CTTN Research Grants Program 2024

Carbon pricing in Central Asia: Opportunities and barriers in the Kyrgyz Republic

November, 2024

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November 2024

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Abstract

As the consequences of climate change intensify, a global effort to implement mitigation strategies is urgently needed. Carbon pricing stands out as a crucial mitigation tool, with carbon taxes and emissions trading schemes (ETS) emerging as the primary instruments. This study examines carbon pricing in the Kyrgyz Republic by examining both the opportunities and barriers. The results show a total carbon cost for 19 economic sectors over 564 million USD, with an average price of 50 USD per ton of CO_2. This study aims to develop an understanding of the economic costs and barriers associated with implementing carbon pricing and identify the sectors that will predominantly bear these costs. The findings indicate that a carbon tax is currently a more promising and administratively feasible option than an ETS, largely because of its simpler implementation and lower administrative burden. Nevertheless, the successful introduction of either carbon pricing mechanism requires the development of a robust carbon infrastructure. Furthermore, integrating carbon pricing into the country's long-term vision and economic development strategies is crucial. These results indicate that high carbon costs are associated with the energy supply sector, while implementing a carbon tax in the mining and trade sectors has high revenue-generating potential. As this study shows, the overall consensus is that a carbon tax could gain support and help generate additional revenue to address climate change in the Kyrgyz Republic. However, evidence is lacking to support a clear understanding of what introducing a carbon tax would imply for the private and public sectors, as well as challenges related to the virtual absence of the required normative and legal frameworks.

Keywords: carbon pricing, climate change, climate mitigation, Central Asia, the Kyrgyz Republic

Abbreviations

ADB – Asian Development Bank
CO_2 – Carbon dioxide
EBRD – European Bank for Reconstruction and Development
ETS – Emissions Trading Scheme
EU – European Union
iCRAFT - Innovative Carbon Resource Application for the Energy Transition Project for Uzbekistan
IOM - Input-Output Model
IPCC - Intergovernmental Panel on Climate Change
IRENA – International Renewable Energy Agency
GHG – Greenhouse Gas(es)
GoKR – Government of the Kyrgyz Republic
MFA – Ministry of Foreign Affairs of the Kyrgyz Republic
MNRETS – Ministry of Natural Resources, Ecology and Technical Supervision of the Kyrgyz Republic
MRV – Monitoring, Reporting and Verification
NAS – National Academy of Sciences
NDC – Nationally Determined Contributions
NSCKR – National Statistics Committee of the Kyrgyz Republic
UNFCC - United Nations Framework Convention on Climate Change
USD – United States Dollar
WB – World Bank

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Introduction

Climate change is an existential threat to human civilization and a crisis multiplier. Although this is a universal concern, the latest scientific evidence indicates that climate change will have a disproportionate impact on developing countries. Central Asia is one of the world's most vulnerable regions because of its high exposure and low adaptive capacity (Azour et al., 2023). The number of extreme weather events has also increased. Aging infrastructures are susceptible to the negative impacts of intensifying natural disasters.

Economists agree that the most effective approach to reducing greenhouse gas (GHG) emissions, thereby mitigating climate change, is to put a price on carbon dioxide (CO_2) emissions. Consequently, governments worldwide are designing carbon-pricing mechanisms that attach costs to each ton of CO_2 produced.

Carbon pricing is predominantly implemented using two methods: carbon taxes and emissions trading schemes (ETS). Although both approaches aim to reduce carbon emissions, they have foundational differences. Carbon tax proponents argue that its clear advantage, beyond its primary goal of GHG emissions, including CO_2, is its ability to generate budget revenue. However, the downside is that it may cause market distortions and have a trickle-down effect on the public. In contrast, ETS supporters argue that it is more market-driven and offers flexibility for businesses, ultimately enhancing sector efficiency. However, this approach also faces challenges, such as decisions on how to allocate emissions and the complexity of designing the trading system, which assumes perfect or nearly perfect knowledge of a sector's emissions.

Several cases demonstrating the successful deployment of carbon pricing initiatives in Europe, Asia, and North America support the efficiency and viability of carbon pricing. Furthermore, developing countries can reduce their GHG emissions and sell carbon credits on the international market in accordance with Article 6.2 of the Paris Agreement (2015).

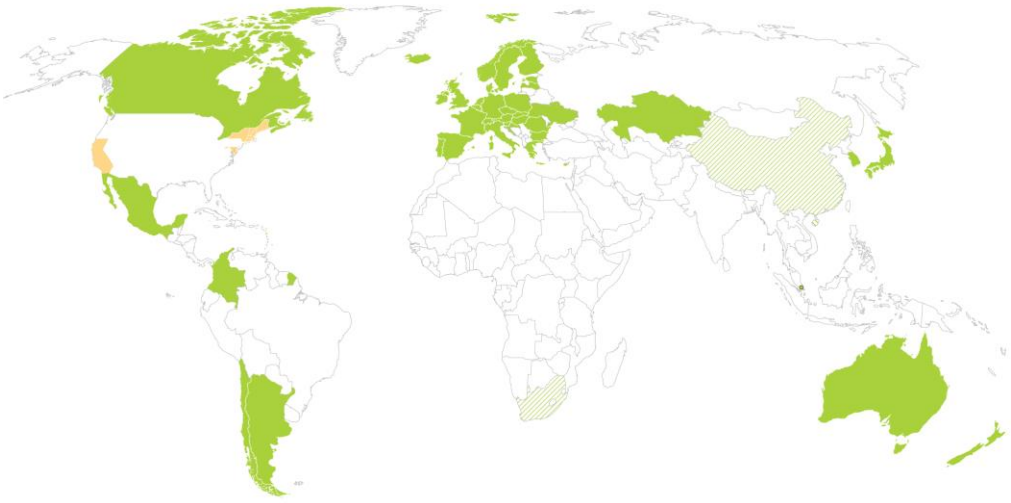


Figure 1: Global carbon pricing. Source: Carbon Pricing Dashboard. World Bank, 2023

More than 120 countries consider carbon pricing in their nationally determined contribution (NDC) targets under the Paris Agreement (World Bank, 2023b; Figure 1).

Context: First steps towards carbon pricing in Central Asia

Central Asian countries will inevitably adopt some form of carbon pricing. Currently, these countries are taking initial steps in this direction. All five Central Asian republics have declared ambitious NDC commitments (see the respective NDC documents from the Governments of Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan). For example, Kazakhstan launched its own ETS in 2013. Uzbekistan recently announced plans to sell carbon emission-reduction credits on international carbon markets, an innovative move supported by a World Bank project aimed at reducing emissions and accessing international carbon markets (World Bank, 2023a). The Kyrgyz Republic has also announced ambitious plans for reducing GHG emissions, with carbon pricing playing a crucial role. Below, the cases of Kazakhstan and Uzbekistan are briefly discussed to provide some regional context for the prospect of introducing carbon pricing in the Kyrgyz Republic.

The case of Kazakhstan

In Central Asia, only Kazakhstan, the region's largest country by territory, has an ETS. Kazakhstan launched its ETS pilot phase in 2013 Modeled after the European Union (EU) ETS framework, the "Kazakhstan Emissions Trading System" was initially conceived to facilitate a transition to cleaner and more efficient technologies in industry, manufacturing, and electricity generation.

By ratifying the Kyoto Protocol on March 26, 2009, Kazakhstan simultaneously implemented energy reform and energy efficiency legislation. This was later reinforced by the "Strategic Development Plan of the Republic of Kazakhstan 2020." The country has outlined general rules for emissions trading and established liabilities for GHG emission limits, as well as categorized operators into major and minor emitters.

The case of Uzbekistan

In 2024, the World Bank announced a groundbreaking initiative, the Innovative Carbon Resource Application for the Energy Transition Project for Uzbekistan (iCRAFT), aimed at helping the government reduce GHG emissions and access international carbon markets. This $46.25 million grant was the World Bank's first "policy crediting" program, and focuses on incentivizing energy subsidy reforms for lower energy consumption and GHG emissions. iCRAFT is the first international carbon market initiative in Uzbekistan and Central Asia under the Paris Agreement, and will generate carbon credits for emission reduction in the energy sector. Although Uzbekistan's global carbon emissions are not substantial, it ranks among the most energy-

intensive nations. The country's low electricity and gas prices, maintained by high subsidies, hinder energy-efficiency efforts. iCRAFT aims to address this issue by encouraging reforms and contributing to Uzbekistan's commitments under the Paris Agreement. This project is supported by the Transformative Carbon Asset Facility and expected to disburse grants annually until 2028, potentially reducing CO_2 by approximately 60 million metric tons. This initiative aligns with the World Bank's commitment to Uzbekistan with its extensive national program supporting reforms and contributing to economic growth.

The economic implications of implementing carbon pricing in this region are likely threefold. First, introducing carbon costs has effects on the economy, although it is currently unclear which sectors will bear the largest burden. Second, the affected sectors and the overall economy are expected to become more carbon-efficient. Finally, the successful implementation of carbon pricing initiatives can generate additional internal and external funds for the region. Therefore, there is a need to analyze the implications of carbon pricing for economies and the requirements for its successful implementation of carbon pricing. This study aims to address this gap. Additionally, the research findings could contribute to the development of a carbon pricing policy that will ensure that the most vulnerable groups are protected from such a policy.

The **objective of this study** is to evaluate the implications of implementing carbon pricing in the Kyrgyz Republic. Specifically, it aims to uncover the potential impact on various economic sectors and assess the readiness of the institutional framework.

Methods

This study relies on two core methods: economic modeling and stakeholder map analysis. The first uses macroeconomic data, allowing for quantitative analysis. All macroeconomic data are for 2022, as this is the most recent period for which the relevant energy balance and input-output (IO) tables are available. The second method assesses the carbon pricing policy from the perspectives of key stakeholders and identifies potential challenges and opportunities. This relies on qualitative methods, including semi-structured interviews and an online survey, to obtain insights into the understanding of the government, private sector, and general public of carbon pricing and what it might imply.

Economic Modeling

The economic modeling in this study uses the Input-Output Model (IOM), which provides an appropriate framework for quantifying the technical and economic connections among various economic sectors at the national level. IOMs have been extensively applied in previous research conducted in several countries and proven to be a reliable methodological approach. This modeling relies on the IO tables published by the National Statistics Committee of the Kyrgyz Republic (NSCKR) in 2022. We also used the Fuel and Energy Balance Dataset 2022. For the IOM we used Table M: Inter-industry balance of production and use of goods and services in the economy of the Kyrgyz Republic in basic prices for 2022 (NSCKR, 2024). As expected, the final consumption numbers differed from the GDP because we omitted the impact of taxes and resources from previous periods. Moreover, the IO tables include 112 products and services, whereas the energy balance dataset includes only 19 sectors. Therefore, we aggregated the IO tables into 19 sectors using the State Classifier of Types of Economic Activities (NSKR, 2017).

Carbon costs are derived from the Carbon Pricing Dashboard of the World Bank[1] because of the lack of an established historical carbon price in Central Asia. In 2024, prices ranged from USD 1–167 globally. In developed countries, such as the EU, for example, ETS the carbon cost can be as high as 70 euros. The wide range of prices can be explained by the different stages of carbon pricing implementation. For the base model, we used the global average price of USD 50 per ton. We did not use Kazakhstan's ETS because of its extremely low prices[2], which do not reflect actual carbon costs (Howie et al., 2020; Howie & Atakhanova, 2022). However, Kazakhstan's experience provides a valuable asset for learning purposes for the rest of the region.

CO_2 Emission Calculation

To estimate CO_2 emissions from various sectors, we applied specific CO_2 emission factors for different fuel types. These emission factors are crucial for converting the consumption of each fuel type into corresponding CO_2 emissions. The detailed formulas are presented in Appendices A and C. The emission factors are the default levels from the Intergovernmental Panel on Climate Change (IPCC) Guidelines (IPCC, 2006), and the calorific values are from the IPCC when available

[1] The Carbon Pricing Dashboard is available at https://carbonpricingdashboard.worldbank.org/

[2] In Kazakhstan, the price per CO_2 ton is USD 1.10; source IMF 2022, p. 36

(IPCC NGGIP, 2004):

- Coal: 1.2 tons of CO_2 per ton of coal. Most of the coal used in the country is lignite, which has a lower emission factor in comparison to coke, for example.
- Oil: 3.07 tons of CO_2 per ton of oil with a calorific value of 42 MJ/kg and emission factor of 73 kg CO_2 per GJ.
- Natural Gas: 1.96 tons of CO_2 per thousand cubic meters of natural gas.
- Fuel Oil: 3.14 tons of CO_2 per ton of fuel oil with a carbon emission factor of 21.1 tC/TJ and calorific value of 42 MJ/kg.
- Diesel Fuel: 3.17 tons of CO_2 per ton of diesel fuel, with a calorific value of 42.6 MJ/kg and a carbon emission factor of 20.2 tC/TJ.
- Gasoline: 3.1 tons of CO_2 per ton of gasoline with calorific value of 44.21 GJ/t, carbon emission factor 19.13 tC/TJ.
- Emission factor for electricity and heat: 144 tonCO_2/GWh.

The emission factors for each fuel type are the default levels from the IPCC Guidelines (IPCC, 2006). Unfortunately, national factors have not been published, and all national GHG inventory reports use the default IPCC values. Coal calorific values are not publicly available; therefore, we used the values reported by the government through mass media outlets (Kaktus, 2016). The emission factors for electricity and heat were derived from the energy profile of the Kyrgyz Republic prepared by the International Renewable Energy Agency (IRENA, 2024).

Finally, we calculated the emission intensities for each sector using the data from the previous steps. Thus, the value of emissions for each sector is divided by the economic value.

To ensure the accuracy of the CO_2 emission calculations, we compared our results with those in recognized published reports such as those from the government and IRENA. We also used various prices for the sensitivity analysis. Furthermore, we used different scenarios to provide more policy options. These scenarios were based on the country's national development strategy and NDCs.

Stakeholder Mapping Approach

In addition to economic modeling, this study used two political analysis tools: stakeholder mapping (an instrument) and the theory of change (a framework approach to social change). Before applying stakeholder mapping and the theory of change to the case of introducing carbon pricing in the Kyrgyz Republic, what these are in the context of this study must be clarified.

Stakeholder mapping in policy analysis is a systematic process used to identify, categorize, and analyze individuals, groups, and organizations that have an interest in or are affected by a particular policy issue. The main objectives of stakeholder mapping are to understand the influences and interests of different stakeholders, facilitate communication and collaboration, and ensure that diverse perspectives are considered in the policymaking process. The key steps

involved in stakeholder mapping include identifying stakeholders, categorizing stakeholders, assessing their stakeholder power and interest in the issue (in our case, it is the issue of carbon pricing), and, finally, mapping stakeholders in a Mendelow matrix, as shown in Figure 2[3].

Figure 2: Power/Interest matrix, Johnson and Scholes (1999) based on Mendelow (1981)

Four stakeholder engagement strategies can be devised based on this matrix. The first strategy for groups of stakeholders with high power but low levels of interest is to keep them satisfied (i.e., understand and try to meet their interests). The second strategy for stakeholders with the highest levels of power and interest is to engage them directly, and preferably transfer to the ownership and overall responsibility for the intended reform. The third strategy for stakeholders with the lowest levels of power and interest is to apply minimal effort. Finally, the fourth strategy for stakeholders with the highest interest but lowest power is to keep them informed. The last group usually includes the general public, as people bear the consequences of climate change but often lack the power to induce change.

The theory of change, as an approach to adaptive management, has become a powerful mechanism for inducing social and administrative change. With its roots in the management literature, theory of change has become a mainstream approach within the global development community. For this project, we applied the theory of change as it is understood in both domestic reform and international development settings. The study required this dual approach for two reasons. First, domestic appeal is required when introducing carbon pricing, so that local stakeholders (policymakers, implementers, business communities, and the public) accept, participate in, and contribute to the successful implementation of carbon pricing mechanisms. Second, the Kyrgyz Republic tends to rely on international partners and donors to finance its most important reforms. Thus, one must consider that this reform will need to appeal not only to the domestic audience but also to the international donor community.

In the context of **domestic reform**, the theory of change is a strategic planning tool used to outline and achieve significant improvements in a country's internal policies, systems, and institutions. This approach is often employed to address various aspects of governance, economic policy, social services, legal frameworks, and other areas that affect national wellbeing and development. At the most basic level, applying the theory of change requires five key phases at the strategic

[3] Please note that this study uses Johnson and Scholes (1999) simplified version of Mendelow's matrix (1981).

planning level.

The first phase is **defining long-term goals**. For example, in carbon pricing, the key stakeholder (in our case, the Kyrgyz government) must be able to identify long-term goals, such as efficiently reducing GHG emissions at a certain rate by a certain date. The second phase is **identifying outcomes**, which range from short-term to intermediate, and would eventually (and ideally) lead to the achievement of long-term goals. For example, to introduce carbon pricing, the Government of the Kyrgyz Republic must calculate the actual external costs of GHG emissions. Thus, a comprehensive analytical task force is required to calculate the impact/costs of GHG emissions across sectors. Primarily, the agriculture and public healthcare sectors must be considered, as they are usually the most affected by excessive GHG emissions. In the third phase, strategic planning is tested through **interventions**. At this stage, strategic planning outcomes are implemented through a set of specific actions or program to achieve the identified outcomes. For example, an intervention could be the introduction of carbon tax as a pilot in a specific sector to determine how those affected would perceive it. The fourth phase is again analytical, as the key stakeholder (i.e., the government) must take stock of **assumptions**, in terms of beliefs and contextual factors that explain how and why the interventions (phase 3) would lead to desired outcomes (phase 2). For example, one potential assumption is that introducing a carbon tax in a specific sector of the Kyrgyz economy would reduce GHG emissions in that sector. The logic behind this is that it would be cheaper for the relevant businesses to modernize and "green" their technological processes and infrastructure rather than continue as usual and pay higher taxes. Finally, throughout the four phases, the key stakeholder should prepare for the fifth phase, identifying the relevant **indicators**. This involves developing a set of metrics to measure the progress and success of the carbon pricing reform.

Applying the theory of change in domestic reform helps stakeholders clearly understand the pathway to achieving significant improvements and allows for better planning, implementation, and evaluation of reforms.

To map the relevant stakeholders, we performed in-depth **interviews** with local stakeholders and conducted an online **survey**. For the in-depth interviews, we recruited several representatives of the Kyrgyz government from relevant ministries and departments, as well as civil society representatives and local experts, including a political psychology specialist to understand potential behavioral trajectories. The interviews were conducted both online and offline in Bishkek in August and September 2024. The interviewees were informed of the study's overall objective and the funding body. All interviewees spoke on the condition of anonymity. While we did not touch on politically sensitive issues, we chose to err on the side of caution and adhere to established ethical considerations when interviewing government officials. The informed consent form is available in Appendix C.

The survey targeted a broad range of stakeholders, including civil society, businesses, and the public. The survey went live in August and open until September 14, 2024. Appendix D presents the survey questions (in Russian).

Both the interviews and surveys contributed qualitative data and complemented the quantitative data collected for this study. The perspectives of current government officials, business communities, civil society, experts, and the public are usually difficult to collect in the Kyrgyz Republic. Both authors employed their professional and personal networks to gain insight into the perceptions of various local stakeholders.

Results

Energy Consumption by Sector

Our analysis of energy consumption by type across various sectors in the Kyrgyz Republic revealed that the economy has diverse shares of energy consumption by type (Figure 3). Across 19 sectors we found that those such as Mining and Quarrying, Other Service Activities, and Public Administration have the highest shares of coal use. Wholesale and Retail Trade have the highest shares of gasoline and diesel fuel consumption.

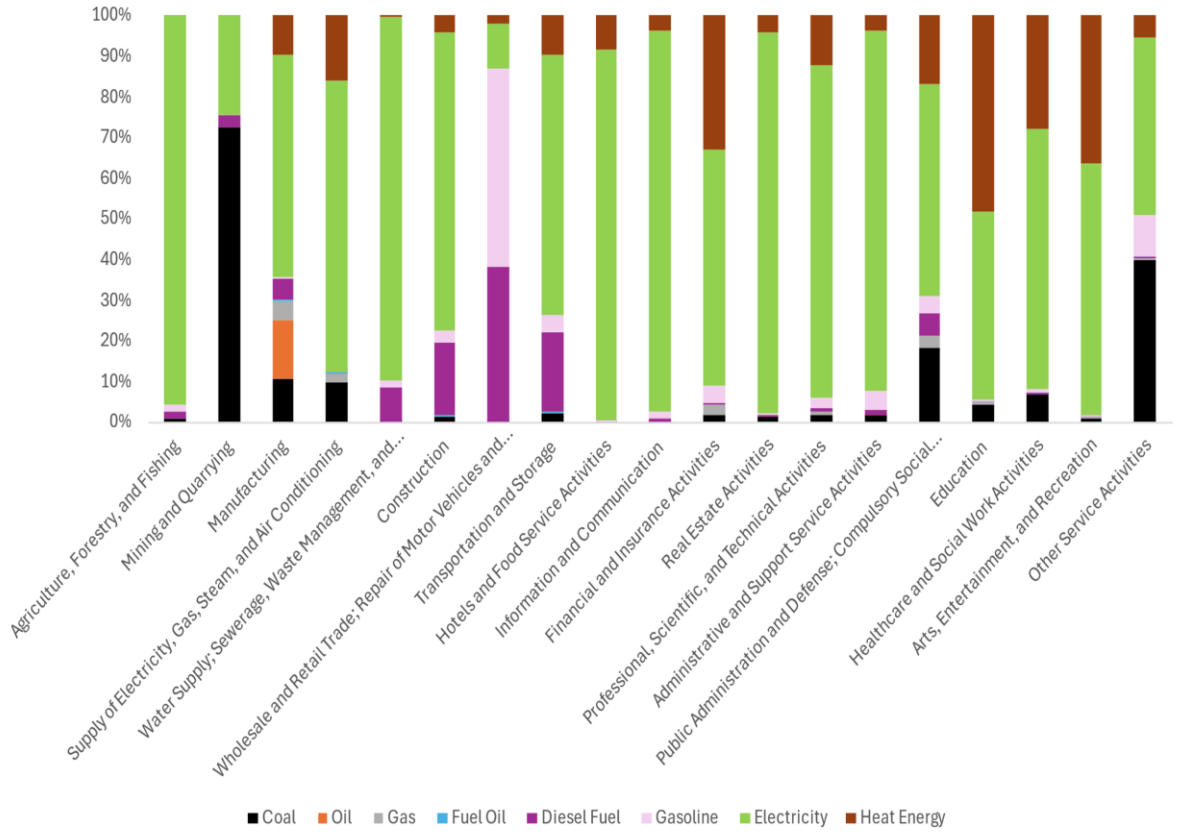


Figure 3. Consumption of types of energy by sectors in percentages in the Kyrgyz Republic. Source: authors' calculations using Energy Balance Report 2022.

One limitation of this approach is that the Energy Balance of NSCKR has only 19 sectors, whereas the IO table contains only 38 sectors. Therefore, we aggregated the sectors into 19 in total (Figure 4). Future research could benefit from a more detailed disaggregation of sectors.

CO_2 Emissions by Sector

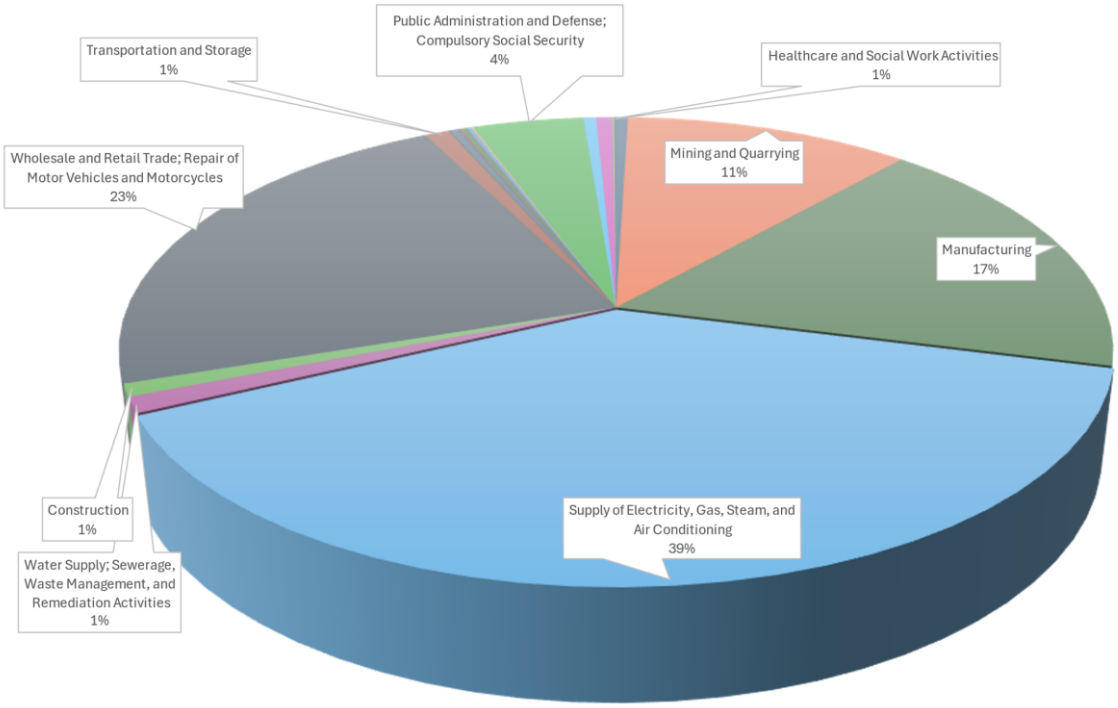


Table 1. Sector-level CO_2 emissions in 2022. Source: authors' calculations**.**

Sector	CO_2 emissions (tons)
Supply of Electricity, Gas, Steam, and Air Conditioning	4,389,353
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	2,554,083
Manufacturing	1,964,892
Mining and Quarrying	1,253,146
Public Administration and Defense; Compulsory Social Security	487,464
Water Supply; Sewerage, Waste Management, and Remediation Activities	122,803
Transportation and Storage	105,551
Construction	98,385
Healthcare and Social Work Activities	72,828
Education	56,125
Agriculture, Forestry, and Fishing	52,380
Real Estate Activities	33,487
Information and Communication	32,269
Professional, Scientific, and Technical Activities	19,637
Financial and Insurance Activities	10,577
Hotels and Food Service Activities	8,171
Other Service Activities	7,997
Administrative and Support Service Activities	7,499
Arts, Entertainment, and Recreation	6,270
Total	11,282,917

Figure 4. CO_2 emissions by sector in percentages. Source: author's calculations using NSCKR data.

The **Energy Supply** sector is the largest consumer of energy, with 1,453.6 thousand tons of coal, 293.1 million cubic meters of natural gas, and 10,475.7 million kWh of electricity. This sector is

also the most significant emitter of CO_2 given its reliance on coal and natural gas, at 4.3 million tons (Table 1).

Trade has the second-largest CO_2 emissions at 2.5 million tons. This sector accounts for the largest share of gasoline and diesel fuel consumption.

Manufacturing consumes a diverse mix of energy sources, including 222.9 thousand tons of coal, 297.8 thousand tons of oil, and 99.6 million cubic meters of natural gas. The CO_2 emissions of this sector are significant, reflecting the energy-intensive nature of manufacturing processes, with 1.9 million tons.

Mining and Quarrying is another major energy consumer, with 905.2 thousand tons of coal and notable electricity consumption. This sector also produces substantial CO_2 emissions, primarily because its heavy coal consumption, reaching 1.2 million tons.

Public Administration has a notable share of energy consumption, particularly in terms of coal (131.3 thousand tons) and electricity (370.9 million kWh), resulting in considerable CO_2 emissions of 487 thousand tons. **Transportation and Storage**, while consuming less energy overall, still contributes to CO_2 emissions, particularly through diesel and gasoline consumption.

The individual emissions of the other sectors were below 150 thousand tons. Notably, sector emission intensity presents a different picture.

Emission intensity by sector

Sector CO_2 emission intensity refers to the amount of CO_2 emissions produced per unit of output or activity within a specific industry. It is typically expressed in units such as kilograms or metric tons of CO_2 emitted per unit of production, including per ton of steel, megawatt-hour of electricity, or GDP contribution from the industry. This metric is crucial for assessing the carbon footprints of different industries, comparing the environmental impact of various sectors, and guiding policy decisions related to emission reduction. To the best of our knowledge, industry carbon intensity data have not been made available for the Kyrgyz Republic.

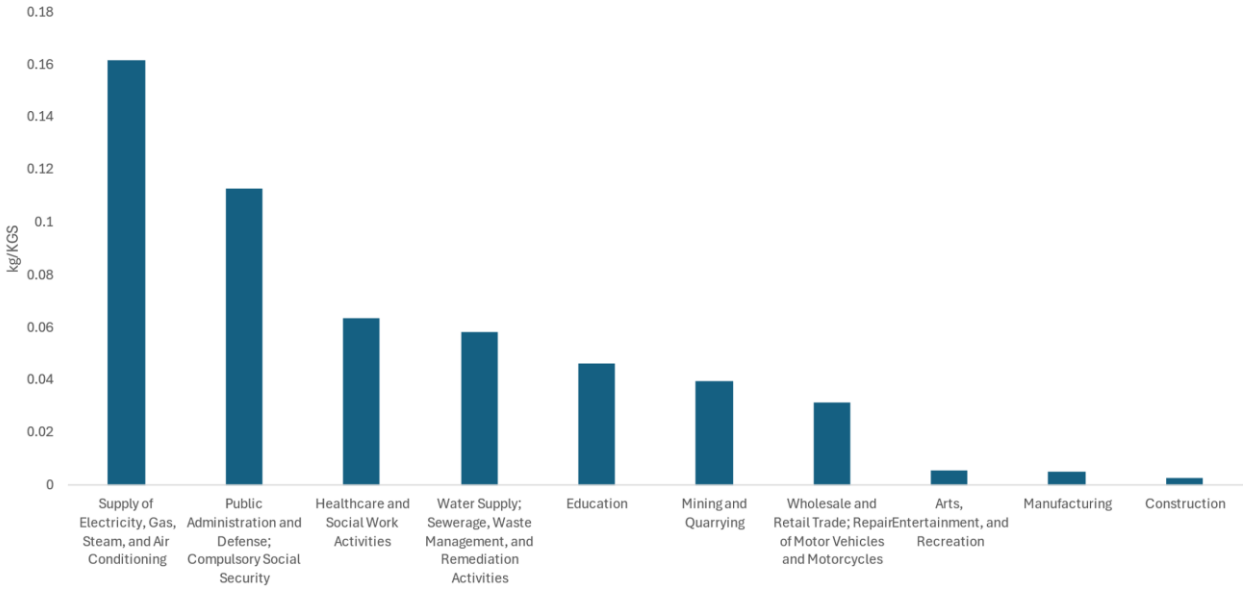


Figure 5. Top ten emission-intensive sectors using inputs from IOM. Source: authors' calculations

Sector-level CO_2 intensity in the Kyrgyz Republic (Figure 5) shows that the top carbon-intensive industries are Energy Supply, Public Administration, Healthcare, Water Supply, and Education. These sectors are mostly run by the government. Carbon use in the public sector is inefficient, which suggests potential policy actions. Although one could argue that public sector emissions are due to nature and goals (i.e., not targeting maximum efficiency), the large difference in intensity is likely because of large energy losses in public buildings (World Bank, 2019). The high carbon intensity in these sectors indicates inefficiency and reliance on energy- and carbon-intensive infrastructure. Thus, infrastructure improvement is a key priority when designing effective carbon pricing policies.

Mining and Trade are two other sectors with high-intensity CO_2 emissions. This is because of the high fossil-fuel consumption in these sectors. If carbon pricing is implemented, these sectors may be affected. These sectors are critical targets for improving energy efficiency and reducing emissions. The mining industry, supported by strong lobbying groups, has long been a significant contributor to Kyrgyzstan's GDP. However, it employs relatively few people, resulting in a minimal impact on vulnerable groups. In contrast, the carbon-intensive trade sector employs a large portion of the population, including vulnerable groups such as low-income households, rural migrants, and women.

The high disparity in energy consumption and CO_2 emission intensity across sectors highlights the lack of a comprehensive emission control policy. Conversely, sectors with lower consumption and emissions may face less immediate economic pressure from carbon taxes but still play a role in the overall energy efficiency and sustainability landscape. Other sectors, although less impactful, contribute to broader energy efficiency and sustainability goals. This comprehensive perspective aids in understanding the economic and environmental implications of energy use and informs targeted policy measures to reduce CO_2 emissions.

Costs of carbon taxes across economic sectors

The total carbon cost for 19 economic sectors is over USD 564 million, with a CO_2 price of USD 50 per ton. The data show a varying mix of fuels (coal, oil, gas, fuel oil, diesel fuel, and gasoline) across sectors in the Kyrgyz Republic. Hence, carbon costs also vary with the CO_2 content.

High CO_2 costs are incurred in the Energy Supply, Wholesale and Retail Trade, and Mining and Quarrying sectors (Figure 6). The Energy Supply sector is the largest CO_2 emitter, with a total CO_2 cost of USD 219 million, primarily driven by CO_2 emissions from coal (4,157,296 tons) and gas (574,476 tons) consumption. Wholesale and Retail Trade also contribute considerable emissions costs, amounting to USD 128 million, with a significant portion stemming from gasoline (1,401,820 tons). The CO_2 cost in the Trade sector is USD 98 million, with emissions totally 1,964,892 tons. The Mining and Quarrying sector also has high CO_2 emissions costs, which are predominantly from coal CO_2 emissions (1,253,146 tons) and total USD 62 million.

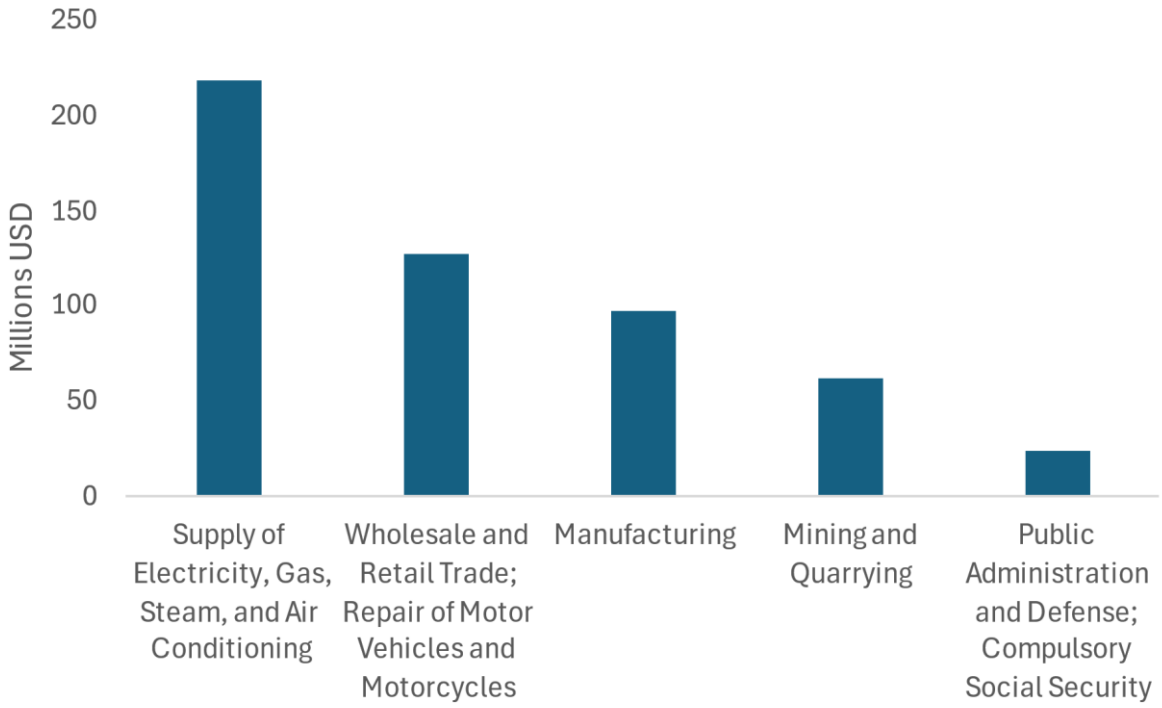


Figure 6. Top five sectors with the highest carbon cost. Source: authors' calculations.

Table 2 shows the CO_2 emissions costs across all sectors.

Table 2. Total cost of CO_2 across sectors

#	Sector	Carbon cost (USD) at $50 per CO_2 ton
1.	Electricity, Gas, Steam, and Air Conditioning Supply	219,467,659
2.	Wholesale and Retail Trade; Motor Vehicle and Motorcycle Repair	127,704,133

3.	Manufacturing	98,244,581
4.	Mining and Quarrying	62,657,308
5.	Public Administration and Defense; Compulsory Social Security	24,373,198
6.	Water Supply; Sewerage, Waste Management, and Remediation Activities	6,140,174
7.	Transportation and Storage	5,277,550
8.	Construction	4,919,249
9.	Healthcare and Social Work Activities	3,641,390
10.	Education	2,806,233
11.	Agriculture, Forestry, and Fishing	2,619,010
12.	Real Estate Activities	1,674,343
13.	Information and Communication	1,613,438
14.	Professional, Scientific, and Technical Activities	981,871
15.	Financial and Insurance Activities	528,851
16.	Hotels and Food Service Activities	408,569
17.	Other Service Activities	399,838
18.	Administrative and Support Service Activities	374,951
19.	Arts, Entertainment, and Recreation	313,523
	Total cost	**564,145,867**

The analysis revealed that energy-intensive sectors such as Energy Supply, Wholesale and Retail Trade, Manufacturing, and Mining and Quarrying were the primary contributors of CO_2 emissions in the Kyrgyz Republic in 2022. Consequently, these sectors would potentially bear the highest carbon taxes, constituting approximately 90% of the total CO_2 costs. In contrast, sectors with minimal energy consumption and emissions, such as Arts, Entertainment, and Recreation, would face only nominal carbon costs. This distribution underscores the economic burden of carbon taxes on high-emission sectors, thereby incentivizing a shift towards cleaner energy practices. A detailed sectoral analysis provides a clearer understanding of the potential economic and environmental benefits of a carbon tax for guiding policy decisions aimed at reducing CO_2 emissions while considering sector-specific impacts.

The four sectors noted above have the highest CO_2 emissions costs; however, among these, the Mining and Trade sectors also have high emission intensities. Therefore, if the aim of a carbon policy is to reduce emissions while increasing budget revenue, it should target both of these sectors. The carbon costs reveal that, in addition to potential budget revenues, an opportunity also exists for efficiency improvements across sectors. These findings can be used to develop scenarios and inform policy recommendations.

Stakeholder mapping

The economic impact of a potential carbon tax cannot be overestimated. However, looking beyond the figures and understand the local context and actorness is important, as it could inform

future reforms. In this section, we explore the stakeholder landscape of the Kyrgyz Republic and provide insights into the potential opponents and proponents of carbon tax reform.

The Kyrgyz Republic is a landlocked Central Asian nation with a presidential political system, regular elections, and a low-income economy[4]. A distinctive feature of the Kyrgyz Republic in the region is its potential key asset: a vibrant civil society. The Kyrgyz Republic is also an active recipient of international development assistance, with a broad range of national, state, non-state, and international donor agencies working in various sectors of the Kyrgyz economy. Therefore, five large stakeholder categories can be identified that need to be considered in the context of this study: the Kyrgyz Government, local business communities, Kyrgyz civil society, the general public, and the international donor community. The first four categories are domestic, whereas the last one is external but crucial, as it could potentially speed up (or slow down) the introduction of sustainable carbon pricing reforms.

The most obvious stakeholder group is the **Kyrgyz government,** which is in charge of defining the overall direction of the country's development and introducing large-scale socioeconomic and political changes. Our carbon pricing research identified the agencies that are key stakeholders within the Kyrgyz government. Four ministries would ideally be primary stakeholders and driving forces, as they need to take lead in introducing carbon pricing and/or be directly involved in calculating and enforcing carbon prices in the Kyrgyz Republic.

First, the Ministry of Economics and Commerce is responsible for overall economic policies. Second, the Ministry of Finance must be involved in the redistribution of the carbon pricing revenue collected. Third, the Ministry of Energy must be extensively involved in the implementation phase, because the energy sector is among the most carbon-intensive sectors in the Kyrgyz Republic. Fourth, the Ministry of Natural Resources, Ecology and Technical Supervision should become a hub for technical expertise in carbon pricing. This Ministry houses the Climate Policy Division, which is a vital department that cooperates with other government agencies and international organizations.

The Ministries of Agriculture and Healthcare will need to participate in identifying the indirect costs of GHG emissions from the country's crops and cattle, and the burden on public healthcare caused by the consequences of climate change, respectively. The Ministry of Culture, Information, Sports and Youth Policy is needed to keep the public informed. The Kyrgyz Ministry of Foreign Affairs has already undergone efforts to negotiate the exchange of the country's debt for environmental projects. The most recent of these negotiations took place between the Kyrgyz Ambassador to Paris and the French Ministry of Economics and Finance[5]. Although such one-off occasions might not appear significant, they demonstrate an overall understanding of the climate

[4] The World Bank 2024. Kyrgyzstan: An overview, available at https://www.worldbank.org/en/country/kyrgyzrepublic/overview, last accessed on 14.09.2024

[5] Source: Kaktus Media 2024. "Kyrgyz MFA offered France to write off its foreign debt in exchange to green projects" (in Russian), published on 06.07.24, available at https://kaktus.media/doc/504724_mid_kyrgyzstana_predlojil_francii_spisat_vneshniy_dolg_v_obmen_na_zelenye_proekty.html

emergency and ability of certain government bodies to seek creative and resourceful solutions to the environmental and economic challenges facing the Kyrgyz Republic.

Civil society has an important role in introducing economic reforms and social change in the Kyrgyz Republic. After decades of vibrant political life, the country has acquired a proactive and diverse civil sector. Some of the existing civil organizations work in the area of climate change and are crucial for communicating the context and objectives of carbon pricing to the general public, lobbying Parliament and the Government, working with business associations, and serving as independent expert communities and public watchdogs to ensure that the introduction of carbon pricing is transparent and efficient. Kyrgyz civil society is distinguished by not only its proactiveness but also its holistic approach to national development. Whether CSOs deal with gender equality or rural poverty, they typically strive to also incorporate environmental considerations. Larger government initiatives yet to be implemented include the establishment of a climate change trust fund[6].

Business communities that may be affected by carbon pricing must be included in the reform process to avoid opposition and barriers. They are the stakeholders who will primarily bear the costs of introducing a carbon tax and, as such, might require more convincing than other stakeholders.

The **general public** in the Kyrgyz Republic is the ultimate interested party in mitigating climate change. However, members of public are also the least powerful actors, if not involved in businesses or relevant civil society organizations, and is likely to have limited say in social change. However, public consent for carbon pricing is key to making this a sustainable change. Furthermore, businesses might incorporate carbon tax-related expenses into the cost of goods and services, which could translate into potential inflation for end consumers (i.e., the general public). This could lead to negative attitudes among the public regarding carbon taxes.

Finally, the **international donor community** would need to play several roles. First, it could help develop carbon pricing mechanisms by lending expertise and tailoring best practices to the Kyrgyz context. Second, it may need to contribute resources for implementing carbon pricing. Third, this community could play a role in public awareness campaigns and government lobbying, as it has a certain amount of power and leverage because of the country's dependence on donor aid.

Stakeholder interviews and survey results

Interviews with government officials and experts

The research team conducted ten in-depth interviews with relevant government officials, representatives from international NGOs and civil society, and academic researchers. The

[6] Source: Akipress News 2024, "Ministry of Natural Resources of Kyrgyzstan intends to set up climate trust fund," available at https://akipress.com/news:795286:Ministry_of_Natural_Resources_of_Kyrgyzstan_intends_to_set_up_climate_trust_fund/

interviews were conducted both online and offline in Bishkek in August and September 2024. The research team approached potential participants via email or phone. All participants were informed of the objectives, purpose, context, and funding body of this research project. Each participant provided an informed consent form in Russian (see Appendix C, Informed Consent Form). The state language is Kyrgyz, but the *lingua franca* of many Bishkek-based professionals and foreign experts id Russian. Not all potential participants who were approached agreed to participate because of their workloads or other reasons. Civil society members and experts were more interested in being interviewed than civil servants.

The interviews revealed several key findings. First, participants acknowledged that the topic of carbon pricing is a actively debated within the government. One senior government official confirmed that with support from Japan and South Korea, the government is currently assessing the feasibility of developing a carbon market. However, he emphasized that this is a long-term process, with no immediate outcomes expected, as the country currently lacks the necessary legislative framework for an ETS. The lack of normative and legal frameworks was quoted several times in the interviews as a significant hinderance to introducing a carbon tax or any other climate change mitigation mechanism. The interviewees also highlighted the lack of dedicated human resources, particularly legal experts and environmental economists, within the government, who could be tasked with developing the required legal and normative frameworks and conducting more in-depth calculations.

Moreover, several interviewees noted that ETS is not considered highly attractive because of the Kyrgyz Republic's limited industrial base. Large industrial producers are mainly concentrated in the energy sector or are strategically important entities that require careful consideration in policy design.

Government representatives also indicated that a carbon tax might have a higher chance of being implemented in the medium term with considerable support from international development organizations and financial institutions, as well as relevant academics. From an administrative perspective, they viewed a carbon tax as more straightforward than an ETS. Furthermore, if introduced, the government anticipates that revenues from a carbon tax would be earmarked for decarbonization initiatives, such as subsidies for green growth.

Furthermore, officials highlighted that carbon pricing is being discussed as part of the forthcoming Green Economy Strategy 2028. At the time of this study, this strategy had not yet been published. Overall, government officials stated that because carbon pricing is a relatively new concept for the country, the government relies on international partners to study global experiences and inform policy development. The government stakeholders also appeared to take interest in this research project, keeping in mind an informal map of relevant stakeholders and experts among local researchers and civil activists. An ecosystem appears to be emerging comprised of committed civil servants, international donors, local researchers, and civil activists involved in various smaller projects. This signifies an opportunity to build strategic partnerships and rally available resources if the government provides a sufficient political push.

Nongovernmental interviewees raised concerns regarding the state's limited capacity to implement carbon pricing measures. They also noted the absence of modern legislation on carbon pricing and GHG emission standards across sectors. Non-environmental civil society organizations appeared to care about climate change and would welcome carbon taxes and other climate-change mitigation mechanisms in principle. However, they also acknowledged the lack of a deeper understanding of what this would imply in political, economic, and social terms. More specialized CSOs understood the sheer amount of work to be done and resources to be raised; however, they remained hopeful that a carbon tax or other measures would be introduced.

One expert suggested that the Kyrgyz Republic should first participate in a voluntary carbon market. In his view, establishing a domestic ETS is still a long way off, and would likely take at least 5–6 years. This delay is primarily due to the absence of essential carbon infrastructure, such as a reliable Monitoring, Reporting, and Verification (MRV) system, a supporting legislative framework, and a cohesive national decarbonization strategy. However, one government expert noted that internal debates about climate mitigation mechanisms are often based on economic components and motivation. Thus, the government sees GHG quota trading or green investment as a means of attracting economic opportunities rather than an opportunity to contribute to resolving the climate change emergency. They noted the need to shift thinking within the government towards greater concerned regarding climate change.

Furthermore, several participants expressed concerns about the limited awareness and understanding of carbon pricing mechanisms within the private sector and among the public. This lack of knowledge poses a significant challenge to policy implementation, as it may lead to resistance from businesses owing to perceived additional costs and the public, who may not fully grasp the environmental and economic benefits of such measures. Without targeted outreach, education, and capacity-building efforts, the successful adoption of carbon pricing policies could be hindered by misconceptions and a lack of stakeholder engagement.

In this regard, the interview with a political psychology expert provided an interesting potential solution. The public is more likely to accept a change if it is presented confidently and without other options. If there are options and consultations (i.e., the possibility of reversing the change), the change is not likely to gain public compliance. Thus, it makes sense for experts and the government to prepare a final product and present it as a solution to both the private sector and general public. If a product (e.g., legislation, regulation, funding, or implementation mechanisms) is clear and does not imply other options (except for potential improvements), the public will be more likely to accept it.

The interviewees also raised a key concern regarding the potential for carbon pricing to increase costs to reduce the competitiveness of domestic industries and impose a greater financial burden on the population. Participants stressed the need for a comprehensive impact assessment, particularly at the sectoral level, to thoroughly evaluate the possible effects on industry performance and competitiveness as well as the social and economic implications for vulnerable groups.

In addition, the participants highlighted the related concern of the private sector's limited involvement in carbon market discussions, which contrasts sharply with practices in other countries. This lack of engagement was seen as a critical barrier because private sector buy-in is essential for the successful implementation of carbon pricing measures. Without adequate participation and input from industry stakeholders, it may be difficult to design effective policies that balance environmental goals with economic realities. Other government interviewees mentioned the ongoing formal and informal discussion between government agencies and international donors on climate-change mitigation mechanisms, but made no mention of the participation of businesses. The civil society sector, especially the CSO, which focuses on environmental issues, usually concentrate on narrow specialized projects, which often receive external funding.

Overall, policymakers' perspectives on the role and effectiveness of carbon-pricing mechanisms were positive and fairly optimistic. There appeared to be a general understanding that carbon pricing can be introduced on a limited scale to develop more efficient and ambitious climate mitigation mechanisms in the future. The potential generation of additional revenue through a carbon tax was also viewed as positive that could further contribute much-needed domestic resources to other green reforms. However, current limitations and barriers were also acknowledged, such as the lack of normative and legislative frameworks, required technical expertise, and financial resources to implement carbon tax reform.

The civil society sector was generally positive about introducing a carbon tax; however, they also highlighted structural limitations (i.e., normative and legal framework and funding). Opinions of the private sector are more difficult to track, especially across sectors. In theory, Kyrgyz business communities have proven themselves to be open to reform and generally agree that climate change is a challenge that must be addressed. However, given the potential short-term consequences of introducing a carbon tax (e.g., increased production costs, extra burden on consumers), the business side my express less enthusiasm to embrace carbon tax reform when it comes to its actual introduction and implementation.

Online Survey Results

In mid-September 2024, 32 people took part in the online survey (see the Online Survey's text in Appendix D). Most participants were in academia or the civil society sector, listed as "other private sector" (Figure 7). This likely reflects the level of public engagement on the topic, in which experts and civil society activists are the most vocal and interested stakeholders, but not necessarily the most powerful.

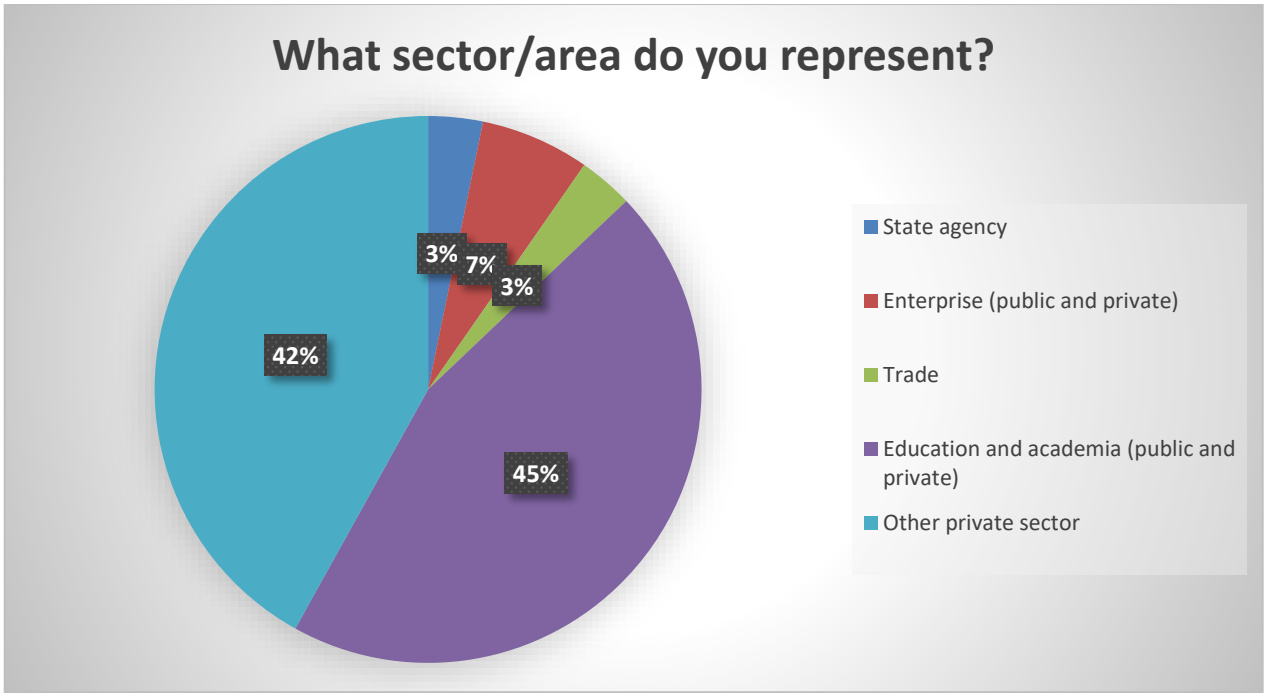


Figure 7: Breakdown of survey participants by sector

Most participants had substantial professional experience, representing mid- and top-level professionals in their respective fields (Figure 8).

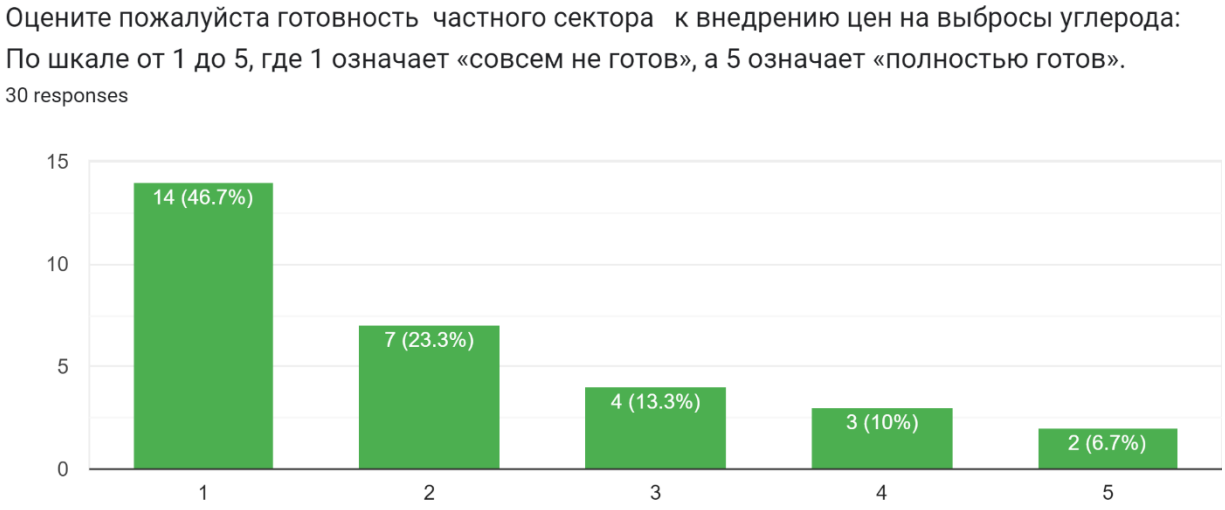
Figure 8: Survey participants' professional experience in years

The participants assessed the government's readiness to implement a carbon pricing mechanism as low. Over 80% of the respondents (Chart 1) indicated that they believed the government is unprepared for such an initiative. This assessment reflects concerns about the current lack of the infrastructure, legislative frameworks, and administrative capacity required for effective implementation.

Chart 1: Please evaluate the readiness of state bodies to introduce carbon pricing: Please rate from 1 to 5, in which 1 indicates "not ready at all" and 5 indicates "completely ready" (translated from Russian by the authors)

The preparedness of the private sector and households was assessed to be even less adequate than that of the government (Chart 2).

Chart 2: Please evaluate the readiness of the private sector for the introduction of carbon pricing: Please rate from 1 to 5, in which 1 indicates "not ready at all" and 5 indicates "completely ready" (translated from Russian by the authors)



Participants indicated that both sectors were ill-equipped to adapt to or support the implementation of carbon pricing mechanisms. This lack of readiness reflects broader concerns regarding insufficient awareness, a limited understanding of the effects of carbon pricing, and the absence of the necessary infrastructure and practices to comply with such policies.

Survey participants reported that effective communication on the benefits of carbon pricing, such as improved air quality, is crucial, particularly when addressing carbon emissions from coal. They noted the need for suitable alternatives to coal for private households, such as heat pumps. However, they also highlighted that the use of natural gas as a substitute is complex because of the need to account for methane emissions.

Participants emphasized the need for a more comprehensive analysis to fully understand the implications of various energy sources and their role in reducing carbon emissions. While they agreed that taxing non-renewable energy sources such as coal, gasoline, and gas is technically straightforward, they stressed the importance of evaluating the broader environmental and social impact. This includes assessing the effectiveness of potential substitutes and managing any unintended consequences that may arise from transitioning to new energy sources.

Survey participants indicated that the energy sector is crucial for variability in carbon pricing mechanisms. However, they were unaware of any specific energy strategies for transitioning towards zero emissions. They noted that increasing the share of renewable electricity is crucial for replacing coal and gasoline consumption. They further noted that electric vehicles and heat pumps are approaching competitive pricing and that even a modest carbon tax on nonrenewable energy sources could accelerate the adoption of these technologies and thus the transition to a low-carbon economy.

Participants also suggested that sharing economic data could help with detailed calculations and projections. They emphasized the need to develop clear and transparent mechanisms for cooperation and stakeholder engagement to support this transition effectively.

The comments section of the survey reflected a general consensus that the government needs to lead the way in introducing a carbon tax, and that the private sector needs to be fully informed and onboard for it to be efficient.

Scenarios for Implementation of Carbon Pricing in the Kyrgyz Republic

Based on the interview results, we identified two scenarios for implementing carbon pricing in the Kyrgyz Republic. The first scenario describes an ETS, and the second concerns the carbon tax. The discussion below presents both options considering the findings from economic modeling and stakeholder interviews. An important assumption for both scenarios is that the government has legislative and carbon infrastructure.

Scenario 1: Emission Trading Scheme

An ETS sets a cap on the total amount of GHGs certain sectors can emit. Companies receive or buy emission allowances, which they can then trade with one another. The cap is gradually reduced to decrease total emissions.

An ETS provides companies with the flexibility to meet their emissions targets in a cost-effective manner. Firms that can reduce emissions at a lower cost can sell their excess allowances to firms facing higher reduction costs, thus promoting cost efficiency across the market. High-emission sectors, such as Energy Supply and Manufacturing, might invest in cleaner technologies and practices to stay within their allowances or reduce their need to purchase additional allowances. This system encourages innovation and investments in low-carbon technologies. If an ETS is implemented in the Kyrgyz Republic, the budget revenues from these two sectors alone could

reach USD 317 million, with a minimum of US 50 per ton of CO_2 (see the Results section).

Furthermore, an ETS can guarantee environmental outcomes by setting a firm cap on emissions. Over time, the cap is reduced, ensuring that total emissions decrease. This mechanism directly targets emission reductions in high-impact sectors, thereby contributing significantly to the national and global climate goals of the Paris Agreement.

An ETS can have a social impact similar to that of a carbon tax by potentially increasing energy and product prices. However, the flexibility of trading can help minimize these costs. The revenue generated from auctioning allowances can be used to fund public services, renewable energy projects, and social programs, ensuring that the transition to a low-carbon economy benefits all segments of society.

The development of an effective ETS in the Kyrgyz Republic faces several challenges. First, it would require a well-functioning MRV system, which the country currently lacks. Moreover, carbon price volatility is a critical issue, particularly in economies with limited industrial diversity such as the Kyrgyz Republic. Establishing an ETS would necessitate the creation of a new administrative framework that the country is not yet prepared to implement.

Another significant challenge is the lack of consultation with the private sector. To date, no formal dialogues or active engagements have taken place with key industry stakeholders, in contrast to practices observed in other countries. This lack of involvement raises concerns regarding the feasibility and acceptance of carbon pricing measures, especially given that emissions in the Kyrgyz Republic are heavily concentrated in the energy sector and a few large, strategically important enterprises. These industries are particularly sensitive to policy and cost changes, making ETS introduction a complex and delicate issue.

In addition to the energy sector, the mining and trade sectors are substantial sources of emissions. However, ETS implementation in these sectors would require a tailored approach. For example, an ETS could be relatively straightforward for the mining and energy supply sectors owing to the limited number of enterprises, making carbon accounting and emissions monitoring more manageable.

Implementing an ETS in the trade sector presents challenges because of the nature of the industry, which primarily involves the movement of goods rather than direct production. The sector's structural characteristics make it difficult to apply conventional carbon pricing mechanisms, thus complicating monitoring and verification efforts. Additionally, this sector employs a broad range of people, including vulnerable groups. Given these complexities, multiple complementary policies are required to ensure the effective management of emissions across sectors. Without such an integrated policy approach, ETS development in the Kyrgyz Republic is unlikely to progress in the medium term because the current political, administrative, and economic environment presents substantial barriers to its implementation.

Scenario 2: Carbon Tax

A carbon tax is often attractive because of its administrative simplicity and budget revenue potential. A carbon tax directly sets a carbon price by defining a tax rate on GHG emissions or the carbon content of fossil fuels. This approach provides a clear economic signal, encouraging businesses and consumers to reduce their carbon footprint by switching to cleaner energy sources or investing in energy efficiency.

The results of our analysis indicate that the financial burden is unevenly distributed in the Kyrgyz Republic. The Energy Supply sector faces the highest potential carbon tax, followed by the Trade, Manufacturing, and Mining sectors. Sectors with lower emissions, such as Entertainment, Accommodation and Food Service Activities and Information and Communication face significantly lower carbon taxes. This difference in carbon tax burdens highlights the economic incentives for sectors to reduce their emissions.

These results indicate that the economic impact of implementing a carbon tax in the Kyrgyz Republic will likely vary across sectors. High-energy-consuming sectors, such as Energy Supply, Trade, Manufacturing, and Mining, will face increased operational costs because of their substantial CO_2 costs. These sectors may pass on some of these costs to consumers, leading to higher prices for electricity, industrial products, and raw materials. The critical question is which of these sectors will pass the largest burden to consumers and potentially harm the industry's competitiveness.

Aa carbon tax is not attractive for the Energy supply sector because it is mostly owned by the government, and inelastic demand threatens to increase the hardship of the population unless a well-designed policy to protect vulnerable groups is put in place. The Trade, Mining, and Manufacturing sectors are better positioned to experience positive results from the carbon tax by increasing efficiency and raising budget revenues. The revenue generated from the carbon tax can be reinvested into the economy to support the transition to renewable energy, improve energy efficiency, and mitigate the adverse economic impact on vulnerable sectors and populations. In Mining, the carbon tax on the coal sector may have a potentially negative impact on the most vulnerable groups in the population, who rely on coal as a primary heating source. Therefore, the implementation of a carbon tax on the Mining sector will require either the exclusion of coal mining or careful policy design, such as providing subsidies for housing energy efficiency programs such as insulation.

Over the long term, a carbon tax is expected to reduce CO_2 emissions significantly by making carbon-intensive energy sources more expensive, thus incentivizing the adoption of cleaner alternatives. High-emission sectors have a financial incentive to invest in technologies that reduce emissions, such as carbon capture and storage, and to shift towards renewable energy sources, such as hydro, solar, and wind power.

Based on our analysis, we believe that a carbon tax should first be implemented in the Trade and

Mining sectors because they have high emissions and CO_2 intensities. This would generate USD 190 million annually. Another potential sector is Manufacturing, which has the potential to generate USD 98 million annually through carbon tax revenue. However, the taxation of Manufacturing sector requires caution and sophisticated design because of its high connectivity with other sectors and the threat of losing international competitiveness. Thus, total annual budget revenue could reach USD 288 million.

On the social front, a carbon tax in these sectors could initially increase the cost of living owing to higher prices. However, if tax revenue is used to subsidize renewable energy projects, improve public transportation, and support low-income households, it could mitigate these effects and promote a more equitable energy transition. The impact on vulnerable groups should be a key consideration in carbon tax policies, especially in the Trade and Coal Mining sectors. The introduction of a carbon tax presents several advantages for the Kyrgyz Republic, particularly compared with an ETS. A key benefit is its price certainty. Unlike an ETS, a carbon tax sets a fixed carbon price, providing predictability for businesses and policymakers alike, which is especially important in countries with fluctuating markets and limited administrative capacity.

Another advantage is that a carbon tax can be integrated into existing tax structures, allowing it to "piggyback" on established administrative frameworks. This makes it particularly suitable for governments with limited capacity, as it reduces the need to develop new and complex regulatory systems from the ground up. In contrast, an ETS requires the creation of entirely new institutions, including MRV mechanisms, which the Kyrgyz Republic currently lacks.

Given the government's administrative capabilities, a carbon tax is more feasible and implementable than an ETS. The administrative burden is significantly lower, enabling the government to manage and enforce carbon pricing measures more effectively.

Furthermore, a carbon tax offers environmental and economic co-benefits. Directly targeting carbon emissions can help address local air pollution while simultaneously improving overall economic efficiency. The tax incentivizes energy efficiency improvements and reduces the carbon intensity of production processes, thereby fostering a shift towards cleaner technologies and practices.

Introducing a carbon tax in the Kyrgyz Republic would require a carefully planned approach, starting with the determination of the tax base. This involves identifying which GHGs, sectors, and economic activities will be subject to the tax, as well as any thresholds for its application. In the context of the Kyrgyz Republic, a carbon tax could focus on gasoline and fuel importers, thus targeting a relatively small number of key actors. This narrower scope would simplify the administrative burden and enhance the government's ability to enforce the tax effectively. Notably, the revenue generated from the carbon tax could be earmarked for green projects such as investments in renewable energy, thereby improving energy efficiency and supporting broader decarbonization efforts.

The next critical step is defining the tax rate. The tax could be set based on the social cost of carbon, which reflects the estimated economic damage caused by each ton of CO_2 emitted.

Alternatively, the tax rate could be designed to meet specific abatement targets, ensuring that it drives measurable reductions in GHG emissions. Another approach is to set the rate based on a revenue target to ensure that the tax generates sufficient funds to finance green initiatives. Benchmarking against regional or international carbon-pricing schemes could provide further insights into setting an appropriate rate that balances environmental goals with economic considerations. By following these steps, the Kyrgyz Republic could implement a carbon tax that is both administratively feasible and aligned with its sustainability objectives while also addressing local environmental concerns and promoting green economic growth.

Both ETSs and carbon taxes offer distinct advantages and face specific challenges. To maximize the benefits of each approach, a hybrid model that combines elements of both systems could be considered. For example, while an ETS could be implemented to cover the major emitting sectors, a carbon tax could be applied to sectors not included in the ETS, ensuring a comprehensive approach to reducing emissions.

A tailored approach is essential for the Kyrgyz Republic, which has a unique economic structure and provides specific data on sectoral energy consumption and emissions. This approach should consider the needs and capacities of different sectors. Implementing support mechanisms for the industries and communities most affected by the shift to a low-carbon economy will be critical for ensuring a smooth and equitable transition.

This study indicates that a carbon tax is currently a more promising and feasible option compared to an ETS, largely because of its simpler implementation and lower administrative burden. Nevertheless, successfully introducing either carbon pricing mechanism would require the development of a robust carbon infrastructure. This includes creating comprehensive legislative frameworks and establishing a reliable MRV system to ensure effective enforcement and accountability.

Furthermore, integrating carbon pricing into the country's long-term vision and economic development strategies is crucial. The carbon-pricing mechanism should align with broader economic and environmental goals to maximize its effectiveness and sustainability. This alignment requires careful planning and coordination to ensure that the policy supports the country's development objectives while significantly reducing emissions.

To enhance the policy's credibility and effectiveness, national consultations must be conducted with all relevant stakeholders. Engaging a diverse range of stakeholders, including private sector representatives, civil society, and academic institutions, will provide valuable insights and foster broad-based support. Such consultations will help address potential concerns, build a consensus, and ensure that the carbon pricing policy is well-informed, widely accepted, and capable of meeting its intended objectives.

In summary, although a carbon tax currently offers a more feasible path forward, its successful implementation, along with any other carbon pricing mechanism, depends on the development of the necessary infrastructure, alignment with strategic goals, and active stakeholder engagement throughout the process.

Benefits of Carbon Pricing

Implementing carbon pricing in the Kyrgyz Republic offers several potential benefits for environmental sustainability. First, it would provide a strong economic incentive to reduce GHG emissions by making carbon-intensive activities costlier, thereby encouraging businesses and individuals to adopt cleaner technologies and practices. This shift could significantly reduce air pollution, resulting in substantial improvements in air quality and public health. Cleaner air would reduce the incidence of respiratory and cardiovascular diseases, thus enhancing citizens' quality of life. Additionally, carbon pricing can generate revenue that the government can reinvest in sustainable infrastructure projects such as renewable energy sources and energy efficiency programs, further accelerating the transition to a low-carbon economy. The adoption of carbon pricing could also enhance the Kyrgyz Republic's international standing by demonstrating its commitment to global climate goals, potentially attracting foreign investment and support for green initiatives. Moreover, it could stimulate innovation and competitiveness within the local economy by driving the development of new sustainability-focused technologies and industries. Overall, carbon pricing has the potential to play a crucial role in advancing environmental sustainability in the Kyrgyz Republic, thus contributing to long-term ecological and economic resilience.

Implementing carbon pricing generally enhances a country's ability to achieve its commitments under the Paris Agreement. Assigning a cost to carbon emissions creates a financial incentive for businesses and individuals to reduce their carbon footprint, thus directly contributing to the reduction targets outlined in their NDCs. This market-based approach encourages the adoption of cleaner technologies and energy-efficient practices, thereby facilitating a shift from fossil fuels towards renewable energy sources. In the Kyrgyz Republic, carbon pricing could accelerate the transition to a low-carbon economy by aligning national policies with global climate goals. Moreover, the revenue generated from carbon pricing could be reinvested into sustainable projects, further supporting efforts to reduce emissions. Additionally, demonstrating a commitment to carbon pricing could enhance a country's international reputation, potentially attracting foreign investment and support for green initiatives.

Conclusion

The economic costs of implementing carbon pricing in the Kyrgyz Republic could be substantial for certain economic segments. The results obtained using an IOM in this study indicate that carbon-intensive sectors, such as energy supply and mining, will bear the highest costs. The energy sector is likely to experience significant cost increases owing to its high carbon emissions and dependence on fossil fuels. Increased production costs may lead to higher electricity and fuel prices, thus affecting both businesses and consumers. Furthermore, this sector may face challenges in transitioning to low-carbon technologies that require substantial investment. Moreover, the trade and mining sectors, although less directly associated with high carbon

emissions, will still face considerable costs. These costs would arise from increased energy prices, which would affect the operational expenses of businesses such as retail, hospitality, and professional services. A cascading effect may occur, in which higher operational costs lead to increased prices for consumers, potentially reducing the demand for services.

Broader economic implications include inflationary pressures, as rising energy costs could lead to an overall increase in the cost of living. Industries facing higher production costs might struggle to remain competitive, both domestically and internationally. In addition, sectors burdened with higher costs may reduce their workforce to maintain profitability, leading to potential job losses. To mitigate these effects, the government may need to provide subsidies or financial support to help industries transition to greener technologies.

The social implications of carbon pricing are a key issue. The implementation of either an ETS or a carbon tax may harm vulnerable groups. For example, a blanket carbon tax on the mining sector could increase heating expenses and increase energy poverty. Therefore, one solution is to provide targeted subsidies to vulnerable households. Moreover, carbon pricing revenue should be earmarked to provide subsidies and improve energy efficiency among households.

Encouraging innovation in renewable and efficient energy sources can help reduce the long-term economic burden. Furthermore, engaging in international carbon markets or receiving foreign aid could offset some of the costs associated with carbon pricing. Although the implementation of carbon pricing is crucial for addressing climate change, is the economic challenges it poses must also be recognized and addressed, particularly for the energy and service sectors in the Kyrgyz Republic. Balancing environmental goals with economic stability requires careful planning and supportive policies to ensure a fair transition for all economic sectors.

The political barriers to implementing carbon pricing in the Kyrgyz Republic are significant and multifaceted. One major challenge is potential resistance from influential stakeholders within the energy and industrial sectors who may fear the economic repercussions of increased costs and lobbying against the policy. Additionally, carbon pricing may lack political and public support, as it can lead to higher consumer prices and impact household budgets, making it a contentious issue among voters. Policymakers may also be wary of the potential job losses in carbon-intensive industries, which could exacerbate social and economic inequalities. Furthermore, the political landscape in the Kyrgyz Republic, characterized by frequent changes in government and policy direction, can lead to instability and hinder the consistent implementation of long-term environmental strategies. Effective communication and education regarding the benefits of carbon pricing, along with measures to support vulnerable sectors and populations, will be crucial for overcoming these political barriers and achieving a successful transition to a low-carbon economy.

Compared with Kazakhstan, the only country in the region with an ETS, carbon pricing in the Kyrgyz Republic should use a different approach to reflect the differences in the two countries' economic structures. In the absence of large and numerous emitters, the Kyrgyz Republic has high

energy intensity in infrastructure and public governance. Therefore, the potential ETS market is small, making the carbon tax is more applicable.

Stakeholders in the Kyrgyz Republic, including businesses, governmental agencies, and civil society organizations, currently face varying degrees of capacity to effectively implement and adapt to carbon pricing mechanisms. Many businesses, particularly in the energy and industrial sectors, lack the technical expertise and financial resources required to transition to low-carbon technologies, making it challenging for them to comply with new regulations without substantial support. Governmental agencies may also struggle with limited experience and infrastructure to monitor and enforce carbon pricing policies, potentially leading to inefficiencies and loopholes. The lack of a solid normative and legal framework is also an important impediment, as many potential initiatives in this area must be regulated by the state. Civil society organizations, while often passionate advocates for environmental sustainability, may not have the necessary influence or resources to drive widespread behavioral changes in the public and private sectors. Thus, their interest is high, but their power is low. Capacity-building requires investment in education and training programs, financial assistance and incentives for technological upgrades, and collaboration among all stakeholders to ensure a cohesive and effective approach to carbon pricing implementation.

Policy Recommendations

1. **Develop a Comprehensive Carbon Pricing Framework**
   Establish a robust legislative and regulatory framework to support the implementation of carbon pricing mechanisms, whether a carbon tax, ETS, or a hybrid approach. This framework should clearly define the tax base, sectors covered, and administrative processes. It should also outline procedures for MRV to ensure transparency and accountability.
2. **Implement a Gradual Rollout**
   Consider a phased approach to the introduction of carbon pricing. The consensus across stakeholders is that caution and thorough planning are paramount; therefore, ensuring a gradual approach is essential. We recommend starting with a pilot program or limited scope to test the system's effectiveness and address potential issues before full-scale implementation. This gradual rollout will allow for adjustments based on initial experiences and feedback to reduce the risk of unintended economic disruptions. For example, a pilot program could be implemented in the mining sector.
3. **Engage in Stakeholder Consultations**
   Conduct comprehensive consultations with all relevant stakeholders, including representatives from industry, civil society, and academia. These consultations should aim to gather input on design considerations, address concerns, and build broad-based support. Engaging stakeholders early in the process will help ensure that the carbon pricing policy is well-informed and widely accepted. Some of the stakeholders interviewed suggested creating coalitions or communities of practices across sectors (the government, civil society, private

sector, and international organizations and donors) to ensure that all potential interests are considered and balanced to prevent potential backlash.

4. **Establish Support Mechanisms for Affected Sectors**
   Develop targeted support mechanisms for the industries and communities most affected by carbon pricing. This could include financial assistance, technical support, or subsidies to mitigate the economic impact and facilitate a smooth transition to low-carbon technologies and practices.
5. **Integrate Carbon Pricing with Economic Development Strategies**
   Ensure that carbon pricing policies align with the Kyrgyz Republic's long-term economic development strategies and environmental goals. Integration with broader economic planning will help maximize policy effectiveness, support sustainable growth, and enhance overall economic resilience.
6. **Build Carbon Pricing Infrastructure**
   Invest in the development of necessary infrastructure, including an effective MRV system, to support carbon implementation of carbon pricing. This infrastructure should be capable of accurately tracking emissions, ensuring compliance, and providing data for policy evaluation and adjustment.
7. **Promote Public Awareness and Education**
   Launch initiatives to increase public awareness and understanding of carbon pricing and its benefits. Educational campaigns can help build public support, clarify the rationale behind carbon pricing, and encourage behavioral changes that align with policy objectives.

Limitations of the study

A key limitation of this study was the absence of national carbon emission coefficients and official data on the calorific value of coal. Calorific value is a key parameter for calculating emission intensity. It would be useful to publish these values in reports, along with other energy supply-related data. Another limitation is that emission factors are the default values from the IPCC and IRENA. Currently, the Kyrgyz government does not provide official national emission factors. The calculation and publication of such numbers would improve the quality of climate research and policies. The statistical data were limited to the 19 sectors mentioned in the Results section. Furthermore, although we attempted to interview only respondents who were involved in carbon pricing topics or decarbonization work, we realized that the interview findings might not capture all the views of stakeholders. Future studies could benefit from targeted surveys of each stakeholder category. In addition, government bodies lack the relevant specialists and dedicated units to focus on a carbon tax. The existing units comprise committed and competent specialists; however, the need for the allocation of more human resources is clear.

Bibliography

Abdi, G., Zhakiyev, N., & Toilybayeva, S. (2023). Decarbonisation opportunities and emerging carbon pricing instruments in Central Asia. In R. Sabyrbekov, I. Overland, & R. Vakulchuk (eds.). *Climate Change in Central Asia. SpringerBriefs in Climate Studies*. Springer. https://doi.org/10.1007/978-3-031-29831-8_5

Azour, J., Dudu, H., & Zhu, L. (2023). How the Middle East and Central Asia can better address climate challenges. International Monetary Fund Blog. https://www.imf.org/en/Blogs/Articles/2023/11/29/how-the-middle-east-and-central-asia-can-better-address-climate-challenges#:~:text=The%20Middle%20East%20and%20Central%20Asia%20face%20a%20sobering%20climate,affected%20and%20conflicts%20may%20worsen.

Bacchi, C. (2000). Policy as discourse: What does it mean? Where does it get us? *Discourse: Studies in the Cultural Politics of Education*, *21*(1), 45–57, https://doi.org/10.1080/01596300050005493

Cai H., Qu S., & Wang M. (2020). Changes in China's carbon footprint and driving factors based on newly constructed time series input–output tables from 2009 to 2016. *Science of the Total Environment*, *711*, 134555. https://doi.org/10.1016/j.scitotenv.2019.134555.

Edwards Jr., D. B., & Klees, S. J. (2012). Participation in international development and education governance. *Global Education Policy and International Development: New Agendas, Issues and Policies*, 55–76.

Goodwin, S. (2011). Analysing policy as discourse: Methodological advances in policy analysis. In L. Markauskaite et al. (eds.), *Methodological choice and design, methodos series 9* (pp. 167–180). Springer. https://doi.org/10.1007/978-90-481-8933-5_15

Government of Kazakhstan. (2023). *Updated nationally determined contribution of Kazakhstan.* United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/NDC/2023-06/12updated%20NDC%20KAZ_Gov%20Decree313_19042023_en_cover%20page.pdf.

Government of the Kyrgyz Republic. (2021). Updated nationally determined contribution of the Kyrgyz Republic. United Nations Framework Convention on Climate Change. https://unfccc.int.

Government of Tajikistan. (2021). *Updated nationally determined contribution of the Republic of Tajikistan*. United Nations Framework Convention on Climate Change. https://unfccc.int.

Government of Turkmenistan. (2023). Updated nationally determined contribution of Turkmenistan. United Nations Framework Convention on Climate Change. https://unfccc.int.

Government of Uzbekistan. (2021). Updated nationally determined contribution of the Republic of Uzbekistan. United Nations Framework Convention on Climate Change. https://unfccc.int.

Green Fiscal Policy Network. (2024). https://greenfiscalpolicy.org/kyrgyzstan/.

Hertwich, E. G. (2021). Increased carbon footprint of materials production driven by rise in investments. *Nature*, *14*, 155. https://doi.org/10.1038/s41561-021-00690-8

Howie, P., Gupta, S., Park, H., & Akmetov, D. (2020). Evaluating policy success of emissions trading schemes in emerging economies: Comparing the experiences of Korea and Kazakhstan. *Climate Policy*, *20*(5), 577–592. https://doi.org/10.1080/14693062.2020.1751030

Howie, P., & Zauresh, A. (2022). Assessing initial conditions and ETS outcomes in a fossil-fuel dependent economy. *Energy Strategy Reviews*, *40*, 100818. https://doi.org/10.1016/j.esr.2022.100818

Intergovernmental Panel on Climate Change. (2006). Guidelines for national greenhouse gas inventories. 2. Energy. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf#page=3.67.

Intergovernmental Panel on Climate Change, & NGGIP. (2004). *National GHG emission factors in former Soviet Union countries.*

International Renewable Energy Agency. (2024). *Energy profile: Kyrgyzstan*. Abu Dhabi: International Renewable Energy Agency.

International Monetary Fund. (2022). Republic of Kazakhstan: Selected Issues. *IMF Middle East and Central Asia Department*, *114*, 1–36. https://doi.org/10.5089/9798400205361.002

International Monetary Fund. (2023). Climate change adaptation and mitigation in the Kyrgyz Republic. *IMF Staff Country Reports*, *2023*(092), A002. https://doi.org/10.5089/9798400232725.002.A002

Johnson, G., & Scholes, K., (1999). *Exploring corporate strategy*. Prentice Hall Europe.

Jun-Ki Choi, A., Bhavik R., Bakshi, B., &, Haab, T. (2010). Effects of a carbon price in the U.S. on economic sectors, resource use, and emissions: An input–output approach. *Energy Policy*, *38*(7), 3527–3536. https://doi.org/10.1016/j.enpol.2010.02.029

Kadyrberdieva, L., Solovyeva, A., & Poghosyan, T. (2022). Climate change adaptation and mitigation in the Kyrgyz Republic. https://www.elibrary.imf.org/downloadpdf/journals/002/2023/092/article-A002-en.xml

Kaktus. 2016. Kyrgyzkomur» Sozdal Sobstvennuyu Laboratoriyu Po Bokovym Uglyam. May 2. https://kaktus.media/doc/332872_kyrgyzkomyr_sozdast_sobstvennyu_laboratoriu_po_proverke_yglia.html.

Leal, P. A. (2010). Participation: The ascendancy of a buzzword in the neo-liberal era. In A. Cornwall & D. Eade (eds.). *Deconstructing development discourse: Buzzwords and fuzzwords* (pp. 89–100). Practical Action Publishing.

Leffers, D., & Ballamingie, P. (2013). Governmentality, environmental subjectivity, and urban intensification. *Local Environment*, *18*(2), 134–151.

McCauley, D. M., & Heffron, R. (2018). Just transition: Integrating climate, energy and environmental justice. *Energy Policy*, *119*, 1–7. https://doi.org/10.1016/j.enpol.2018.04.014

Mendelow, A. L. (1981). *Environmental scanning-The impact of the stakeholder concept*. ICIS.

Mi, Z., Zheng, J., Meng, J., Ou, J., Hubacek, K., Liu, Z., Coffman, D., Stern, N., Liang, S., & Wei, Y.-M. (2020). Economic development and converging household carbon footprints in China. *Nature Sustainability*, *3*, 529–537. https://doi.org/10.1038/s41893-020-0504-y

Nansai, K., Fry, J., Malik, A., Takayanagi, W., & Kondo N. (2020). Carbon footprint of Japanese health care services from 2011 to 2015. *Resources, Conservation and Recycling*, *152*, 104525. http://doi.org/10.1016/j.resconrec.2019.104525

National Statistics Committee of the Kyrgyz Republic. (2017). *State classifier of types of economic activities*.

National Statistics Committee of the Kyrgyz Republic. (2024). *Inter-industry balance of production and use of goods and services in the economy of the Kyrgyz Republic*.

Paris Agreement. (2015). United Nations Framework Convention on Climate Change (UNFCC), Paris, France, Dec. 12, 2015. https://unfccc.int/sites/default/files/english_paris_agreement.pdf.

Swyngedouw, E. (2015). Depoliticised environments and the promises of the Anthropocene. In R. L. Bryant (ed.). *The international handbook of political ecology* (pp. 131–146). Edward Elgar Publishing.

United Nations Framework Convention on Climate Change. (2021). Regional dialogues on carbon pricing: Central Asia. https://unfccc.int/sites/default/files/resource/REdiCAP%20Central%20Asia%20Final%20Report%20and%20Roadmap%20EN.pdf

Withey, P., Sharma, C., Lantz, V., McMonagle, G., & Ochuodho, T. O. (2021). Economywide and CO2 impacts of carbon taxes and output-based pricing in New Brunswick, Canada. *Applied Economics*, 1–18. https://doi.org/10.1080/00036846.2021.2001422

World Bank. (2019). *Roadmap for the implementation of energy efficiency in public buildings of the Kyrgyz Republic*.

World Bank. (2023a). *Innovative World Bank project will help Uzbekistan reduce emissions and access international carbon markets*. https://www.worldbank.org/en/news/press-

release/2023/06/30/innovative-world-bank-project-will-help-uzbekistan-reduce-emissions-and-access-international-carbon-markets.

World Bank. (2023b). *State and trends of carbon pricing: International carbon markets*. World Bank Working Papers.

World Bank. (2024). The Carbon Pricing Dashboard. Open data available at https://carbonpricingdashboard.worldbank.org/, last accessed on 13.09.2024.

Wu, X., Li, C., Guo, J., Wu, X., Meng, J., & Chen, G. (2021). Extended carbon footprint and emission transfer of world regions: With both primary and intermediate inputs into account. *Science of the Total Environment*, *775*, 145578. https://doi.org/10.1016/j.scitotenv.2021.145578

Howie, Peter, and Zauresh Atakhanova. 2022. "Assessing Initial Conditions and ETS Outcomes in a Fossil-Fuel Dependent Economy." *Energy Strategy Reviews* 40 (March): 100818. doi:10.1016/j.esr.2022.100818.

Howie, Peter, Shreekant Gupta, Hojeong Park, and Daulet Akmetov. 2020. "Evaluating Policy Success of Emissions Trading Schemes in Emerging Economies: Comparing the Experiences of Korea and Kazakhstan." *Climate Policy* 20 (5): 577–92. doi:10.1080/14693062.2020.1751030.

IPCC. 2006. "Guidelines for National Greenhouse Gas Inventories." 2. Energy. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf#page=3.67, last accessed on 13.09.2024

IPCC NGGIP. 2004. "National GHG Emission Factors in Former Soviet Union Countries."

IRENA. 2024. "Energy Profile: Kyrgyzstan." Abu Dhabi: International Renewable Energy Agency.

Kaktus. 2016. "«Kyrgyzkomur» Sozdal Sobstvennuyu Laboratoriyu Po Bokovym Uglyam.," May 2. https://kaktus.media/doc/332872_kyrgyzkomyr_sozdast_sobstvennyu_laboratoriu_po_proverke_yglia.html, last accessed on 13.09.2024

NSCKR. 2024. "Inter-Industry Balance of Production and Use of Goods and Services in the Economy of the Kyrgyz Republic."

NSCKR. 2017. "State Classifier of Types of Economic Activities."

World Bank. 2019. "Roadmap for the Implementation of Energy Efficiency in Public Buildings of the Kyrgyz Republic." Washington, D.C.

World Bank. 2023a. "Innovative World Bank Project Will Help Uzbekistan Reduce Emissions and Access International Carbon Markets." https://www.worldbank.org/en/news/press-release/2023/06/30/innovative-world-bank-project-will-help-uzbekistan-reduce-emissions-and-access-international-carbon-markets last accessed on 13.09.2024

World Bank. 2023b. “State and Trends of Carbon Pricing: International Carbon Markets.” World Bank Working Papers. Washington, D.C.

Appendix A: CO2 emissions calculation formulas

Conversion of emissions per terajoule (CO_2/TJ) of energy to CO_2 emissions per ton of energy

$$CO_2 = \frac{CO_2\ per\ TJ}{Energy\ Content\ in\ TJ/ton}$$

Appendix B: Converting gigacalories (GCal) to gigawatt-hours (GWh)

Step 1: Convert Gigacalories to Joules:

Energy (J) = Energy (GCal)*4.184*10^9J/GCal

Step 2: Convert Joules to Watt-hours

Energy (Wh) = Energy (J)*2.77778*10^{-7}Wh/J

Step 3: Convert Watt-hours to Gigawatt-hours

Energy (GWh) = (Energy (Wh)/10^9)*GWh/Wh

Sector	Coal Consumption (thousand tons)	Oil Consumption (thousand tons)	Gas Consumption (mln cubic meters)	Fuel Oil Consumption (thousand tons)	Diesel Fuel Consumption (thousand tons)	Gasoline Consumption (thousand tons)	Electricity (million kWh)	CO_2 from Coal (tons)	CO_2 from Oil (tons)	CO_2 from Gas (tons)	CO_2 from Fuel Oil (tons)	CO_2 from Diesel Fuel (tons)	CO_2 from Gasoline (tons)	Total CO_2 Emissions (tons)	Carbon Tax ($)
Accommodation and Food Service Activities	0	0	0	0	0.1	0.1	46.8	0	0	0	0	317	315	632	31600
Arts, Entertainment, and Recreation	0.4	0	0.1	0	0	0.1	21.5	1144	0	196	0	0	315	1655	82750
Administrative and Support Service Activities	0.4	0	0	0	0.3	1	19.6	1144	0	0	0	951	3150	5245	262250
Financial and Insurance Activities	0.6	0	0.7	0	0.2	1.2	17.3	1716	0	1372	0	634	3780	7502	375100

Professional, Scientific, and Technical Activities	1.2	0	0.8	0	0.6	1.6	57.4	3432	0	1568	0	1902	5040	11942	597100
Real Estate Activities	2.3	0	0	0	1	0.8	165.3	6578	0	0	0	3170	2520	12268	613400
Information and Communication	0.5	0	0	0	0.8	2.8	136.1	1430	0	0	0	2536	8820	12786	639300
Other Service Activities	3.6	0	0	0	0.1	0.9	3.9	10296	0	0	0	317	2835	13448	672400
Agriculture, Forestry, and Fishing	2.3	0	0	0.1	3.3	3.6	193.2	6578	0	0	314	10461	11340	28693	1434650
Education	11.3	0	1.9	0	0.1	0.5	115.8	32318	0	3724	0	317	1575	37934	1896700
Human Health and Social Work Activities	19.1	0	0.8	0	0.7	2.4	178.2	54626	0	1568	0	2219	7560	65973	3298650
Construction	1.6	0	0.1	0.5	22	3.6	89.9	4576	0	196	1570	69740	11340	87422	4371100
Water Supply; Sewerage, Waste Management, and Remediation	0.4	0	0	0	23.7	3.7	246.5	1144	0	0	0	75129	11655	87928	4396400

Activities															
Transportation and Storage	2.5	0	0.2	0.5	22.9	4.9	75.8	7150	0	392	1570	72593	15435	97140	4857000
Public Administration and Defense; Compulsory Social Security	131.3	0	21.4	0	40	28.2	370.9	375518	0	41944	0	126800	88830	633092	31654600
Manufacturing	222.9	297.8	99.6	2.1	108.8	13.2	1129	637494	914246	195216	6594	344896	41580	2140026	107001300
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	3.3	0	0.2	0	356.4	452.2	105.8	9438	0	392	0	1129788	1424430	25640480	128202400
Mining and Quarrying	905.2	0	0	0	35.5	3.5	301.7	2588872	0	0	0	112535	11025	2712432	135621600
Energy Supply	1453.6	0	293.1	42	7	7.3	10475.7	4157296	0	574476	131880	22190	22995	4908837	245441850
Total domestic consumption	2762.5	297.8	419	45.2	623.5	531.6	13750.4	7900750	914246	821240	141928	1976495	1674540	13429199	671459950

Appendix C: Informed consent form used for the interviews (in Russian)

Информационное письмо-приглашение к участию в проведении исследования

Информация о проекте исследования

Данное исследование проводится командой научных сотрудников из Кыргызской Республики. Команда состоит из экономиста Рахата Сабырбекова и политолога Айжан Шаршеновой. Тема исследования: «Установление цены на углерод в Центральной Азии: Возможности и препятствия на примере Кыргызской Республики». Исследование проводится при содействии программы исследовательских грантов Института Центрально-Азиатского Регионального Экономического Сотрудничества (ЦАРЭС). Мнения, выраженные в данном исследовании, отражают точку зрения авторов и могут не совпадать с мнением ЦАРЭС.

Приглашение

Мы приглашаем Вас принять участие в исследовании, проводимом группой исследователей из Кыргызской Республики (Рахат Сабырбеков и Айжан Шаршенова).

В данном информационном письме, мы бы хотели объяснить, что будет включать в себя Ваше участие. Если у вас возникнут вопросы после прочтения приведенной ниже информации или вам потребуется дополнительная информация о проекте, пожалуйста, свяжитесь с командой исследователей aijan@crossroads-ca.org или rahat.sabyrbekov@gmail.com

Какова цель проекта?

Цель проекта - изучить возможность установления цены на углерод в Центральной Азии с учетом политических и экономических реалий региона. Установление цены на углерод становится одним из популярных способов борьбы с изменением климата во многих странах. Мы бы хотели рассмотреть, насколько это применимо в нашем регионе на примере Кыргызской Республики.

Почему меня пригласили принять участие?

Мы приглашаем Вас принять участие в этом проекте в качестве респондента, потому что Вы являетесь экспертом, и Ваш опыт и знания стали бы бесценным вкладом в наш исследовательский проект.

Ваше участие

Вам будет предложено принять участие в интервью с одним из исследователей (Рахат или Айжан). Интервью займет не более часа Вашего времени и будет проведено онлайн или вживую, в зависимости от Вашего преподчтения. Ваше участие является полностью добровольным и анонимным, а все личные данные, связанные с обсуждением, будут рассматриваться конфиденциально. Участие, к сожалению, не оплачивается.

Что будет с результатами проекта?

Мы планируем рассказать о результатах исследования в академических публикациях, а также на национальных и международных конференциях. По желанию, Вы можете получить копию публикации, когда она будет готова.

Благодарим вас за прочтение этого информационного листка и за то, что вы решили принять участие в этом исследовании.

Заявление о согласии/принятии:
Соглашаясь принять участие в этом исследовательском проекте, вы соглашаетесь со следующим:

- Вы прочитали и поняли данный документ об информированном согласии.
- У вас была возможность задать вопросы исследователям и получить ответы.
- Вы понимаете, что участие в данном исследовательском проекте является полностью добровольным, и вы имеете право отказаться от участия в нем в любое время без объяснения причин.
- Вы согласны на участие в интервью с одним из исследователей и на использование информации и мнений в дальнейших публикациях при условии анонимности (по Вашему желанию, мы можем отменить условие анонимности и цитировать напрямую – укажите Ваше предпочтение внизу)
- Вы согласны на использование и хранение собранных данных и понимаете, что с ними будут обращаться с максимальной осторожностью и конфиденциальностью

Подпись Дата

*Я желаю отменить условие анонимности и даю согласие на прямое цитирование моих мнений.

Подпись Дата

Appendix D: Online survey (in Russian), open in August

онлайн опрос

Спасибо, что согласились принять участие в этом опросе! Опрос займет 5-6 минут вашего времени. **Цель опроса** — оценить последствия внедрения цены на выбросы углерода. В частности, мы стремимся понять потенциальное влияние на различные секторы экономики и оценить готовность институтов.

Ценообразование на выбросы углерода — это стратегия, используемая для сокращения выбросов парниковых газов путем назначения стоимости за выбросы углекислого газа.

Есть 2 типа ценообразования на выбросы углерода:

1. **Прямой налог,** взимаемый с содержания углерода в ископаемом топливе, обычно измеряемый за тонну выбрасываемого CO_2. Этот налог стимулирует производителей сокращать свои выбросы. Полученный доход можно использовать для различных целей, например, для финансирования проектов по возобновляемым источникам энергии или снижения других налогов

2. **Система торговли квотами на выбросы:** Правительство устанавливает ограничение или лимит на общий объем парниковых газов, которые могут быть выброшены определенными секторами или всей экономикой. Компаниям выдаются или они должны покупать разрешения на выбросы определенного объема CO_2. Если они выбрасывают меньше, они могут продать свои излишки другим компаниям.

Какой сектор/сферу вы представляете?
Mark only one oval.

- ◯ Госорган
- ◯ Производство (гос и частное) ◯
- Торговля
- ◯ Образование и наука (гос и частное)
- ◯ Другой частный сектор

Сколько у вас профессионального опыта?
Mark only one oval.

- Менее 3х лет
- 4-10 лет
- Более 10 лет

1. Оценка знаний

Оцените пожалуйста свои личные знания о **ценообразовании углерода** по шкале от 1 до 5, где 1 означает «отсутствие знаний», а 5 означает «максимально возможный уровень знаний».

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

Оцените пожалуйста свои личные знания о **налоге на углерод** по шкале от 1 до 5, где 1 означает «отсутствие знаний», а 5 означает «максимально возможный уровень знаний».

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

Оцените пожалуйста свои личные знания о **системе торговли квотами на выбросы** по шкале от 1 до 5, где 1 означает «отсутствие знаний», а 5 означает «максимально возможный уровень знаний».

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

2. Готовность заинтересованных сторон

Оцените пожалуйста готовность **государственных органов** к внедрению цен на выбросы углерода: По шкале от 1 до 5, где 1 означает «совсем не готов», а 5 означает «полностью готов».

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

Оцените пожалуйста готовность **частного сектора** к внедрению цен на выбросы углерода: По шкале от 1 до 5, где 1 означает «совсем не готов», а 5 означает «полностью готов».

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

Оцените пожалуйста готовность **домохозяйств** к внедрению цен на выбросы углерода: По шкале от 1 до 5, где 1 означает «совсем не готов», а 5 означает «полностью готов».

Mark only one oval.

1	2	3	4	5
◯	◯	◯	◯	◯

3. Меры по повышению готовности

Какие меры или действия, по вашему мнению, необходимы для повышения уровня готовности следующих заинтересованных сторон?
Государственные органы
Отрасли, частный сектор
Население в целом

_____

_____

_____

_____

_____

4. Препятствия к внедрению

Каковы, по вашему мнению, основные препятствия для внедрения ценообразования на выбросы углерода в Кыргызстане?

Tick all that apply.

☐ Низкая осведомленность населения ☐
Неготовность гос органов
☐ Это дорого и повысит стомость жизни
☐ Нет технической инфраструктуры измерения углерода ☐
Другое

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