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# Challenges and Improvements based on the First Trading Period of South Korea's Emissions Trading Scheme (Focusing on Emission Allowance Allocation)

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## ABSTRACT

South Korea's Emissions Trading Scheme (KETS) has received severe criticism regarding allowance allocation issues since its launch in 2015. The primary purpose of this study was to present the allocation issues identified during the first KETS trading period and to suggest feasible approaches to overcoming these challenges that fit within KETS' overarching development direction. The following four issues were identified as major challenges for KETS at the end of the first trading period: 1) Low trading volumes of emission allowances, 2) fewer allocations based on lower mean emissions during the previous trading period, 3) lack of c[onsideration of adjustment factors for new installations and deployments, and 4) the absence of opportunities for opinion exchange on allocation issues between participating businesses and the government. Feasible approaches to these challenges include 1) setting up guidance for each measure aimed to stabilize the market price of emission allowances, 2) allocating additional allowance amounts as greenhouse gas (GHG) emissions are reduced, 3) lowering the adjustment factor for new installations and deployments, and 4) establishing an official platform managed by a supervising body involving civil experts, governmental and non-governmental organizations, and state-owned banks. These strategies would contribute to future development of KETS.

***Key words:*** *Climate Change, Greenhouse Gas Emissions, Emission Trading Scheme, Allowance Allocation, South Korea*

## 1. Introduction

Since the Kyoto Protocol went into effect in 1997, signatories to the Protocol have been striving to achieve their binding targets of reducing their GHG emissions to which they are committed to the international community. Other than primary action, they have been implementing the Emissions Trading Scheme (ETS), Joint Implementation (JI), and Clean Development Mechanism (CDM) as auxiliary mechanisms to the Protocol (Nazifi, 2010; Cho, 2012; Yamin et al., 2001; Ahn, 2015; Lho, 2015; Cho and Kim, 2016; Neelima et al., 2016). South Korea was not then included in Annex B, a group of countries with binding targets to reduce GHG emissions. However, as the Post-2020 Climate Change Regime began, South Korea was one of the countries with an obligation to reduce GHG emissions (Aleksandar et al., 2016; OECD, 2013; EAF, 2017). In 2015, it officially declared the Intended Nationally Determined Contributions (INDC), committing itself to cutting GHG emissions by 37% from the business-as-usual level by 2030 (UNFCCC, 2019; Hong, 2016; Ministry of Environment, 2019; Chae, 2016). Several measures have been taken to reduce GHG emissions at the national level, including implementing the South Korea's Emissions Trading Scheme (KETS) since 2015.

However, efforts by the South Korean government to reduce GHG emissions had domestically begun before the launch of KETS. The government started efforts with its declaration of Low Carbon Green Growth as a national vision back in 2008. The five-year development plan with this vision provided a national strategy for reducing GHG

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emissions in South Korea (Nazifi, 2010; Yun, 2015; Lim et al., 2014; Rhee, 2012). Subsequently, the South Korean government enacted a law, the Framework Act on Low Carbon Green Growth in 2010. This set legal grounds for introducing the emissions trading scheme in terms of framework (Cho, 2012; Yun 2015; Lim, 2014; Lee and Kim, 2018). Legislation with regard to allocation and trading in emission allowances of GHG was outlined, and established in 2012, providing legal support for implementing the System of Management by Objective in GHG and Energy as a primary measure for reducing national GHG emissions (Cho, 2012; Yun, 2015; Rhee, 2012). In this context, the South Korean government had begun to form a legal system with a focus on energy efficiency to prevent increases in GHG emissions via the increase in energy use. Targeted businesses under the system were included under KETS when it launched in 2015 (Park, 2017).

The South Korean government is planning to operate KETS in stages until 2025, starting with the first trading period of 2015–2017. As Table 1 outlines, given the need for trials, effort, and time for the scheme to be completely legally established, the first trading period seemingly took an operational direction to ensure the flexibility of the system, making use of offsetting. From this aspect, measurement, reporting, and verification (MRV) were not well-established, and the relevant infrastructure for setting up an inventory of emissions, reductions, and offsets, required to issue allowances, was still in the preparation stage. The aim of second trading period, as shown in Table 1, is to increase the number of targeted businesses, enforce emission reductions, and strengthen the MRV baseline by extending the scope of KETS following the first trading period. The third trading period aims to induce the targeted businesses to voluntarily reduce GHG emissions through the KETS market mechanism, and to enhance liquidity on the side of allowance supply.

However, beyond setting the main objectives for each trading period, KETS produced many significant challenges during the first trading period, for example, the low trading volume in the trading market during the first trading period (Chae, 2016; EISKMG, 2018; Lim et al., 2014; Ministry of Environment, 2014; KCMI, 2019). This low trading volume triggered a sharp decline in the trading price of emission allowances from the aspect of allowance demand and supply (Cho and Kim, 2016; Lee and Park, 2015; Lho, 2015; Han, 2014; Shim and Lee, 2015). The allocation method itself considerably negatively impacted price setting during the initial stage of KETS (Chae, 2016; KMG, 2018; Lho, 2015; Han, 2014; Shim and Lee, 2015; Lee et al., 2015). These problematic issues are thought to be deeply associated with the allocation of emission allowances in KETS. Therefore, it is important to understand and discuss the seriousness of these issues, as allocated allowances play a major part in the trading scheme because they provide financial aid in increasing the competitiveness of participating businesses in KETS. Hence, this primary purpose of this study was to discuss major challenges regarding the allocation of emission allowances that were identified during the first KETS trading period, and to suggest and discuss feasible approaches to overcoming the identified challenges to present a developmental direction for the upcoming KETS trading periods.

Table 1. South Korea Emissions Trading Scheme's main objectives by trading period

| Trading Period | First Trading Period (2015-2017) | Second Trading Period (2018-2020) | Third Trading Period (2021-2025) |
|---|---|---|---|
| Main Objective | - Build up experience<br>- System establishment | - Considerable level of GHG reduction | - Vigorous GHG reduction |
| | - Reconsideration of system flexibility such as offsetting<br>- Build up inventory infrastructure for Measurement, Reporting, and Verification (MRV) | - Expanding system coverage and setting higher reduction targets<br>- Increasing MRV level | - Preparing for new climate change regime<br>- Inducing voluntary reduction by covered businesses<br>- Increasing liquidity of allocated allowances |

The remainder of this paper is structured as follows: Sections 2 and 3 provide the analysis and discussion of the overview and major developments, respectively, regarding the allocation of emission allowances of the first KETS trading period. Section 4 discusses the identified challenges with regard to the allocation of emission allowances during the period. Section 5 suggests and discusses possible approaches to addressing the identified challenges. Lastly, in Section 6, a developmental direction for KETS in terms of the allocation of emission allowances is presented.

## 2. Overview of Emission Allowance Allocation for the First KETS Trading Period

### 2.1 Primary Features

The scheme was designed to operate for three years each for the first and second trading periods, and five years for each trading period thereafter. Following the National Allocation Plan (NAP), approximately 1.686 billion units of Korean Allowance Units (KAU) were allocated during the first trading period. Six types of greenhouse gases, subject to the Kyoto Protocol (carbon dioxide, methane, $SF_6$, nitrous oxide, hydrofluorocarbons, perfluorocarbons), were the gases targeted during the first trading period. In total, 525 businesses participated in the scheme during the period (SAF, 2015; Kim, 2013; Kim, 2017; Park, 2015; Iwata, 2014).

The first trading period of KETS ran from 2015 to 2017 (Table 2). The targeted businesses during that trading period had their allowances allocated via grandfathering (free allocation), which is slated to be phased out over time (Lim et al., 2014; Kim, 2013; Kim, 2017; Cho, 2015). It is thought that the South Korean government had planned to use the allocation method to provide new businesses entering under the KETS with free financial aid to enhance their competitiveness for entry into the trading market. The government seemed to have planned to phase out the method with market functions improving over time as no legislation regarding the baseline calculation for allocating allowances had been set up at that time (Kim, 2017; Cho, 2015). Other than free allocation, the scheme is also planned to gradually phase in auctioning: 3% of auctioning for the second trading period and more than 10% of auctioning for the third trading period (Samil, 2015; Kim, 2017; Cho, 2015).

The reduction achievements under the scheme include the reduction of GHG emissions by businesses under the System of Management by Objective in GHG and Energy (Ahn, 2015; Kim, 2017). After receiving the allocated allowances, businesses subject to KETS internally monitor GHG emission reduction activities. Results should be submitted to the government after verification by a third independent authority.

Table 2. Primary features of emission allowance allocation in the first trading period

| | Primary Features |
|---|---|
| Setting Objectives | Following the National Allocation Plan (NAP), issuing 1.69 billion units of allowances (66.7% of total GHG emissions) for first trading period |
| Trading Period | 2015-2017 (three years) |
| Targeted Gases | 6 GHGs (Kyoto Protocol): $CO_2$, $CH_4$, $N_2O$, PFCs, HFCs, $SF_6$ |
| Covered Businesses | 525 businesses during the first trading period |
| Allowance Allocation | Grandfathering, benchmarking (Share of grandfathering: first trading period−100%, second trading period −97%, third trading period−less than 90%) |
| Early Reduction Credits | 2.5% of total allocated allowances of first trading period. |
| Banking/Borrowing | (Banking) Allowable between planned years and trading periods.<br>(Borrowing) Within 10% between planned years, not allowable between trading periods; borrowing share increased from 10% to 20% in May 2016. |
| Penalty | Three times the mean price of allocated allowances of the business in trading market (below a maximum of 10,000 won (Korean currency)/less than one ton of $CO_2$ emissions). |

Whether businesses have complied with the reduction obligation can be decided by verifying the amount of allowance units to be discarded in late June in the next planned year of the trading period. This process is repeated yearly within the same trading period (Kim, 2013; Ahn, 2015).

The scheme allows allocated allowances held by the participating businesses to be banked for the next planned year of the same trading period with approval from the Ministry of Environment. Allowances held by the businesses can also be banked to the next trading period. There is no limit to the amount of bankable allowances. Participating businesses are permitted to receive allocated allowances in advance from allowances to be allocated for the next planned year or next trading period (Cho, 2012; Ahn, 2015; Rhee, 2012; Kim, 2013). However, borrowing can be allowed within 20% of the amount of allowances to be submitted to the Ministry of Environment (Cho and Kim, 2016; Rhee, 2012; Cho, 2015). If a participating business has a shortage of allocated allowances even with borrowing at the point when it is supposed to submit the allowances, then penalty surcharges for the short amounts could be imposed on the business (Rhee, 2012; Park, 2017; Park, 2011; Lee, 2017; Iwata, 2014).

The scheme implements offsetting in which Korean Offset Credits, credits to be issued for reducing GHG emissions outside KETS, is allowed to be traded by businesses subject to KETS. The amount of tradable credits in the trading market is limited within 10% of the total amount of allocated allowances under KETS as well (Chae and Park, 2016; Park, 2015; Iwata, 2014; Cho, 2015).

## 2.2 Certification of GHG Emission Reduction Business and Types

Under KETS, businesses are permitted to perform the business of reducing GHG emissions outside KETS as long as the business is verifiable and compliant with international standards acknowledged by the Kyoto Protocol. Businesses are able to use Certified Emission Reductions (CER) credits from Clean Development Mechanism (CDM) (Lee, 2017; Kim and Sim, 2017; CGS, 2015). The GHG emission reduction business outside KETS is categorized on the basis of the United Nations Clean Development Mechanism (UNCDM), which includes carbon capture and storage, and reuse. The types are: energy industry, energy distribution, energy demand, manufacturing industry, chemical industry, building, transportation, metal manufacturing, fuel leakage, HFC, PFC, and $SF_6$ emissions, use of organic solvents, waste disposal, afforestation and reforestation, and agriculture (Park, 2017). The types of businesses reducing GHG emissions outside KETS are divided into domestic reduction and overseas reduction. Credits issued from a reduction business outside KETS that is run inside South Korea and credits from international carbon markets corresponding to the Kyoto Protocol can be used in the KETS trading market (Kim, 2013; Ahn, 2015; Kim, 2017). CERs that are issued from CDM projects, domestic or overseas, can also be traded. Operators of businesses outside KETS are entitled to call for the domestic CDM commission to cancel issued CERs and to receive a certificate of cancellation following completion of the cancellation. An operator can request an issuance of Korean Offset Credits (KOCs) corresponding to the amount of cancelled CERs after submitting the cancellation certificate to the government. The government issues the Korean Offset Credits and, after trading in the trading market, businesses subject to the allocation of allowances under KETS can convert KOCs into Korean Credit Units (KCUs) and use them for compulsory compliance with reducing GHG emissions (Park, 2015).The types of emission allowances discussed thus far relevant to the operation of KETS (ICCA 2019) can be summarized as follows:

(1) KAU (Korean Allowance Unit): Emission allowance that is allocated to businesses subject to KETS
(2) KCU (Korean Credit Unit): Emission allowance that is converted from Korean Offset Credits.
(3) KOC (Korean Offset Credit): Emission allowance issued and certified by the South Korean government for reducing, absorbing, and removing GHG emissions outside KETS.

## 3. Major Developments Regarding Allocation and Trading During First Trading Period

### 3.1 Allocation of Allowances During First Trading Period of KETS

As shown in Table 2, the South Korean government allocated 1.69 billion units of allowances, 66.7% of the country's total emissions, for the first trading period. The allowances were allocated to five industrial areas. The amount of allocated allowances for the planned years of the trading period was yearly adjusted, maintaining the total amount of allowances to be allocated for the trading period by area: industry (48.1%), conversion (42.9%), waste (1.7%), building (1.1%), and transportation (0.2%), with industry and conversion receiving more than 90% of the total allocated allowances (Ministry of Environment, 2014; Cho, 2015; Oh and Yoon, 2018). Out of the total amount, 1.598 billion tons of allowances for the first trading period were allocated in KAUs to KETS businesses while 89 million tons of the allowances were reserved. Out of the reserved allowances, 14 million tons were allocated for the market stability of the allocated allowances, 41 million tons for early reduction achievements, and 33 million tons for new entrants and expansions of the existing businesses. Table 3 details the share of the allocated allowances by area for the first trading period (Lho, 2015; Lee, 2017; Cho, 2015).

The amount of allowances allocated to KETS businesses shortly before the first trading period was approximately 1.6 billion units, about 79% of the 2.02 billion allowances that KETS businesses had initially requested. Later, the Ministry of Environment accepted complaints from the 40 KETS businesses calling for more allowances, and allocated them an additional 6.6 million allowances out of the reserve (CGS, 2019).

### 3.2 Trading and Primary Developments During First Trading Period

During the first trading period, KAUs and KOCs were traded to some degree in the KETS market, whereas the KCU trading volume was considerably low relative to the other two types of emission allowances. The first trading period was divided into two trading periods. Each trading period had a number of shares that were traded, as shown in Table 4. The table shows the share of emission allowances by type during each trading period (Kim and Sim, 2017).

As Table 4 shows, the KOC trading volume during the first half of the trading period was higher than that of KAUs. Presumably, businesses that had a massive amount of CERs converted them into KOCs while vigorously participating in trading (Ministry of Environment, 2014; Lee, 2017; Kim and Sim, 2017). The overall trading volume during the second half of the first trading period considerably increased, as did KAUs. Restrictions on scale and limits on feasibility of the initially approved CDM businesses were thought to keep KOCs and KCUs from increasing and meeting allowance demand in KETS. Hence, demand for allowances during the second half of the trading period was naturally met, mainly by KAUs.

Tables 3 and 4 show that the amount of the allowances traded during the first trading period was relatively insignificant compared with the total amount of the allocated allowances for the period. The rationale behind this is, first, that KETS businesses refrained from selling their allocated allowances with the expectations of a rise in KAU prices for low liquidity into the trading market. Businesses are obliged to submit their secured allowances to the government, and businesses short of allowances are supposed to pay penalties. However, businesses with an allowance surplus did not put their remaining allowances in the trading market with the expectation that the price of their allowances would increase for a shortage in trading allowances. Second, KETS itself had difficulties setting a proper price for KAUs for trading due to governmental intervention in adjusting the price of allowances during the initial stage of KETS. Third, not many KETS businesses were interested in an emissions trading market in a perilous state, putting their survival at stake due to global economic depression and a spike in international oil prices at that time (Kim and Sim, 2017; Oh and Yoon, 2018).

Table 3. Share of allocated allowances by sector and subsector for first trading period (tone)

| Sector | Subsector | | Planned Year | | | Allowance |
|---|---|---|---|---|---|---|
| | | | 2015 | 2016 | 2017 | |
| Total allowances | | | 573,460,132 | 562,183,138 | 550,906,142 | 1,686,549,412 |
| Pre-allocations | | | 543,227,433 | 532,575,917 | 521,924,398 | 1,597,727,748 |
| Reserves | | | | | | 88,821,664 |
| Conversion | Generation | | 250,189,874 | 245,284,190 | 240,378,507 | 735,852,571 |
| Industry | Mining | | 245,386 | 240,575 | 235,763 | 721,724 |
| | Food and Beverage | | 2,534,679 | 2,484,980 | 2,435,280 | 7,454,939 |
| | Textile | | 4,701,454 | 4,609,269 | 4,517,084 | 13,827,807 |
| | Lumber | | 384,051 | 376,521 | 368,990 | 1,129,562 |
| | Paper | | 7,630,496 | 7,480,879 | 7,331,261 | 22,442,636 |
| | Oil refining | | 19,153,420 | 18,777,862 | 18,402,305 | 56,333,587 |
| | Petrol chemistry | | 48,857,291 | 47,899,305 | 46,941,318 | 143,697,914 |
| | Glass and Ceramics | | 6,263,680 | 6,140,863 | 6,018,046 | 18,422,589 |
| | Cement | | 43,518,651 | 42,665,3444 | 41,812,037 | 127,996,032 |
| | Steel | Except process | 103,284,517 | 101,259,331 | 99,234,144 | 303,777,992 |
| | | F-gas | 675,361 | 662,119 | 648,877 | 1,986,357 |
| | Nonferrous metal | | 6,888,332 | 6,753,266 | 6,618,201 | 20,259,799 |
| | Machinery | | 1,416,225 | 1,388,456 | 1,360,687 | 4,165,368 |
| | Semiconductor | Except process | 8,252,756 | 8,090,937 | 7,929,118 | 24,272,811 |
| | | F-gas | 2,202,049 | 2,158,871 | 2,115,694 | 6,476,614 |
| | Display | Except process | 6,705,480 | 6,574,000 | 6,442,520 | 19,722,000 |
| | | F-gas | 2,438,238 | 2,390,430 | 2,342,621 | 7,171,289 |
| | Electric and Electronic | | 2,877,479 | 2,821,058 | 2,764,637 | 8,463,174 |
| | Automobile | | 4,242,789 | 4,159,597 | 4,076,405 | 12,478,791 |
| | Shipbuilding | | 2,683,132 | 2,630,522 | 2,577,911 | 7,891,565 |
| Building | Building | | 4,017,219 | 3,938,450 | 3,859,681 | 11,815,350 |
| | Communication | | 3,089,243 | 3,028,670 | 2,968,096 | 9,086,009 |
| Transportation | Aviation | | 1,289,780 | 1,264,490 | 1,239,201 | 3,793,471 |
| Public and Waste | Water | | 766,351 | 751,324 | 736,298 | 2,253,973 |
| | Waste | | 8,919,500 | 8,744,608 | 8,569,716 | 26,233,824, |

Table 4. Share of emission allowances by type during first KETS trading period

| First Trading Period (2015-2017) | Korean Allowance Unit (KAU) | Korean Offset Credit (KOC) | Korean Credit Unit (KCU) | Total (%) |
|---|---|---|---|---|
| 1 January 2015-30 June 2016 | 38 | 62 | 0 | 100 (11 Mt $CO_{2eq}$) |
| 1 July 2016-31 December 2017 | 69.1 | 28.1 | 2.8 | 100 (17 Mt $CO_{2eq}$) |

# 4. Challenges Regarding Allocation of Emission Allowances During First Trading Period

## 4.1 Low Trading Volume of Allocated Allowances in Trading Market

Price-setting of allocated allowances at a proper level through the market mechanism in KETS would not have been expected during the first trading period as an insufficient amount of allowances was supplied for the demand in the trading market (Shim and Lee, 2015; Samil, 2015; ETU 2018). As discussed above, the amount of emission allowances to be traded was insufficient compared with the total amount of allowances that had been allocated for the first trading period (Kim and Sim, 2017). However, it was possible for KETS businesses to supply their CERs from CDM projects, increasing the total amount of allowances into the trading market. However, the number of certified CDM projects was also insufficient as well since the launch of KETS in January 2015 (Kim and Sim, 2017). In addition to the difficulties in securing a sufficient amount of allowances in the trading market, KETS businesses holding allocated allowances were not willing to trade them in the market, worsening the shortage of allowances (Chae and Park, 2016). Even KETS businesses that met their emissions reduction targets were holding the remaining amount of allocated allowances or were banking them rather than trading them in the market. This triggered a shortage of allowance supply for trading. Businesses with an allowance surplus after use were increasing holdings in preparation for future market uncertainties (Chae and Park, 2016; Samil, 2015). The market uncertainties included government policies regarding the emissions trading scheme, the risk of price volatility, and concern about the future amount of GHG emissions (EISKMG, 2018). The shortage of liquidity in the amount of allowances increased the trading prices of the allocated allowances in the trading market. This cannot be deemed as a cost-effective method of reducing GHG emissions (Lee and Park, 2015), forcing KETS businesses in need of more allowances to secure allowances for a high cost or to fail to do so, calling into question the effectiveness of the emissions trading scheme.

## 4.2 Method of Fewer Allocations Based on Fewer Annual Mean Emissions of Previous Trading Period

Allowance allocation of GHG emissions is supposed to be set on a national emission allowance allocation plan according to the Fundamental Plan of Korean Emissions Trading System by the Ministry of Planning and Finance of the South Korean government (Ministry of Environment, 2014). Currently, KAUs are allocated based on the mean GHG emissions of the past baseline year. In other words, they are allocated on the calculated annual mean emissions of the total three-year GHG emissions of the previous trading period (Rhee, 2012; Ministry of Environment, 2014; Lee and Park, 2015; Kim, 2013; Cho, 2015). If the mean emissions of the previous trading period is low, then the amount of allowances to be allocated for the next trading period is low as well. As businesses under KETS are prone to securing as many allowances as possible for financial aid, the logic previously mentioned could discourage businesses engaging in emissions reduction activities in order for businesses to obtain as many of the allocated allowances as possible. That is, a chance exists that emissions increase as a side effect of that purpose (Cho, 2012). Even businesses that have sufficient GHG emission reduction technologies would refrain from undertaking reduction activities and would lack motivation to improve these technologies. In general, this could hamper the development of GHG emissions reduction technologies in the low carbon market.

## 4.3 Nonconsideration of Adjustment Factor for New Installations and Deployments

Under KETS, the same adjustment factor is supposed to be applied to both newly installed and expansions of emission installations and deployments (Kim, 2017; Yoo et al., 2017). However, newly manufactured emission installations and deployments are likely to produce fewer GHG emissions than existing emission installations and deployments due to the application of advanced GHG emissions reduction technologies (Kim and Sim, 2017). Hence, KETS businesses

with newly manufactured emission installations and deployments may still be burdened with setting and achieving GHG emission reduction targets if the same adjustment factor is applied as for existing installations and deployments. This can discourage KETS businesses from investing in and researching the development of installations and deployments with the application of GHG emission reduction technologies. In other words, in the long term, this would induce KETS businesses to select existing installations and deployments with low efficiency in reducing emissions, leading to slowing the pace of GHG emissions reduction in the business sector as a whole.

### 4.4 Absence of Opportunities for Opinion Exchanges on Allowance Allocation between Participating Businesses and Government

The System of Management by Objective in GHG and Energy provided a negotiation stage for setting targets for reducing GHG emissions where participating businesses would suggest and exchange opinions on the development of the system (Chae and Park, 2016; Lim et al., 2014). Simply, the negotiation stage provided opportunities for communication. After governmental assessment, subsequent to application by businesses for the allocation of allowances, the amount of allowances is determined and allocated. Allocation was determined partly through the relevant allowance allocation consultations regarding the state of GHG emissions between businesses and the government (Lim et al., 2014). Such consultations in the process of allocating allowances can prevent the surplus or shortage of allocated allowances, as they help the government to accurately estimate the present state of GHG emissions. Under the current KETS, no such a policy tool enabling the government to accept the opinions and views from KETS businesses has yet been implemented (Lim et al., 2014). Emission allowances under KETS are allocated to the participating businesses top-down corresponding to the amount of GHG emissions from the businesses, considering the total amount of emissions by sector. This top down structure makes it hard for KETS businesses to voice problems and difficulties they may have experienced.

## 5. Overcoming the Challenges for Improvement

Following Section 6 which dealt with challenges with allowance allocation that KETS experienced during the first trading period, this section suggests and discusses approaches to overcoming each aforementioned challenge.

### 5.1 Set up of Guidance for Each Measure Aimed at Stabilizing the Price of Allocated Allowances in Trading Market

The South Korean government is implementing several measures to address market instability that can be triggered by a rise or fall in the price of allocated allowances, which are caused by an imbalance in the supply and demand of allocated allowances in the trading market (Cho and Kim, 2016; Lho, 2015). Additional allocation of allowances to the reserve, Put option guaranteeing low limit value of reduced credits, setting the minimum or maximum limits on allocated allowances for holding, putting a limit on the reduction and extension of allocated allowances to borrow, limiting the reduction and extension of Korean Offset Credits, and setting the lowest retail price of the allocated allowances are among the measures that the relevant KETS law stipulates (Lho, 2015). The need and the method to implement these market-stabilizing measures are stipulated in KETS' enforced ordinances. Which methods should be applied to which cases is, however, not clarified (Han, 2014). This can lower the predictability of the concerned policies and reduce their effectiveness. Hence, concrete procedures and the relevant guidance for each one of the measures should be clarified so that these market-stabilizing measures can be realized in a coherent and predictable manner.

### 5.2 Considering Adding Allowances of Reduced Emissions as Incentive

The current allocation method of allowances in KETS is based on the amount of allowances corresponding to the mean value of annual emissions of the previous trading period (Rhee, 2012; Lee and Park, 2015; Cho, 2015). With

this method, if businesses reduce their emissions up to a certain amount, the amount of allowances they are allocated should be reduced according to the reduced amounts. This would discourage them from attempting to reduce their GHG emissions, and encouraging businesses to purposefully evade trading emission allowances, reducing the total amount of allowances for trading in the market. As a responsive measure, allocating an additional amount of the allowances as much as the reduced GHG emissions of the previous trading period when allocating allowances for the next trading period should be a feasible solution. This is a positive approach from the perspective that incentives are provided in agreement with a business' efforts in reducing GHG emissions during the previous trading period. However, the MRV inventory of GHG emissions is firmly overarching and accounting for a relevant legal system should be first well-established for objectivity and verification regarding achieving reduced emissions. Benchmarking based on security of the sufficient amount of the reliable data can be an effective alternative allocation method, but it seems rather early to be applied with KETS due to the lack of data with reference to GHG emissions from the industries (Lee and Park, 2015).

### 5.3 Lowering Adjustment Factor for New Installations and Deployments

Under KETS, businesses with a plan to install new or expand upon existing manufactured installations and deployments that emit GHG emissions need to have their adjustment factor lowered, as newly manufactured installations and deployments are likely to be designed to emit less GHGs than existing ones (Chae and Park, 2016). Targets for reducing GHG emissions should be lowered so that the burden to reduce GHG emissions should be lower on businesses with a plan to install new or expand upon existing manufactured installations and deployments. Measures to reduce this burden could induce new businesses in industries to join KETS, and could lead the new entrants to increase their efforts in developing technologies for reducing GHG emissions. For businesses with a plan to replace their installations and deployments with new ones, grading newly manufactured installations and deployments based on their capacity to reduce GHG emissions, and having a systematic legal set up for lowering the emissions reduction target according to the grading, should be a measure to consider. For this set up to work effectively, a methodology to estimate GHG emissions for grading and guidance concerning the set-up should be sufficiently considered and incorporated into the legal set-up.

### 5.4 Set-up of Official Window for Dialogue Through an Authority Body Involving Civil Experts, Government, Non-governmental Organization and State-owned Bank

As aforementioned, no legitimate tool under the current KETS provides an opportunity for communication where the two parties, the government and the participating businesses, are able to address difficulties and issues with the allocation of allowances (Chae and Park, 2016; Lim et al., 2014). In that regard, setting up an official platform for dialogue between both parties through an authority body involving civil experts, government, non-governmental organization and state-owned bank could help address the absence of a legitimate tool. The margin of governmental intervention in the trading market should also be reduced in the process. The authority body should have a more transparent and objective outlook on the difficulties and issues with regard to the allocation of allowances. Although the operation of KETS through the market mechanism based on the supply and demand of the allocated allowances may be significant, an important piece of legislation intended to keep the body from exceeding its authority should also be established.

## 6. Conclusions

Having launched before the 2015 Climate Change Agreement in Paris, KETS produced a sharp difference in opinions on the capabilities of the government and businesses from the initial stage of the implementation as a primary responsive measure against climate change by the South Korean government. As the government tried to introduce a GHG emissions reduction policy aligned with international

climate change policy, the industries maintained that it was too early for Korean industries to join the international stream as they were not yet prepared for that direction. The emissions trading systems that were partly running in the United States, Japan, China, and Canada prior to KETS are different in structure and operation from that of South Korea, as the Korean ETS was designed to run at national level. Therefore, it is harder for KETS to be modeled after the systems of those countries in those aspects (Ministry of Environment, 2019). In addition to it, the Ministry of Environment was the first authority in charge of KETS, and then the Ministry of Planning and Finances. This charge then returned to the Ministry of Environment. This confusing shift increased uncertainty in KETS businesses in terms of KETS' operation (Rhee, 2012; Cho, 2015; ETU, 2018). And the Allocation of emission allowances for the second trading period should have been complete by June 2017, but allocation was delayed due to the process of establishing the relevant environmental and energy policies, and only allowances for the first year of the second trading period were allocated (ETU, 2018).

The aforementioned could negatively impact KETS development. However, as of now, KETS must restore the trading volume of emission allowances in the market by ending mistrust in its effective long-term functioning before anything else. In the regard, the suggested allocation method for additional allowance amounts corresponding to the amount of reduced GHG emissions during the previous trading period seems to be a feasible approach for restoring the amount of allocated allowances in the trading market. A systematic legal set-up enabling the lowering of the adjustment factor for newly manufactured GHG-emitting installations and deployments for expansions or new businesses, and the allocation of allowances based on the adjustment factor, are needed as well. Regarding the absence of opportunities for opinion exchange between participating businesses and the government on allowance allocation, an official platform for dialogue between both parties should be set up through an authority body involving civil experts, government, non-governmental organization and state-owned bank. Ultimately, legislation banning KETS businesses from holding allocated allowances to a certain amount for a set period of time should be established for the current KETS to operate soundly and effectively. Other than the discussed approaches, some feasible methods could be implemented to contribute to the operational development of KETS for the next trading periods. First, if KETS businesses with insufficient ability to reduce their internal GHG emissions continue holding their allocated allowances, the amount should be adjusted by facilitating emissions-reduction business outside KETS. Second, a benchmarking shift would serve the purpose of establishing KETS if a GHG emissions reduction technology committee exists for each industrial sector. If the committee shares and spreads the development of technologies and the relevant information with reference to manufacturing industrial products, the approach could be effective in terms of emission allowance allocation and the acceleration of KETS development for the upcoming trading periods.

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