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THE PATHWAY TO AN EFFECTIVE ETS AND POWER MARKET INTERACTION: THE CASE OF THE KOREAN ETS

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With a solution-oriented mandate, the Asia Society Policy Institute tackles major policy challenges confronting the Asia-Pacific in security, prosperity, sustainability, and the development of common norms and values for the region.

EXECUTIVE SUMMARY

The power sector is one of the most important areas to cover in any emissions trading system (ETS), due to the scale and abatement potential of greenhouse gas (GHG) emissions in that sector. However, some critical challenges need to be overcome before an ETS can fulfil its emissions-reduction potential by driving fuel switching away from coal and toward renewables and low-carbon fuels. This is one of the most important topics for ETS development in Asia given the tight controls on power markets.

The case of the Korean ETS (K-ETS) provides valuable insights for the pathway to an effective interaction between an ETS and the power market to support power sector decarbonization, based on recent developments and potential next steps. The details of this case study and learning points for ETS development in Asia are presented in this issue paper. Based on this case study, key requirements necessary for an ETS to effectively reduce power sector GHG emissions include the following:

- For the power market, mechanisms are needed to reflect ETS carbon costs in power station dispatch decisions, such as an environmental merit order system and to fully pass-through carbon costs to retail electricity prices. These will enable reductions in power sector emissions first by a reduced GHG emissions factor of power generation and second by a demand-side response by electricity consumers. It will also enable full auctioning for the power sector; the benefits of this are described below.

- For ETS allocation, there should be full (100 percent) auctioning for the power sector once an effective system of carbon cost pass-through to electricity prices is in place. This provides the strong signal needed to reduce emissions, as all emissions allowances need to be paid for, and it generates auction revenue that can finance investments in GHG reduction projects in power and other sectors. Furthermore, a system can be introduced to compensate the electricity price increase to vulnerable stakeholders including low-income households and electro-intensive industry, financed by ETS auction revenue. In the transition to full auctioning, free allocation should be based on benchmarks that reward low–carbon power generation by not

The case of the K-ETS provides valuable insights for the pathway to an effective interaction between an ETS and the power market to support power sector decarbonization.

differentiating by fuel type and should be set at an ambitious level to avoid windfall gains for fossil fuel power stations.

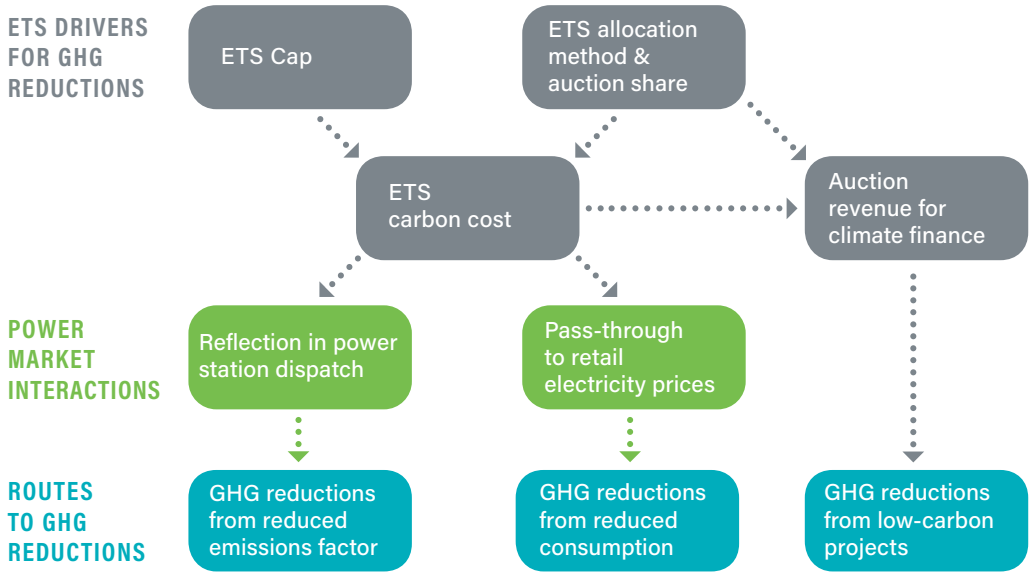
- For ETS cap setting, alignment of the level and trajectory of the cap consistent with achieving the goals of the Paris Agreement should result in a sufficiently tight cap and high enough carbon prices to drive power sector decarbonization. The K-ETS cap-setting method, with a direct link between the cap and the national GHG emissions target should readily enable this outcome. The use of ETS auction revenue to support investment in GHG emissions reduction projects by ETS entities will help address the concerns arising from high carbon prices.

INTRODUCTION

The intended effect of an ETS on the power sector is to reduce GHG emissions primarily through the impact of the carbon price. First, the carbon price should impact power station dispatch and investment decisions in the wholesale market, switching from coal to low-emitting fuels such as natural gas and renewables, hence reducing the emissions factor of the power sector.[1] Second, the carbon price should impact end-user electricity demand through higher electricity prices in the retail market to reduce the demand for electricity generation. A further mechanism comes from the generation of ETS auction revenue used to finance GHG emissions reduction projects in the power and other sectors. Figure 1 provides an illustration of the interactions.

These mechanisms in the European Union ETS (EU ETS) have enabled significant reductions in GHG emissions from the power sector. By 2030, this sector is expected to have achieved the greatest emissions reductions of all EU

FIGURE 1: **ETS & POWER MARKET INTERACTIONS FOR POWER SECTOR GHG EMISSIONS REDUCTIONS**



[1] The emissions factor of a coal-fired power plant is approximately 0.89 tCO_2 eq./MWh, while a natural gas-fired plant is approximately 0.39 tCO_2 eq./MWh. This means that the carbon cost incurred by coal-fired power is more than twice the carbon cost incurred by natural fired power. If the difference in the fuel costs per MWh between coal and natural gas is less than the difference in carbon cost per MWh, natural gas-fired power generation is given priority before coal in the dispatch order.

While the K-ETS has always been successful in limiting GHG emissions to below the cap, emissions reductions had not been achieved in the power sector because carbon costs were not being reflected in power station dispatch decisions.

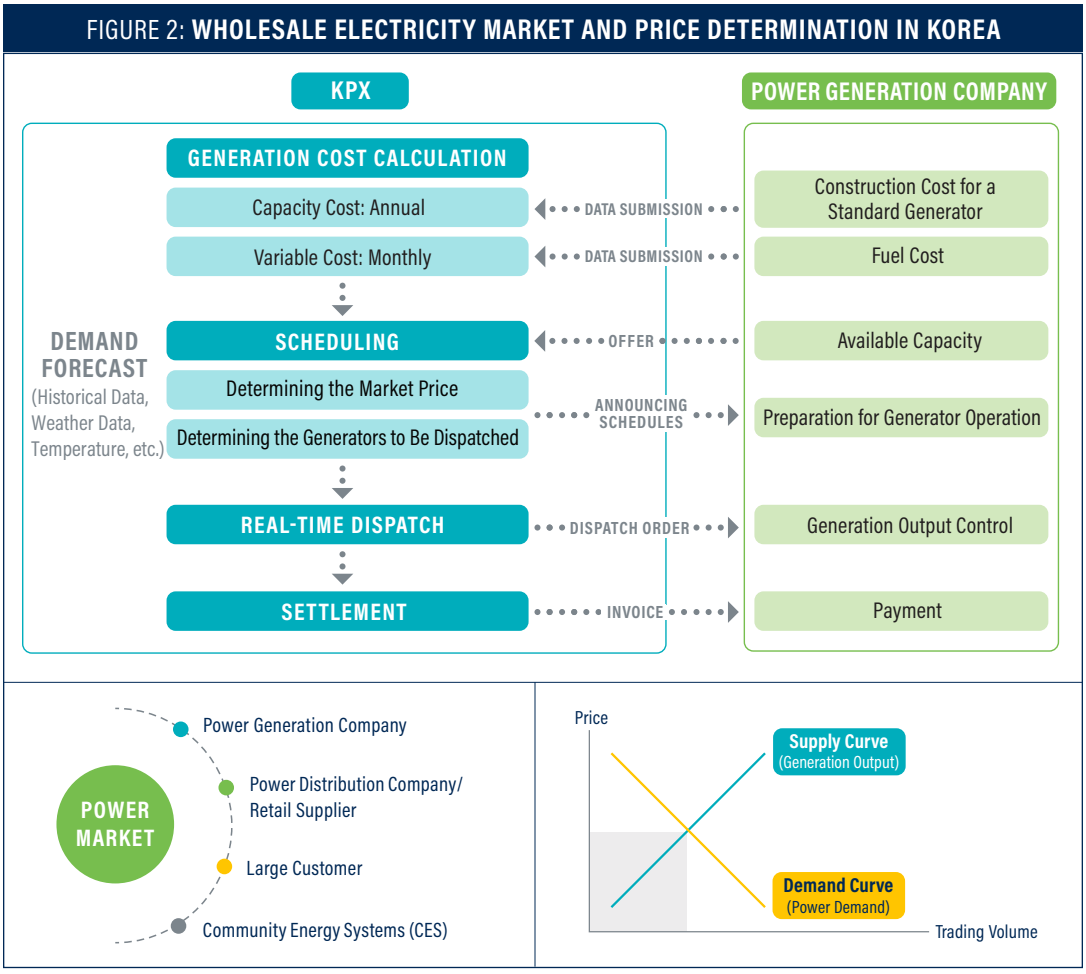
sectors, with only a relatively small remaining contribution to EU GHG emissions.

While the K-ETS, Korea's main climate policy tool, has been successful in limiting GHG emissions to below the cap, emissions reductions have not yet been achieved in the power sector.[2] This is primarily because carbon costs were not being reflected in power station dispatch decisions in the economic merit order system in the wholesale market,[3] illustrated in Figure 2. This market determines the sequence of dispatching power stations based on power-generating operating costs, mainly fuel costs, and excluding carbon costs. Furthermore, in the wholesale market, the net costs paid by power generators to purchase carbon allowances are refunded to them monthly. As a result of these factors, there were no economic incentives for fuel switching in the power sector under the K-ETS.

In addition, there was no pass-through of carbon costs to retail electricity prices,[4] with no impact on electricity consumption behavior of final users. Further related issues include only a moderate level of the carbon price, a very high share of free allocation (and low share of auctioning), and a free allocation method that did not incentivize low-carbon fuels.

This paper describes the developments in the power market and the ETS design to address

FIGURE 2: **WHOLESALE ELECTRICITY MARKET AND PRICE DETERMINATION IN KOREA**



[2] In fact, power sector GHG emissions increased slightly more than overall emissions between 2015 (the start year of the ETS) and 2019 (+0.6 percent compared to +0.3 percent).

[3] In the wholesale market (Korea Power Exchange (KPX)) power-generating companies (GENCOs) make daily bids, based on their power generation operating costs.

[4] Regulated by the Ministry of Economy and Finance (MOEF).

With the introduction of the environmental merit order, the sum of carbon costs and fuel costs have become the determinant of the dispatch order of power stations. This is a key policy to facilitate fuel switching in the power sector.

these problems and the key further developments required.

PROGRESS AND REQUIRED DEVELOPMENTS

Power Market

Wholesale market

From 2020, when the national allocation plan for the third K-ETS implementation period (2021–2025) was prepared and discussed, policymakers addressed the insignificance of the ETS to reducing emissions in the power sector. The government passed a law to replace the economic merit order with the environmental merit order starting from 2022. As well as the driver of climate action, a significant driver to implement this policy was also air quality, as coal power stations are a key source of air pollution. With the implementation of the environmental merit order, the sum of carbon cost[5] and fuel cost has been the determinant of the dispatch order of power stations. This is a key policy to facilitate fuel switching in the power sector. Power stations using higher carbon fuels have higher carbon costs and with an increase in carbon prices, the carbon cost will become the major determinant in the merit order of dispatching the plants, that is, the fuel choice in the power market. Coal will become increasingly disadvantaged and used less often, in a similar way to the experience in the EU where coal takes a lower priority dispatch position in the merit order.

Sinchang wind farm in Jeju Island, South Korea./Gettyimages

However, with 90 percent of allowances for the power sector allocated freely (and only 10 percent paid for in the auction) and the carbon price currently at only moderate levels, the actual carbon allowance costs are not yet high enough to drive fuel switching through this mechanism. Furthermore, a portion of the actual net carbon costs incurred to purchase allowances are are still paid in the fuel cost settlement process to generating companies. This arrangement would need to result in full pass-through of carbon costs to retail electricity prices to avoid windfall gains to generating companies.

Retail market

In conjunction with the environmental merit order, through a new regulation in 2022, fuel costs are now supplemented by carbon costs and passed through to retail electricity prices through periodic (quarterly) adjustments. However, there is a low ceiling on the maximum amount of adjustment of 3 KRW/KWh (less than 2 percent of household electricity prices), as well as the option — and in fact the actual practice — for policymakers to set the adjustment at an even lower level. With this limit on the adjustment of the fuel cost, combined with the large proportion of free allocation of allowances, the current impact on consumption behavior of final users is negligible. The limit should be removed or increased to drive an effective demand-side response and enable power generators to pass through their full carbon costs.

Associated with such a move, a system could be introduced to compensate the cost increase to vulnerable stakeholder groups

[5] The actual carbon cost incurred to acquire allowances in excess of freely allocation allowances.

The key aspects of allocation design that impact the carbon price signal include the auction/free allocation share and the type of free allocation design.

including low-income households and electro-intensive industry. This support can be financed by ETS auction revenue, the amount of which could significantly increase when the limit on the rise in retail electricity prices is removed. The auction share for the power sector could be 100 percent, which would result in full pass-through of carbon costs.

ETS design

Allocation

The key aspects of allocation design that impact the carbon price signal include the auction/free allocation share and the type of free allocation design. Related to the auction share is the use of auction revenue that can facilitate significant GHG emissions reductions through investment in relevant projects. These aspects are described below.

Auctioning, along with the carbon price, is key to driving a strong carbon price signal, although its share is relatively low in the K-ETS. In its current (third) phase (2021–2025), the share of auctioning for the power sector is 10 percent of total allowances, increasing from 3 percent in the second phase, with free allocation for the remainder. The new administration in Korea is planning to increase the auction share in Phase 4, although the level is not yet decided. Similar to the EU ETS, full (100 percent) auctioning for the power sector would be needed to provide a strong economic incentive to switch away from coal-fired power stations. This will serve the decarbonization of the power sector when there is effective carbon cost pass-through to retail electricity prices as described above.

A major benefit of auctioning is the generation of revenue to support GHG reduction projects.[6] This can be a substantial source of finance to fund Korea's net zero transition, in particular, assistance for ETS entities' GHG emissions reduction projects, once a high auction share and high carbon price are attained, thus creating a virtuous circle. For example, in the EU the amount of ETS auction revenue generated from 2013 to 2021 has been USD 118 billion, with approximately 50 percent generated in 2020 and 2021 alone. Through these benefits, revenue recycling can play a key role in sustaining industry buy-in to an ETS.

While free allocation continues for the power sector, a further issue is the use of separate GHG emissions benchmarks for coal-fired and gas-fired power plants.[7] This does not provide an economic incentive to lower the use of coal. It is possible that according to the allocation rules for the second part of the current phase (2024–2025), a single coal and gas benchmark would apply that would create a stronger incentive to move away from coal. However, the proposed value of the single benchmark[8] would be too generous for gas-fired facilities and so a way of avoiding windfall gains is needed. This issue could be solved if a more ambitious single coal and gas benchmark were applied, such as best performance (e.g., top 10 percent efficient) of natural gas facilities.[9]

Finally, to enable the ETS to stimulate demand-side reductions in electricity consumption, in the absence until recently of any mechanism to pass through carbon costs to retail electricity prices, the K-ETS also controls indirect emissions associated with electricity and steam consumption. This indirect emissions allocation would no longer be necessary and would need to be removed when the limit is lifted on the extent of carbon cost pass-through to retail electricity prices and when there is full allocation by auction to the power sector. A knock-on effect of remov-

[6] This is already anticipated in the K-ETS with uses of the revenue defined in the ETS legislation.

[7] To prevent windfall gains to natural gas facilities.

[8] Based on weighted average performance of coal- and gas-fired facilities.

[9] Under this approach, the total amount of freely allocated allowances would be less than 50 percent of the capped allowances in the power sector. Most coal-fired power plants would need to purchase a large number of allowances to cover their GHG emissions, which would give a strong incentive to reduce the construction and operation of coal-fired power plants.

The K-ETS cap should significantly tighten in Phase 4 (2026–2030) when it will be aligned with the revised NDC of a 40 percent reduction in GHG emissions by 2030 from 2018 levels. This is expected to result in a large increase in carbon prices.

ing indirect emissions allocation would be a reduction in the number of K-ETS entities, as many are included only due to their indirect emissions. However, if desired, this could be counteracted by expanding the ETS coverage in other ways, for example, by including energy suppliers to transport and building sectors and their associated emissions from energy consumed in these sectors, similar to the California Cap-and-Trade Program and the proposals for expanding the EU ETS ("ETS 2").

Cap Setting

The level of the ETS cap is the key driver of the carbon price as this determines the supply and relative scarcity of allowances in the carbon market. The current K-ETS cap is aligned to Korea's previous 2030 Nationally Determined Contribution (NDC) target of a 26.3 percent reduction by 2030 compared to 2018 levels. This cap level is not creating much scarcity of allowances in the market as evidenced by only moderate current levels of carbon prices. However, the cap should significantly tighten in Phase 4 (2026–2030) when it will be aligned with the revised and more ambitious NDC of a 40 percent reduction in GHG emissions over the same period.[10] This change is forecast to result in a large increase in carbon prices, similar to the sharp increase in EU ETS carbon prices from 2020 in line with the EU's more ambitious 2030 GHG reduction target under the "Fit for 55" package. This will be key to creating the strong carbon price signal to drive power sector decarbonization, in combination with the above changes in the power market and ETS allocation system.

These changes are already anticipated, together with the need to provide financial support to K-ETS entities in making GHG emissions reductions, through funds from auction revenue recycling as described above.

LESSONS FOR ETS AND POWER MARKET DEVELOPMENT IN ASIA

This paper has examined the current status of development in Korea to achieve an effective interaction of its ETS and the power market, as well as suggestions to complete the work and make the K-ETS a fully effective tool to support the decarbonization of Korea's power sector.

While each country has its own power market and ETS context, Korea's experience should provide valuable insights for other Asian countries on how to make an ETS work for the power sector, and work more quickly. Based on this case study, key requirements necessary for an ETS to effectively reduce power sector GHG emissions are summarized as follows:

- For the power market, there should be a mechanism to reflect ETS carbon costs in power station dispatch decisions, such as an environmental merit order system and full pass-through of carbon costs to retail electricity prices. This will enable reductions in power sector emissions first by a reduced GHG emissions factor of power generation and second by a demand-side response by electricity consumers. It will also facilitate full auctioning for the power sector with the major benefits described below.

- For ETS allocation, full (100 percent) auctioning for the power sector should be facilitated by carbon cost pass-through to electricity prices as described above. This provides the necessary strong signal to reduce emissions as all emissions allowances would need to be paid for, and it

[10] Within the overall 40 percent reduction target, the reduction target for the power sector is expected to be slightly greater at 44.4 percent, which will be reflected in the level of initial allocations for this sector.

100 percent auctioning for the power sector will be possible once carbon costs are fully passed through to electricity prices. This will provide a strong signal to reduce emissions and will generate significant revenue to finance investments in GHG reduction projects in ETS sectors and for other beneficial purposes.

generates auction revenue that can finance investments in GHG reduction projects in power and other sectors. Furthermore, a system can be introduced to compensate the electricity price increase to vulnerable stakeholders including low-income households and electro-intensive industry, financed by ETS auction revenue. In the transition to full auctioning, free allocation plays an important role, but benchmarks for allowances should reward low-carbon power generation by not differentiating by fuel type and should be set at an ambitious level that avoids windfall profits for fossil fuel power stations.

- For ETS cap setting, alignment of the level and trajectory of the cap with a pathway that is consistent with achieving the goals of the Paris Agreement should result in a sufficiently tight cap and high enough carbon prices to drive power sector decarbonization. The K-ETS cap-setting method, with a direct link between the cap and the national GHG emissions target, including the 2030 NDC, readily enables this mechanism. The ETS auction revenue should be used to support investment in GHG emissions reduction projects by ETS entities to help address the concerns that will arise with high carbon prices. The adequacy of carbon leakage mitigation measures under high carbon prices would also need to be reviewed.

All these effects are currently demonstrated in the EU ETS, where there were few challenges to power market interaction due to the liberalized EU power markets. Despite the more acute challenges in Asia due to tightly controlled power markets, solutions are emerging. By learning from best practice, the full effectiveness of the ETS as a tool to support decarbonization of the power sector can be achieved in Asia, just as well as has been in the EU.