ)	4.37	4.73	8%	4.55	4%	8.77	101%	9.47	117%
Natural gas		19.24	19.44	1%	19.34	1%	21.74	13%	21.13	15%
Electricity	US$ per kwh	0.08	0.09	8%	0.09	4%	0.16	87%	0.18	112%

Source: Simulations from CPAT

V. Implementation and Policy Implications

In this report we examine the price of a carbon tax on the Mongolian economy. The base scenario for a carbon tax implemented in 2025, with rates increasing from USD 1 to USD 10 per ton of CO2 by 2035, impacts all fuels and sectors comprehensively. Three alternative scenarios are also assessed. This includes coal, natural gas, gasoline, diesel, LPG, kerosene, and other oil products, across all activities (e.g., power, transportation, shipping, residential, industry). We also cover all relevant industries from food and forestry to services, mining, chemicals, iron and steel, other metals, machinery, cement, and other manufacturing and construction activities.

Over a five-year period, we suggest a phase-out of subsidies to energy producers, along with an end of energy price controls. Additionally, 100% of the revenue generated from the carbon tax will be redistributed to the low-income population to mitigate any adverse economic impacts.

5.1 Discussion on various impacts

The Mongolian economy is heavily reliant on fossil fuels, primarily on coal, for its energy needs. This dependency poses significant challenges in transitioning to a low-carbon economy. Implementing a carbon tax could incentivize a shift towards renewable energy sources, but the transition may be slow due to insufficient existing infrastructure and the initial high costs of adopting new technologies.

A carbon tax can potentially reduce the competitiveness of Mongolian industries, particularly those that are energy intensive. Increased production costs may lead to higher prices for Mongolian goods, making them less attractive in the international market. This could adversely affect export-oriented industries, leading to a trade imbalance and potential job losses.

On the positive side, a carbon tax can stimulate investment and innovation in green technologies. Businesses may seek to reduce their tax burden by investing in energy-efficient processes and renewable energy sources. This can foster a new industry focused on clean technology and sustainable practices, potentially leading to long-term economic benefits.

One of the most immediate impacts of a carbon tax is the increase in prices for goods and services. Households would bear the brunt of higher costs, especially for energy and transportation. This could lead to inflationary pressures and reduce disposable income, impacting overall consumer spending.

The regressive nature of a carbon tax means that low-income households are disproportionately affected. These households spend a larger share of their income on energy and essential goods, making them more vulnerable to price increases. To mitigate this effect, targeted redistribution policies, such as direct rebates or subsidies, are necessary to protect the most vulnerable populations.

Effective redistribution policies can help offset the adverse effects on low-income households. These could include direct cash transfers, energy assistance programs, or tax credits aimed at reducing the financial burden. Such measures can ensure that the carbon tax achieves its environmental goals without exacerbating social inequalities.

For firms, a carbon tax represents an increase in production costs, particularly for those in energy-intensive industries. This could lead to reduced profit margins and potential layoffs if companies are unable to pass on the costs to consumers. Firms might also face higher costs for compliance and reporting, adding to their operational burdens.

However, the long-term perspective suggests that firms may respond by investing in energy-efficient technologies and practices to lower their carbon footprint. This could lead to operational savings over time and enhance their competitiveness in a market that increasingly values sustainability.

Political resistance is a significant barrier to implementing a carbon tax. Policymakers may face opposition from various stakeholders, including industry lobbyists, workers' unions, and the public, who fear the economic repercussions. Building a broad consensus and demonstrating the long-term benefits of the carbon tax is crucial for its successful implementation.

Lack of awareness and understanding of the long-term benefits of a carbon tax can hinder its acceptance and effectiveness. Public education campaigns and transparent communication from the government can help build support by illustrating how the tax contributes to environmental sustainability and economic resilience in the long run.

In summary, while a carbon tax presents several challenges, including higher costs for households and firms, potential reductions in competitiveness, and political resistance, it also offers opportunities for fostering innovation, investment in green technologies, and implementing effective redistribution policies to mitigate adverse effects. Addressing these challenges requires careful planning, stakeholder engagement, and robust policy design to ensure that the benefits of a carbon tax are realized for the Mongolian economy.

5.2 How to implement the carbon tax?

A carbon tax can be effectively *levied* on the carbon content of fossil fuels at the *point of extraction or importation*. This method ensures that the tax is applied as early as possible in the supply chain, capturing the broadest base, and simplifying the administrative process. By taxing fossil fuels at the source — such as coal mines, oil wells, or ports of entry — the government can reduce the number of taxable entities, thereby lowering compliance and enforcement costs. This can create a ripple effect throughout the economy. Producers and importers will likely pass on the cost of the tax to downstream consumers, including manufacturers, power plants, and ultimately, end-users. This approach encourages all stakeholders to seek carbon-reducing alternatives and promotes energy efficiency across the entire supply chain. Moreover, by targeting the source, the tax framework can more easily adapt to changes in energy production and consumption patterns, ensuring that it remains effective in reducing emissions over time.

In addition, levying the tax at the extraction or importation stage can provide clearer price signals to the market. This transparency helps businesses and consumers make informed decisions about energy use and investments in low-carbon technologies. For policymakers, this method offers a straightforward mechanism to monitor and adjust the tax rate based on emission reduction targets and economic conditions. Ultimately, by implementing the carbon tax at these critical junctures, the policy can achieve its environmental objectives while minimizing administrative complexity and economic disruption.

Another challenge is to design a framework for *distributing* carbon tax revenues in a fair and efficient way. In the context of the Mongolian economy, a distribution via *lump-sum rebates* would be appropriate. A lump-sum rebate ensures that the carbon tax revenue is redistributed directly to low-income households that are disproportionately affected by the increased costs of energy and goods. It can reach a wide range of the population, including those who may not receive significant amounts of income or pay corporate taxes, such as informal sector workers or small business owners. This approach helps mitigate the regressive nature of carbon taxes, where poorer households spend a higher proportion of their income on energy. A lump-sum rebate is straightforward to administer and understand. Every household receives a fixed amount, making the policy transparent and easy to implement without complex adjustments in the tax system. The policymaker needs nevertheless to decide what is an appropriate definition of low-income. Based on our previous analysis (Figure 5), households spending more than 5% of their income in energy (around 40% of the population) could benefit from this lump-sum rebate. This share will have to be reviewed in time as energy prices vary.

Other redistribution policies, such as regressive rebate or reduction of the VAT, could be thought of. Table 7 briefly outlines these policies and their distribution channel as well as advantages and disadvantages.

Table 7. Scenarios for the redistribution of the carbon tax revenue

Scenario	**Distribution channel**	**Advantage**	**Disadvantage**
Flat rebate	Via pensions or salaries	Easy to put in place and provides direct income	Not guaranteed to cover the whole population given the informal sector
Regressive rebate	Via pensions or salaries: The rebate increases with the energy burden in the household budget	Fairer measure for the poorest households which endure a larger burden of energy price increase	Difficult to define a fair threshold
Reduction of VAT	Via lower VAT tax on primary goods	Reaches all consumers	Does not necessarily benefit more to the poor

5.3 Further implementation discussions

The implementation of the carbon tax requires the amendment of the legislation to define the objectives, scope, and basic principles of the tax. Environmental protection laws will need to be amended accordingly. A framework for the measurement and reporting of emissions by companies should be established. Compliance and enforcement mechanisms should also be planned. The government agency that will administer the tax and its revenues should be clearly identified, and appropriate training should be provided to administrators.

Gradual implementation of the tax and consultation with stakeholders could increase the chances of success and acceptability of such a policy. One recommendation would be to start with a pilot programme and implement the tax gradually. In our simulation, we have planned for the tax to be implemented across the economy from 2025. A more gradual approach could be adopted after an evaluation of the pilot programme. Moreover, this policy could be combined with other policies, such as incentives for renewable energy production and liberalisation of the energy price.

Finally, even after the implementation, the carbon tax framework would require continuous monitoring and adjustment to changing internal and external conditions. Specific attention should be paid to *carbon leakage* which occurs when production shifts to countries with less stringent climate policies, undermining global emission reduction efforts. This requires regional and international cooperation. One instrument to prevent carbon leakage is the Carbon Border Adjustment Mechanism (CBAM). CBAM imposes a carbon price on imported goods equivalent to the carbon price that would have been paid if the goods were produced under the importing country's carbon regulations.

VI. Conclusion

Climate change presents a profound challenge globally, necessitating effective policies to mitigate its impacts. The Mongolian economy, characterized by significant reliance on fossil fuels faces unique challenges in this context. We address the urgent need for carbon emissions reductions by designing and assessing the impact of a carbon tax policy on the economy and households. Implementing a carbon tax not only aligns with global climate goals but also promotes innovation in low-carbon technologies.

In a first step, we assess the current state of Mongolia from an environmental and economic composition perspective. In a second step, we design and evaluate the economic, environmental, and social outcomes of such a tax, considering the unique structure of the Mongolian economy heavily reliant on fossil fuels. Third, we develop a comprehensive toolkit for the implementation of the carbon tax, including strategies for revenue redistribution to mitigate adverse effects on vulnerable populations. This report also seeks to provide policy recommendations based on best practices from other countries and tailored to Mongolia’s framework.

The analysis using the CPAT model for a baseline and three alternative scenarios for 2035 horizon, reveals important results. Implementing a carbon tax in Mongolia could significantly reduce greenhouse gas emissions (by 7% to 30%) and promote cleaner energy sources (between 28% and 40% of the total energy composition by 2035 as compared to 23% if business as usual). The projected welfare benefits from reduced air pollution and improved public health are substantial (between 2.1% and 9.6% of GDP).

The report also highlights the regressive nature of carbon taxes, implying redistribution policies targeted for low-income households to mitigate the price impact. Therefore, we recommend a lump-sum rebate as a redistribution policy for its simplicity, equity, and ability to provide immediate financial support to households.

Future research should explore more detailed sector-specific impacts of the carbon tax, particularly in the energy and mining sectors, which are pivotal to the Mongolian economy. Investigating the long-term behavioural changes in households and firms due to carbon pricing and understanding the dynamics of energy market liberalization will also be crucial. Additionally, studying the potential for integrating renewable energy incentives and assessing the political feasibility and public acceptance of carbon tax policies in Mongolia would provide valuable insights for policymakers.

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Appendix

Table 1. Estimates of Reductions in Projected GDP in Different Regions of the World

Study (Period covered)	Country/Region	Assumed Reductions (-)/Increases (+) in CO2 Emissions (in percent)	Estimated Reductic (-) in Projected GI (percent of baselin
Manne and Richels (1992) **(1990-2100)**		**From levels prevailing in 1990**	
	• USA	-20	-3.0 [2030]
	• OECD	-20	-2.0 [2010]
	• Soviet Union – Eastern Europe	-20	-4.0 [2020]
	• China	+100	-10.0 [2050]
	• Rest of World	+100	-5.0
	• World	+16^2	-5.0
Edmond and Reilly (1983) **(1975-2050)**		**From levels prevailing in 1990**	
	• USA	+70	-0.4
	• World	+162	-1.0
Nordhaus (1991) **(1990-2100)**	• World	50% reduction from levels that would have otherwise prevailed in 2100	-1.0
Burniaux et al (1991) **(1990-2020)**		**From levels prevailing in 1990**	
	• N.America	-20	-0.8
	• Europe	-20	-7.0
	• Pacific	-20	-3.7
	• Energy-exporting Developing Countries	+50	-3.6
	• China	+50	-1.5
	• USSR	-20	-2.2
	• World	+17	-1.8
Whalley and Wigle (1991) **(1990-2030)**	• World	50% reduction from levels that would have otherwise prevailed in 2030	-4.2

Source: Mabey at al (1997), page 74

Table 2: Summary of Carbon Taxes Across the World in Local Currency

	Jurisdiction	Share of jurisdictio n emissions covered	Currency	2018	2019	2020	2021	2022	2023
1	Finland	36.0%	EUR	73	77	77	77	77	77
2	Poland	3.8%	PLN	0.29	0.3	0.3	0.31	0.32	0.34

3	Norway	63.0%	NOK	500.03	508.23	636.33	589.92	766.21	950.59
4	Sweden	40.0%	SEK						1150.42
5	Denmark	40.0%	DKR	173.2	175.3	177	178.5	179.2	181.7
6	Latvia	5.0%	EUR	4.5	4.5	9	12	15	15
7	Estonia	6.6%	EUR	2	2	2	2	2	2
8	Switzerland	33.0%	SFR	96	96	96	96	120	120
9	British Columbia	70.0%	CAN	35	40	40	45	50	65
10	Iceland	55.0%	ISK	3595.1	4357.6	4357.6	4466.6	4575.5	4924.1
11	Ireland	40.0%	EUR	20	20	26	33.5	41	48.5
12	Japan	75.0%	JPY	289	289	289	289	289	289
13	United Kingdom	24.0%	GBP	18	18	18	18	18	18
14	France	35.0%	EUR	44.6	44.6	44.6	44.6	44.6	44.6
15	Mexico	44.0%	MXN	53.03	55.52	57.17	59.08	63.43	68.37
16	Portugal	40.0%	EUR		12.61	12.61	23.68	23.68	23.68
17	South Africa	80.0%	ZAR			127	134	144	159
18	Chile	29.4%	USD	5	5	5	5	5	5
19	Colombia	23.0%	COP	15764	16422	17211	5	18830	23394.6
20	Ukraine	71.0%	UAH	0.41	10	10	10	30	30
21	Liechtenstein	80.6%	SFR	96	96	96	96	120	120
22	Singapore	80.0%	SGD		5	5	5	5	5
23	Northwest Territories	79.0%	CAN			20	30	40	65
24	Prince Edward Island	56.0%	CAN		20	30	30	30	50
25	Canada	30.0%	CAN		20	30	40	50	65
26	Netherlands	52.0%	EUR				30	41.75	51.12
27	Argentina	20.0%	ARS	179.53	264.94	407.88	519.87	555.16	695.92
28	Spain	1.9%	EUR	20	15	15	15	15	15
29	Newfoundland and Labrador	47.0%	CAN		20	20	30	50	65
30	Luxembourg	65.0%	EUR				34.16	39.22	41.38
31	New Brunswick	39.0%	CAN			30	40	50	65

32	Zacatecas	50.0%	MXN	250.00	250.00	289.06	250.00	250.00	250.00
33	Uruguay	11.2%	YUY					5645.45	6024
34	Queretaro	50.0%	MXN						580.94
35	State of Mexico	50.0%	MXN						43
36	Yucatan	50.0%	MXN						280.1

Country/ Region	Year Introduced	Coverage of Energy Sectors				Coverage Rate, all GHGs (percent)	Price, $/tonne	Revenue/ Rent, % GDP	Point of Tax/ Regulation	Revenue Use
		Power	Industry	Transport	Buildings					
Carbon Taxes										
Argentina	2018	✓	✓	✓		20	5	0.070	Midstream	General budget
Colombia	2017	✓	✓	✓	✓	23	5	0.04	Midstream	Environmental spending
Chile	2017	✓	✓			29	5	0.05	Downstream	General budget
Indonesia	2022	✓				26	2	0.05	Midstream	General budget
Singapore	2019	✓	✓			80	4	0.04	Midstream	General budget
South Africa	2019	✓	✓	✓	✓	80	10	0.04	Midstream	General budget
Ukraine	2011	✓	✓		✓	71	1	0.05	Midstream	General budget
Uruguay	2022		✓	✓		11	127	1.15	Midstream	General budget, environmental spending
ETSs										
EU	2005	✓	✓			41	87	0.26	Downstream	General budget, environmental spending
Austria	2005	✓	✓			37	87	0.11	Downstream	General budget, environmental spending
Belgium	2005	✓	✓			38	87	0.19	Downstream	General budget, environmental spending
Bulgaria	2005	✓	✓			52	87	1.82	Downstream	General budget, environmental spending
Croatia	2005	✓	✓			32	87	0.33	Downstream	General budget, environmental spending
Cyprus	2005	✓	✓			51	87	0.43	Downstream	General budget, environmental spending
China	2013, 2014, 2016, 2021	✓				38	9	0.32	Downstream	Environmental spending proposal
Czech Republic	2005	✓	✓			51	87	0.78	Downstream	General budget, environmental spending
Germany	2005, 2021	✓	✓	✓	✓	85	62	0.44	Mid & Downstream	Environmental spending
Greece	2005	✓	✓			47	87	0.66	Downstream	General budget, environmental spending
Hungary	2005	✓	✓			30	87	0.39	Downstream	General budget, environmental spending
Italy	2005	✓	✓			34	87	0.18	Downstream	General budget, environmental spending
Kazakhstan	2013	✓	✓		✓	46	1	0.10	Downstream	General budget
Korea	2015	✓	✓	✓	✓	73	19	0.99	Downstream	Environmental spending
Lithuania	2005	✓	✓			30	87	0.44	Downstream	General budget, environmental spending
Malta	2005	✓	✓			34	87	0.28	Downstream	General budget, environmental spending
New Zealand	2008	✓	✓	✓		49	53	0.20	Downstream	General budget, environmental spending
Romania	2005	✓	✓			33	87	0.89	Downstream	General budget, environmental spending
Slovakia	2005	✓	✓			50	87	0.64	Downstream	General budget, environmental spending
US	2009, 2012, 2018, 2021	✓	✓	✓	✓	7	24	0.05	Up & Midstream	General budget, direct transfers, environmental spendir
Hybrid										
Canada	2019	✓	✓	✓	✓	67	38	0.16	Downstream	Tax cuts, environmental spending
Denmark	1992, 2005	✓	✓	✓	✓	62	52	0.29	Mid & Downstream	General budget
Estonia	2000, 2005	✓	✓			63	79	1.26	Mid & Downstream	General budget
Finland	1990, 2005	✓	✓	✓	✓	67	77	0.76	Mid & Downstream	General budget, tax cuts
France	2005, 2014	✓	✓	✓	✓	56	64	0.41	Mid & Downstream	General budget, environmental spending
Iceland	2005, 2010	✓	✓	✓	✓	93	56	0.62	Mid & Downstream	General budget
Ireland	2005, 2010	✓	✓	✓	✓	59	62	0.23	Mid & Downstream	General budget,direct transfers, environmental spendir
Mexico	2014, 2020	✓	✓	✓	✓	61	4	0.02	Midstream	General budget
Japan	2010, 2011, 2012	✓	✓	✓	✓	77	2	0.05	Midstream	Environmental spending
Latvia	2004, 2005	✓	✓			25.4	79	0.39	Midstream	General budget
Liechtenstein	2005, 2008	✓	✓	✓	✓	81	130	0.60	Mid & Downstream	General budget
Luxembourg	2005, 2021	✓	✓	✓	✓	79	38	0.048	Mid & Downstream	General budget
Netherlands	2005, 2021	✓	✓			46	87	0.270	Mid & Downstream	General budget
Norway	1991, 2005	✓	✓	✓	✓	55	87	0.94	Mid & Downstream	General budget
Poland	1990, 2005	✓	✓	✓	✓	51	81	1.45	Mid & Downstream	Environmental spending
Portugal	2015, 2005	✓	✓	✓	✓	70	56	0.52	Mid & Downstream	General budget, environmental spending
Slovenia	1996, 2005	✓	✓	✓	✓	89	47	0.48	Mid & Downstream	General budget
Spain	2005, 2014	✓	✓		✓	37	82	0.25	Mid & Downstream	General budget, environmental spending
Sweden	1991, 2005	✓	✓	✓	✓	77	109	0.52	Mid & Downstream	General budget
UK	2013, 2021	✓	✓			49	67	0.42	Downstream	General budget, tax cuts
Switzerland	2008	✓	✓		✓	44	114	0.16	Midstream	Tax cuts, direct transfers, environmental spending

Source: (Mesa Puyo & Zhunussova, 2023). Chile: Technical Assistance Report – An Evaluation of Improved Green Tax Options, IMF, January 2023, Report.