World Economy Brief

October 18, 2023 | Vol. 13 No. 37 | ISSN 2233-9140

Impact of China's Emissions Trading System on Industries and Its Policy Implications

Jihyun Jung Research Fellow, Chinese Regional Strategy Team, Center for Area Studies (jhjung@kiep.go.kr)

I. Introduction

China, the world's largest carbon emitter and skeptical of developing countries' emissions reduction commitments, announced internationally in 2020 its vision to peak carbon emissions in 2030 and achieve carbon neutrality by 2060. In order to achieve its mid- to long-term growth target for 2035 (first stage goal of socialist modernization, doubling GDP from 2020), China has set the target period for carbon emission peaking and achieving carbon neutrality. It plans to reduce carbon emission intensity (emission to GDP) rather than total carbon emission by 2030, the target year for carbon emission peaking, and its strategy is to rapidly reduce total carbon emission by 2060 after achieving the mid- to long-term growth target in 2035.

China's emission reduction strategy has a significant impact on China's economy and society as a whole, and Korea, which has a close economic tie with China, will also be affected. For example, if China controls production in high-emitting industries to reduce emissions, Korea, which imports those products, will also be affected. The greater the dependence on imports, the greater the impact. In fact, a similar situation occurred with Korea's urea imports in 2021. Therefore, it is important for Korea to analyze the impact of China's carbon neutral strategy on the economy and industry.

In general, government-led direct regulation and public investment policies, and market-based policies using pricing mechanisms are being used to reduce carbon emissions. The same is true for China. Market-based policies utilize the pricing mechanism to encourage economic entities to voluntarily internalize negative externalities and include subsidies, Emissions Trading System (ETS), and carbon taxes. China's carbon neutral policy announced in 2021 includes the continuous promotion of policies such as direct regulation, public investment, and subsidies, as well as the nationwide implementation of the ETS and the expansion of applicable industries. In fact, China is implementing not only the regional ETS (currently 8 regions) that has been implemented at the regional level since 2013, but also the national ETS from 2021, and plans to integrate them and expand the scope of applicable industries in the future.

Since the cost of carbon emission (emissions trading prices) is added to the production costs of the industries subject to the ETS, if the industry (item) is used as an input in another industry, it will also affect the production costs of other industries. This impact occurs directly or indirectly in various industries, and the impact occurs differently depending on the industrial structure. Accordingly, this study analyzed the impact of China's ETS on Chinese industries using the input-output model, and derived implications for Korea-China economic relations based on the results.

II. Estimation of ETS Burden Rate by Industry in China

According to many previous studies, the emissions trading price is mainly determined by energy prices such as oil prices, climate, economic growth, technological progress, financial markets, and detailed policies related to ETS. However, it is almost impossible to predict emissions trading prices by reflecting these factors under the current circumstances. Accordingly, in this study, we estimated the carbon emission cost borne by each industry under China's national ETS and estimated the ETS burden rate by industry (emission cost relative to total output by industry) as follows.

** ETS burden rate by industry*

= Emission cost ÷ Total output by industry

** Emission cost*

= Emissions trading volume (tCO$_2$)
× Average trading price (yuan/tCO$_2$)

= Total emissions × (Trading volume÷ Total emissions) × Average trading price

= Total emissions × (|Total emissions - Free allocation|÷Total emissions)
× Average trading price

= Total emissions × (1-Free allocation proportion) × Average trading price

In the above equation, China's total emissions by industry used CEEIO's 2018 carbon dioxide emissions data. In addition, the average annual emissions growth rate was estimated based on the total emissions estimate from the Tsinghua University (2021) study, which is the basis of China's carbon neutral strategy, and the change in emissions of each industry was estimated. Furthermore, the trade size (share without free quotas) compared to total emissions was estimated by taking the situation in 2021, when China launched the national ETS, as the initial value, and then reflecting recent policy changes related to free quotas. (Here, it is assumed that industry-specific adjustment coefficients and paid allocation proportions are indifferent) The emissions trading price was based on the average price in 2021 (44 yuan/tCO_2), and it was assumed that the price in 2030 would reach the 2021 price level of the EU-ETS (about a 10-year gap).

China plans to apply the ETS only to the power generation industry until 2025 and to expand it to eight major high-emitting industries from 2026. After estimating the emission cost by industry by considering these policies, the emission cost burden rate by industry due to ETS was estimated as shown in the table below. In this study, instead of predicting the exact carbon regulation burden rate by year, the average value for 2021-2025 and 2026-2030 was used to analyze the impact of ETS by reflecting future trends.

As a result of estimating the ETS burden rate by industry, it is expected that from 2021 to 2025an emission cost burden of 0.53% of total output will be imposed only on the power generation industry. From 2026 to 2030, the ETS burden rates for the electric power generation and primary metals manufacturing industries are the highest at 3.28% and 2.32%, respectively, while those for non-metallic minerals and processed coal/petroleum products are 1.15% and 0.77%, respectively. The overall burden rate estimate itself is not large, which is in line with China's carbon neutral strategy, which plans to peak emissions in 2030.

Table 1. China ETS's Free Allocation Share and Emissions Trading Price Estimates (2021~2030)

Year	Emissions trading volume /Total emissions (%)	Free allocation proportion (%)	Average trading price (yuan/tCO_2)
2021	5.0	95.0	44
2022	9.8	90.3	57
2023	14.3	85.7	73
2024	18.5	81.5	93
2025	22.6	77.4	120
2026	26.5	73.5	154
2027	30.2	69.8	198
2028	33.7	66.3	254
2029	37.0	63.0	326
2030	40.1	59.9	419

Source: Author's estimation.

Table 2. Estimation of Emission Cost Burden by Industry Due to China's ETS

		Average burden rate from 2021 to 2025 (%)	Average burden rate from 2026 to 2030 (%)
Agriculture	Agriculture	0	0
Mining	**Mining**	**0**	**0.14**
Manufacturing	Food/Drink	0	0
	Textile/Leather	0	0
	Wood/Paper	**0**	**0.03**
	Coal/Oil Processed Products	**0**	**0.77**
	Chemistry	**0**	**0.31**
	Non-metallic minerals	**0**	**1.15**
	Primary metal	**0**	**2.32**
	Metal processing products	**0**	**0.05**
	Machinery/Equipment	0	0
	Automobile	0	0
	Other transportation equipment	0	0
	Electrical equipment	0	0
	Computer/Electronics	0	0
	Other Manufacturing	0	0
	Power Generation	**0.53**	**3.28**
Construction	Construction	0	0
Service	Wholesale/Retail	0	0
	Transportation(airline)	**0**	**0.43**
	Other services	0	0

Source: Author's estimation.

III. Impact of ETS on Chinese Industrial Production

China's ETS increases the cost of inputs within Chinese industries, which affects the producer prices (production costs) of each Chinese industry. Input-output analysis was used to analyze this ripple effect.

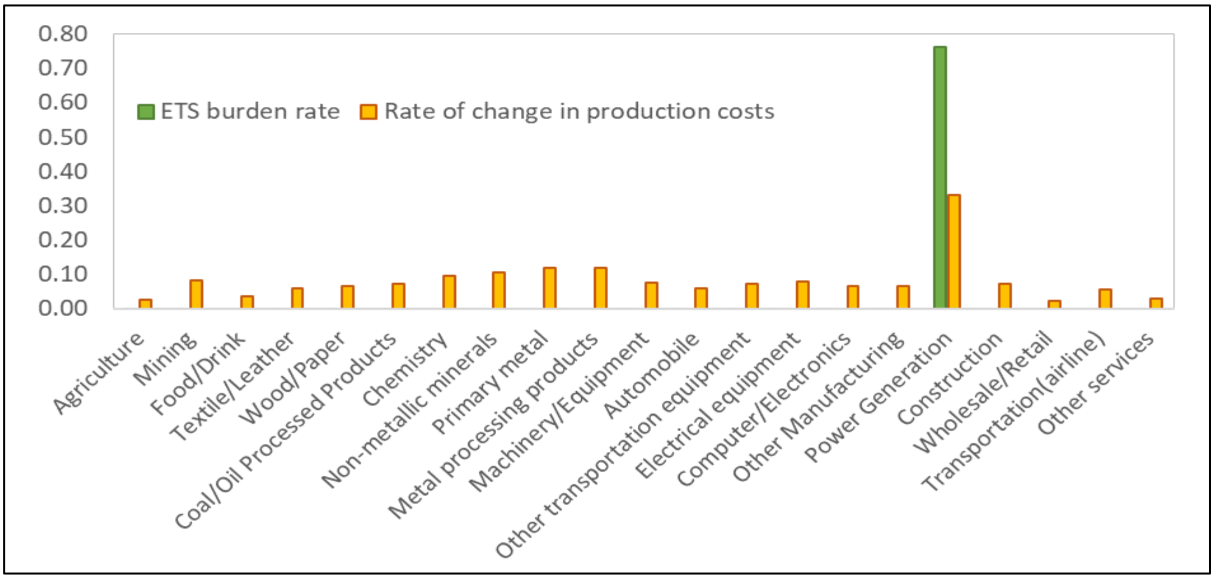
As a result of the analysis, during the period when the ETS was only applied to the power generation industry (2023-2025), the rate of change in production costs was the highest in the power generation industry at 0.33%. However, in industries where ETS is not applied, production costs in manufacturing industries such as primary metals, metal processing products, non-metallic minerals, and chemicals were also found to increase by 0.09 to 0.12%.

In addition, even from 2026 to 2030, when the ETS is extended to high-emitting industries, the ETS burden rate for high-emission industries such as power generation, primary metals, and non-metallic minerals was found to be high. However, the production cost increase rate was highest for metal processing products, which have a very low ETS burden, compared to the power generation industry and primary metals, which have the highest ETS burdens. This is believed to reflect the characteristics of China's input-output structure, in which high-emitting industries such as minerals, metals, chemicals, and electric power are used as inputs in the production process of metal processing products.

In addition, the rate of increase in production costs in non-ETS industries such as electricity, machinery/equipment, construction, and other transportation equipment, was higher than in some emitting industries (coal/petroleum processing products, etc.). Even in the service industry, the production cost increase rate in the construction industry where the ETS burden rate was not applied was much higher than in the transportation industry where the ETS burden rate was applied.

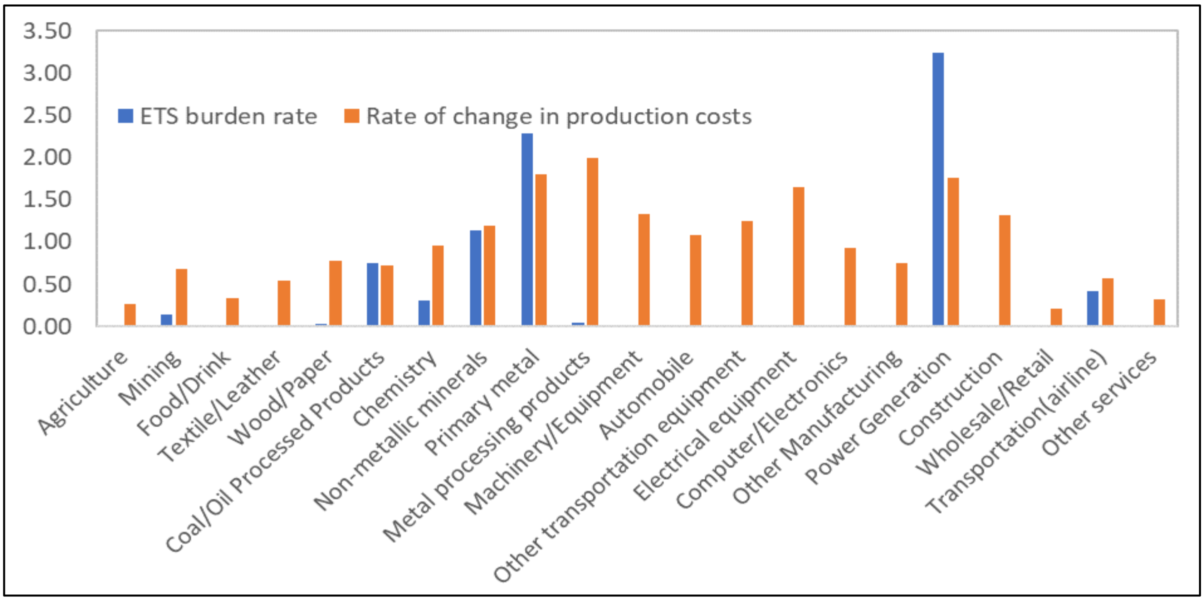
In other words, China's ETS has an effect on increasing production costs not only in high-emitting industries to which the policy applies, but also in other industries, and sometimes production costs in industries to which the ETS is not applied have increased even more.

Figure 1. ETS Burden Rate and Production Cost Change Rate by Industry in China (2023~2025)



Source: Author’s estimation.

Figure 2. ETS Burden Rate and Production Cost Change Rate by Industry in China (2026~2030)



Source: Author's estimation.

IV. Implications for Korea-China Economic Relations

If the emission cost burden rate for each industry increases due to the ETS, production costs will increase, which will ultimately lead to an increase in consumer and export prices. If all increases in production costs are passed on to increases in export prices, the increase in the production costs of industries in China due to the ETS will lead to an increase in Korea's import prices from China. In particular, metal processing products, machinery/equipment, non-metallic minerals, and automobiles are industries that have relatively high import price growth rates due to the ETS and are also highly dependent on imports from China.

Meanwhile, the impact of the carbon pricing policy on computers/electronics, which accounts for the largest share of imports to China, is expected to be limited. Meanwhile, in terms of Korea's investment in China, the industries that will be most affected by the increase in production costs due to China's ETS are electrical equipment and automobiles, and computers/electronics, chemicals, and non-metallic minerals are also expected to be relatively affected.

If China's carbon pricing policy is further strengthened in the future, the impact will be felt not only in the industries subject to the carbon pricing policy, but also in various other industries. In addition, if production costs rise due to technology development and investment related to emission reduction in the process of promoting the non-market-based carbon reduction policy that the Chinese government is currently focusing on, it may cause a greater cost increase than the carbon pricing policy.

In addition, if China controls the production and distribution of key items in the name of reducing carbon emissions, the likelihood of a decrease in export volume and a deepening of price increases may increase. In other words, in the process of China strengthening its carbon reduction policies, including carbon pricing policies, Korea is constantly exposed to risks in the supply chain of imports from China, so it must prepare a multifaceted response plan.

Reference

Jung, Jihyun, Hankyoung Sung, Hongwon Kim, Hanna Lee, Joo Hye Kim, and Hea Ji Park. 2022. "Effects and Implications of China's Carbon Pricing Policy on Changes in Korea-China Economic Relations." KIEP Policy Analyses, no. 22-25. Korea Institute for International Economic Policy. (in Korean)

Institute of Climate Change and Sustainable Development of Tsinghua University et al. 2021. "中国长期低碳发展战略与转型路径研究 [China's Long-Term Low-Carbon Development Strategies and Pathways]" 中国画家出版集团. https://www.efchina.org/Attachments/Report/report-lceg-20210711 (accessed in October 2023)