Business perspective on GHG ETS in Korea and its operation in the first compliance year

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[Abstract]

Korea’s domestic emissions trading scheme commenced in January 2015 targeting mainly the industry and power sectors and compelled companies to transform their energy efficiency and greenhouse gases mitigation management. This study aims at exploring the means by which Korean companies evaluate their allocation position and engage in emissions trading in the first compliance period as well as identifying their standpoint on trading barriers and policy expectations in view of emissions trading inauguration.

Questionnaire surveys and on-site hearings targeting Korean companies under the Korean emission trading scheme were conducted at the start of operations (February to March, 2015) and after the compliance year (May in 2016), respectively. The actual operation results are observed and compared with the survey study findings.

This study set out to identify the perspective of Korean companies on emission market participating and extrapolate pointers for policy implication as well suggestions for the government and the subject companies in terms of ways to improve the current emission trading scheme in order to stimulate emission trading under the scheme.

Keywords: Company perspective, emission trading barriers, Korean carbon market, Korean domestic emission trading scheme, petrochemical industry
Highlights

- Traded emissions in the first year of K-ETS were small with the average carbon pricing, 10 USD.
- Short-allocation in the first phase is the overall perspective of the petrochemical industry.
- The supply shortage of emissions in the market is the primary barrier for trading.
- Korean companies seems to perceive ETS as the compliance mechanism in this stage.
- Pro tem policy uncertainties exist due to changes related Ministry that impedes trading decision at the company level.
- Companies’ systematic and analytical responses to the carbon market were sought.
1. Introduction

Greenhouse gases (GHGs) emission trading, a market based instrument, is based on the idea of using market mechanisms to mitigate GHGs, and offers the option to achieve a given emissions reduction target with the least costs (Heindl and Löschel, 2012). The cost-effectiveness advantage can be realised through trading by reallocating transferring the responsibility for emission control responsibility away from higher marginal abatement cost firms and towards lower-marginal abatement cost firms, based on the difference in marginal abatement costs of each firm (Hanley, Shorgen, White, 2013).

Korea’s initiation of domestic emission trading (Korean Emission Trading Scheme: K-ETS) in January 2015 launched the second largest carbon market in the world and acts as the backbone to its climate change policy. Amidst strong resistance from industry, the government emphasised its cost-effectiveness in mitigating GHG emission in comparison with existing mandatory regulations (PCGG press 2011; Kim 2010; Lee 2009).

While conventional climate change policies aimed at industry had been dominated by voluntary agreements (VA) and command and control, the market under the new instrument was inactive despite the 100% free allowance as seducement offered in the first compliance year, which was designed to allow percolation of the policy throughout industry.

Europe’s industry displayed a similarly sluggish response to emissions trading in the first phase of European ETS, which was designed to test administrative authority in developing infrastructure and to allow its familiarisation within the designated companies. Many studies dissected the reasons for this and unearthed several barriers, including institutional influence (Engles et al., 2008), allocation position (Engels et al, 2008, Roberts and Staples, 2007, Sabitova, 2011), transaction cost (Jaraite and Kazukauskas, 2012), policy uncertainties (Brewer, 2005) and inadequate knowledge of the scheme (Sandoff and Schaad, 2009, Pinkse and Kolk, 2007, Martin et al., 2014).

Therefore, being able to gauge the perspectives of Korean industry to the carbon market as well as its strategies for emission trading has become a prerequisite in order to clarify the bottlenecks, deal with ingrained impediments, and to improve policy efficacy in order that this system can be put to its intended use of limiting GHG emissions for the forthcoming phase. This paper is therefore designed to address this shortfall in related research.

As such, this study expands on the previous one by Suk (2014), which identified the perspectives of Korean companies on the introduction of ETS, and in particular explores the means by which they evaluate their allocation status and engage in trading in the first compliance period. It also showed the extent of existing barriers to trading and what they expected in terms of policy in order to activate trading. The study was empirical, making use of questionnaire
surveys targeting Korea’s petrochemical industry focused on entities confronted by K-ETS, as well as on-site hearings. They were implemented at the outset of Scheme operation and then after the companies submitted emission statements to the government in May 2016, separately. Actual operation results were observed and comparatively discussed along with the survey findings on company perspectives on emission trading, in order to provide pointers for improving policy.

This paper is set out as follows. Section 2 provides the latest iteration of K-ETS; section 3 outlines the research method and material and also introduces the target industry of the survey; section 4 gives the survey results of business perspectives on the Scheme via statistical summary; section 5 discusses the actual operation results compared with the survey results; and section 6 concludes the research findings and policy implications.

2. Korea Emission Trading Scheme: Finalised Policy Design


A strategic action plan for forming an institutional framework for a GHG reduction system incorporating ETS to promote a domestic carbon market first took shape through inclusion in the Fourth National Countermeasures on Climate Change in 2008. This led to introduction of a preparatory ETS programme (‘GHG and Energy Target Management Scheme (TMS)’), a mandatory regulation to limit energy consumption and GHG emissions of large energy-consuming entities and business sites, in 2011. The scheme set out to establish a GHG emissions inventory and management procedures for the monitoring, reporting, and verification (MRV) of GHG emissions, paving the way for full-blown introduction of ETS in Korea.

In May 2012, the ETS bill, namely the ‘Act on Allocation and Trading of Greenhouse Gases Emission Allowances’ was approved by parliament and, after initial postponement due to heavy opposition from industry, domestic ETS entered into effect from January 2015.

ETS in Korea is a ‘cap & trade’ system in principle. Six greenhouse gases, namely CO₂, N₂O, CH₄, PFCs, HFCs, and SF₆, are covered under the scheme and gasses generated by both direct and indirect means are targeted by ETS. The commitment period is basically five years except for the first two phases, which are periods of three years, 2015–2018, and 2018–2020. The compliance period is one year during each commitment period. In total, 572 were eligible to trade

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1 Article 46 (2) of the Framework Act of 2010 (in Korean)
2 Article 2(9) of the Framework Act of 2010 (in Korean)
emissions during the compliance year of 2015, including 525 initially designed subjects, 44 facilities newly targeted in 2015 and three public financial institutes—Korea Development Bank, Industrial Bank of Korea and Korea Export Import Bank (KRX, 2016). Entities and business sites belong to 23 sectors in 5 fields: power, public & waste, building, transportation and industry comprising either entities emitting over 125,000 t-CO₂ or business sites emitting over 25,000 t-CO₂ annually on average during 2011–2013.

While a government estimate predicts national total GHG emissions will reach 776 Mt-CO₂ by 2020, realising the national GHG mitigation target of a 30% GHG emission reduction compared to the business as usual (BAU) level will require Korea to cut emissions by 233Mt-CO₂ by 2020, allowing the country to emit 543 Mt-CO₂ in total by 2020 (MOEK, 2014). Based on this, the government published the ‘National GHG Emission Allocation Plan’ in 2014, which was revised to reflect the voice of industry, resulting in an aggregate emissions amount for the first phase (2015–17) of approximately 1,687 billion t-CO₂, which is 76.7% of the total emissions BAU by ETS target entities during the same period (around 2.2 billion t-CO₂). Of this, 1,598 billion t-CO₂ are allocated for the first phase and the remainder emissions (89 million t-CO₂) are allocated as a reserve for additional allocations due to unplanned establishment or expansion of facilities or to stabilise the market (MOEK, 2014). The emissions cap drops by 2% for each compliance period of 2015–17, i.e., individually around 574 Mt-CO₂, 562 Mt-CO₂ and 551 Mt-CO₂. The allowances were allocated fully for free in the first phase (2015–2017). The GHG emissions of regulated entities accounted for about 66% of the national total (MOEK, 2014).

Allocation was given 100% free in the first phase (2015–2017) as the test period in Phase II (2018–2020) and 3% of the total emission allowances will be auctioned. The proportion for auction will be increased to at least 10% in Phase III (2021–2025).

Banking of allowances to the next compliance year and the first year of the next commitment year is permitted but between phases is not permitted. Amounts to be banked are unrestricted and can be carried over on an annual basis to successive years. Regulated entities and business sites have been obliged to surrender allowances for each tonne of CO₂ they emit at the end of each reporting year, and are imposed with a fine of three times the average market price of credits and a maximum of 100,000 KRW/t-CO₂ (about 90 USD/t-CO₂; 1000 KRW = 0.87 USD on April 15, 2016) for any shortfall in allowances in each compliance period.

The government amended the ETS Act and the Enforcement Decree of ETS Act on May 24 in 2016, which now provide an exception of 20% of borrowing during the first implementation phase due to lack of emissions in the market. For the early action, it was initially allowed up to 3% from total allowances, however according to the amended the Enforcement Decree of ETS Act, approved early actions shall be assigned the additionally for the second and third compliance year in the first implementation period. However, if the total early actions for a company is exceed
a certain amount, the additional allowance by the early action will be calculated by multiplying the early actions factors (see equation (1)).

\[
\text{Early action factor} = \frac{\text{Recognised total of early mitigation action by company}}{\text{Recognised total of early mitigation action}} \quad (1)
\]

Through a revision bill the government has largely reorganised how K-ETS is managed: the analogy of ‘control tower’ is given to the Office for Government Policy Coordination for overseeing climate change policy, and the Ministry of Strategy and Finance (MOSF) established new division, the climate economic policy division in the Future & Social Policy Bureau where is responsible for planning, coordinating, establishing of emission allocation as well as governing inter-ministry coordination for operating emissions trading market and market stabilisation measures, which were originally the responsibility of the Ministry of Environment (MOE) of Korea (2016.5.31 MOSF Press).

The detail scheme design, related article number in the ‘ETS Act’ and ‘the Enforcement Decree of ETS Act’ are summarised in table 1.

Table 1: Summary of the final scheme design of Korea emission trading scheme

<table>
<thead>
<tr>
<th>Item</th>
<th>Article number in related law</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Plan of ETS (amended)</td>
<td>Article 4 of ETS Act, Article 2 of Enforcement Decree of ETS Act</td>
<td>To be established five-yearly by Minister of MOSF before 1 year of at least a year prior to the implementation period.</td>
</tr>
<tr>
<td>National Allocation Plan</td>
<td>Article 5 of ETS Act, Article 3 of Enforcement Decree of ETS Act</td>
<td>To be completed at least six months before each implementation phase, by Minister of MOSF</td>
</tr>
<tr>
<td>Phase and share of free allocation</td>
<td>Article 13 of Enforcement Decree of ETS Act</td>
<td>Phase I: 2015–2017; Phase II: 2018–2020; Phase III: 2021–2025; 100%</td>
</tr>
<tr>
<td>Target entities and business site</td>
<td>Article 8 of ETS Act</td>
<td>In total of 572 entities emitting over 125,000 t-CO₂ or business sites emitting over 25,000 t-CO₂ annually on average during 2011–2013.</td>
</tr>
<tr>
<td>Allowance in the first phase</td>
<td>Article 12 of ETS Act</td>
<td>In total of 1.687 billion t-CO₂ in the first phase. For the each year; 2015: 574 million t-CO₂; 2016: 562 million t-CO₂; 2017: 551 million t-CO₂.</td>
</tr>
<tr>
<td>Borrowing (amended)</td>
<td>Article 36 of Enforcement Decree of ETS Act</td>
<td>10% of emissions in each compliance year (20% in first implementation period)</td>
</tr>
<tr>
<td>Banking</td>
<td>Article 28 of ETS Act</td>
<td>Banking of allowances to next compliance year and first year of next commitment year</td>
</tr>
<tr>
<td>Offset</td>
<td>Article 38 of Enforcement Decree of ETS Act</td>
<td>10% of allocated allowances</td>
</tr>
</tbody>
</table>

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3. Research method and materials

In order to measure the perspectives of Korean companies, a questionnaire survey and several on-site hearings were implemented, as explained in the following sections.

3.1 Questionnaire survey and samples

A questionnaire was designed to fulfill this research purpose and consisted of four major components: general information on a company; status and target of company energy and GHG management and preparations for emissions trading; self-evaluation of allocation position and trading period under consideration; and evaluation of relevant policies, barriers to trading, and policy expectations.

Data was collected via emailed questionnaire survey from February to March, 2015 in the early stage of Scheme operation and covered 134 petrochemical companies, 84 of which came under K-ETS, 11 under the Target Management System (TMS), and the remaining 39 under neither ETS nor TMS. Environmental and energy managers were targeted in the survey. TMS is a mandatory regulation to cap the total energy consumption and GHG emission, and targets companies with high energy intensities not meeting K-ETS criteria.

Valid responses were received from 35 companies, sizes of which are summarised in table 2.

<table>
<thead>
<tr>
<th>Company size</th>
<th>Number in total (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>2 (5.7)</td>
</tr>
<tr>
<td>Medium</td>
<td>18 (51.4)</td>
</tr>
<tr>
<td>Large-medium</td>
<td>6 (17.1)</td>
</tr>
<tr>
<td>Large</td>
<td>9 (25.7)</td>
</tr>
<tr>
<td>Total</td>
<td>35 (100.0)</td>
</tr>
</tbody>
</table>

Referring to Korea’s ‘Minor Enterprises Act’ classification system, which determines
company size by number of employees, 9 are large companies with over 1,000 employees, 6 are large-medium, 18 are medium-sized with 50–300 employees and two are small companies with less than 50 employees.

Of the 35 respondents, 32 were ETS targets in 2015 whose proposition is 38% of the total petrochemical companies, 84, under the ETS. CO₂ emissions of these 32 companies in 2013 accounted for 63% of the total emissions from the ETS targeted petrochemical companies.

3.2 Petrochemical sector in Korea

This study implemented a survey targeting Korea’s petrochemical industry, mainly due to the key responsibility of this sector in terms of its 7.8% share of national GHG emissions; it was fourth largest in the world based on ethylene capacity in 2012 (KPIA, 2013). Korea exported 45.9 billion USD worth of petrochemicals in 2012, or 8.4% of the country’s total exports in the same year (KPIA, 2013). The total energy consumption of Korea’s petrochemical industry in 2014 was 62,065 thousand TOE (tonnes of oil equivalent), the largest portion at 52.2% among manufacturing sectors, and a large increase from 30.6% in 1990 (KEMCO, 2016). BAU emissions from the petrochemical sector were estimated to reach 59.6 Mt-CO₂ by 2020. According to the ‘National GHG Mitigation Roadmap’, the petrochemicals industry is required to reduce its emissions by 7.5%, which ‘allows’ it 55.1 Mt-CO₂ emissions by 2020. Of the reduction amount, the government expects to cut about 1.59 Mt-CO₂ through efficiency improvements in common equipment (driers, electric motors, boilers) (Joint ministries, 2014). A total 84 petrochemical companies are regulated under K-ETS in the first phase, and a total of 144Mt-CO₂ was allocated for this sector in the same period. The allowance for each year is 48.9, 47.9 and 46.9Mt-CO₂ (MOEK, 2014).

3.3 On-site hearings and visited companies

The on-site hearings were conducted during May, 2016, in which four companies subject to K-ETS from different industry sectors were visited to hear of their experiences in emission trading in the first compliance year and opinions on how to improve it. Actual names of companies cannot be revealed in accordance with their wishes for non-disclosure.

4. Survey Results and Discussions: Business Perspectives on the Scheme

This section provides a statistical overview of business perspectives with reference to K-ETS, allocation status, strategies for complying with insufficient allowance, and engagement with and preparations for the K-ETS as well as the companies’ perspectives on emission trading, including trading period, trading barriers, and practical support required to activate trading. The section ends with a discussion on issues regarding K-ETS operations and how they are regarded from the viewpoint of the companies.
4.1 Allocation Position and Strategies for Compliance

This section provides a summary of the statistical results on company evaluations of their allocation position as regards allowance in the first phase and how they prioritise actions necessary to surrender allowances.

4.1.1 Allocation position in the first phase (2015–2017)

In order to help predict the demand for certain types of transactions, we asked the surveyed companies to indicate whether their emission allowance for the first phase is over-allocated or under-allocated, since an over-allocated company is expected to aim at selling allowances while an under-allocated company is expected to buy allowances.

Of the respondents, 90% said that the allowance is an under-allocated and there is high possibility to exceed the allowances if going through the usual energy strategies of BAU in the first phase. For comparison, the first phase of EU-ETS in 2005 saw an over-allocation rate of 4.6% for all entities (Kettner et al., 2007).

The emission allowance allocation issue concerned the nitty-gritty of progress in negotiations between the government and industry right up until the scheme started. Industry forced the government into reconsidering its initial Allocation Plan (announced May 2014), resulting in a newly revised plan in September 2014 that embraced the requirements of industry and increased the emission reduction to 10% across the board for all industries (Suk, 2015). However, industry argued that the total amount emissions allocated to companies in the first phase (2015-2017) is still approximately 400 M-tonnes lower than the projected BAU emissions level of the business during the same period.

4.1.2 Strategies aimed at complying with the allowance

Companies that answered ‘under-allocated’ in Section 4.1.2 were additionally asked to identify what they would prioritise, of the pre-listed possible actions, in order to make up for the insufficient emissions allowance”. The five possible actions listed are ACTION01 (conduct internal GHG mitigation efforts and activities to meet the allowance), ACTION02 (borrow the allowance from the next compliance year), ACTION03 (buy emissions on the market), ACTION04 (utilise emissions approved as the early action or offset credit), and ACTION05 (pay the penalty for excess emissions). Figure 1 gives the shares of companies in terms of priority for each action.

As the priority action, companies selected ACTION01, which shows that Korean companies tend to cover any lack of allowance via internal management, e.g., environmental equipment expansion, technology development and adoption, production adjustment.

Companies would borrow emission allowances from the next compliance period
(ACTION02) if they could not meet the allowance via internal carbon management—as seen in EU-ETS. The purchase of emissions from the market (ACTION03) is considered as the next best thing. Sandoff and Schaad (2009) found that EU-ETS firms were very inactive in trading EUAs and concluded that formulating trading strategies is not a top priority among the participating companies.

A company’s utilisation of emission credits obtained by early action or through offset programme participation (ACTION04) attracted the lowest possibility. Most companies did not select the option to pay the penalty for excess emissions without special measures (ACTION05).

Figure 1: Priority Action to Taken for Compliance due to Insufficient Allowance (n=28)

4.2 Engagement and Preparations for K-ETS

4.2.1 Company energy saving and GHG mitigation target goal

For companies, setting a target would clarify the aim and enable a systematic, organised approach and allow management to focus on achievable goals and to attain the best possible results from available resources (Kyriakopoulos, 2012).

We requested companies to inform us of the status of their energy saving and GHG mitigation target setting. The results are shown in figure 2. Of the 32 companies, nearly 63% had clear annual targets for energy saving GHG mitigation; 45.7% indicated they have specific targets for 3–5 years, 14.3% said they had targets of 10 years or longer, and 23% had no specific quantitative targets currently. Of the total, 11.4% appeared likely to set goals shortly.
None of the small companies had long term energy saving GHG mitigation targets. Among the middle-sized company, 30% of them has not set a specific GHG reduction while half of them has annual target. 50% of large-medium sized companies has set the annual energy and GHG emission management target. However when it comes to the longer term targets for 3~5 years target or 10 years, the percentage decrease to 17% each. Among the large companies, nearly 70% had either yearly or medium-term (3~5 years) targets for energy and GHG management, and a quarter of them had set a target of 10 years or longer.

These results clearly show that Korean companies prefer short-term commitments to deliver investment and carbon reductions and that the status of energy-saving and GHG mitigation targets setting varies according to company size.

Figure 2: Company energy saving and GHG mitigation target (n = 32)

4.2.2 Monitoring and statistics of internal energy use

In the questionnaire, the surveyed companies could select the status of systems used for monitoring and statistics on energy use and GHG emissions. Multiple selections were possible among the given list. The results are indicated in figure 3.
Of the total, 59% have established guidelines for energy use and GHG emissions and 53% have installed monitoring devices for major energy consuming facilities and equipment. Around 47% have specific departments and staffs for energy management for internal energy measurement and statistics. On the other hand, 26.5% admitted that they have not established internal measurement and statistics systems for energy use and GHG emissions, and 6% said they would establish systems shortly.

Nearly 80% of large-sized companies have installed monitoring devices on energy using equipment and facilities, and have specific energy management department and staffs. Nearly 70% of large companies have energy use and GHG mitigation guidelines; 50% of middle-sized and large-middle-sized have developed guidelines or installed monitoring devices. Only 30% of them established energy management department and staffs. None of the small companies have energy management-related departments. The survey found that systematic energy use and GHG emissions management systems had not been introduced as a whole within the ETS targeted companies.

4.2.3 Preparations for emissions trading

Once a company gets drawn into ETS there are a number of important issues to be prepared for in terms of the impact ETS will have, several of which are listed below. Korea’s petrochemical companies indicated the activities they have dealt with in response to K-ETS. Figure 4 shows the percentages of samples that answered ‘YES’.

Figure 3: Status of monitoring and statistics of internal energy use (n = 34)
Most of the companies had made institutional preparations, such as establishing an internal GHG emissions inventory (88% of companies), information collection (79%), and registration and account opening in the KRX for market participation (76%). However, as only half of the companies had made trading plans, carbon-oriented management and strategy are likely to stay at the primary stage. Half of samples carry out strategic carbon market analysis presently; 44%, a relatively small percentage, have established specific divisions engaging in ETS participation; budget allocation was carried out by around 40%; and 38% of companies engaged with external service providers to help them carry out Scheme obligations.

A comparison of Korea with European ETS in several countries is revealing—companies had established management teams and project directors, developed strategic responses, and performed impact assessments of ETS on themselves in the early stage of EU-ETS (Brewer, 2005). In a survey of Australian liable entities, the respondents extensively outsourced services, such as auditing and legal, to assist them in scheme requirements; 75% had established new governance policies and carbon risk management frameworks to comply with policy related to carbon pricing mechanisms (IETA, 2013).
4.3 Perspectives on Emissions Trading under K-ETS

4.3.1 Emission trading period under consideration

To uncover information on the timing companies started emissions trading, a question was designed to ask companies which trading period they were considering, based on an ordinal scale of 1 to 5, with ‘1’ representing ‘not possible at all’ and ‘5’ being ‘very high possible’. The results show the shares of companies who answered as to the degree of ‘possible’, ‘high possible’ and ‘very high possible’.

The five periods are listed as (1) ‘Early time after the scheme started in January 2015’; (2) ‘If necessary, anytime during the compliance period from the start in January 2015 to December 2015’; (3) ‘After the end of compliance year to before the emission statement submission (1st January to 31st March 2016)’, (4) ‘After submission of the annual statement of emissions and up to June after verification and application for the banking and borrowing before the allowance submission to government (1st April to end of June 2016)’. The last option was (5) ‘No plan for any emission trading’.

The periods in the choices were set based on the K-ETS schedule announced by the government. According to this schedule (MOEK, 2014), the designed companies are required to report emissions statements within three months after the end of the compliance year (31st December, 2015), i.e., by March 2016, as this the period in which companies will have either booked a deficit or surplus. Companies can borrow or bank the emissions to adjust the emissions to be verified within five months after a compliance year. Offset projects need to go through reviews in this period. The finally approved emissions are then submitted to the government within one further month (the end of June, 2016) after official verification. Companies who fail to surrender their allowances in this period will be fined a non-compliance emission penalty three times the average market price.

The results of the trading periods considered are shown in figure 5, in which it can be seen that the majority of companies are considering to buy or sell emissions from January to June, 2016, after the end of compliance year and before emissions verification, as predicted by Korea’s government (Hankyung newspaper, 2015).

Figure 5: Possible trading period during the first compliance year of K-ETS
Only a small share of companies planned to participate in the carbon market in other periods. Meanwhile, it was also learnt that some companies have no plans to trade emissions during the first year.

4.3.2 Trading barriers, seen from a company perspective

An ordinal scale of 1 to 5 was adopted to measure the difficulties companies face in preparing and planning for emissions trading under K-ETS. Table 3 gives mean scores for each barrier.

The lack of supply of emissions in the market is the most important barrier (4.4) hindering participation in emissions trading. As indicated in section 4.1.1, the majority of companies felt their allowance is insufficient compared with the expected emissions. The company pointed out that the lack of allocated emissions resulted in supply shortages in the market.

This contrasts with EU-ETS, where sufficient availability of allowances was cited as the primary reason for the lack of trading on the part of the companies in the early phase (Engels et al, 2008, Roberts and Staples, 2007, Sabitova, 2011). According to such studies, over allocated companies adopted a wait-and-see approach to the market as regards allowance price. For example, in Germany, the major regulated companies under EU-ETS were over-allocated freely distributed permits in the first phase; about 50% of them are active in allowance trading (Heindl and Löschel, 2012).

Economists often assume that firms make decisions according to the price of emissions and act in a rational, profit-maximising manner. However, this study confirmed that companies suffer from considerable uncertainty over policy and carbon pricing in trading decisions (4.2). It was similarly viewed among EU ETS participants that such ‘market rationality’ was likely hindered
by confusion over the design of current policy and stringency of future policy, which both influence carbon pricing (Brewer 2005). Thus, companies prefer to adopt a wait-and-see strategy to one that addresses market opportunities of the scheme (Engels et al., 2008). Policy uncertainty has also impacted on the commitment of entities to invest in their internal capacity to address GHG emissions (IETA, 2013). From our interviews with companies under K-ETS, some of them adopted a conservative stance on market participation due to policy uncertainty due to re-organisation brought about by Ministry changes. They forecasted that the price of carbon will increase due to the limited supply of emissions, but that the reduction burden is planned to be strengthened unless the government takes an amelioration measures.

It is likely to be difficult for some Korean companies to estimate the necessary amount of emissions for transaction (4.0), and they also felt less incentive to trade. This may be due to a lack of understanding of market mechanisms and, accordingly, the absence of a strategy corresponding to the carbon market. As with some facilities in EU-ETS, many companies in K-ETS may perceive ETS as a compliance measurement at the stage. Most of the companies in EU-ETS do not make their allowances available despite possessing an excess supply but use banking from one year to the next (Martin et al., 2014). This is because, as several studies confirmed (Sandoff and Schaad, 2009, Pinkse and Kolk, 2007, Martin et al., 2014), companies perceived ETS to be a compliance mechanism rather than a market-based policy instrument, so they adopted a strategy more orientated to compliance with the scheme and aimed for balanced accounts only (Engels et al., 2008). As a result, 54% of the 429 manufacturing firms in EU-ETS did not trade on the EU market (Martin et al., 2014). Similarly, of the 44 industrial companies and power generators, 62% reported that they were not trading on the market and only 48% said they were factoring the value of their allowances into their daily operations (McKinsey and Ecofys, 2006).

It was also revealed that some companies have not even made administrative and internal preparations (3.5) or set up accounting systems (3.4) for emission trading.

Transaction costs are important in explaining the lack of participation in the market (Jaraite and Kazukauskas, 2012)—such costs, other than price, are incurred in the process of exchanging goods and services and include costs such as market research, finding buyers or sellers, negotiating and enforcing contracts for permit transfers. In the initial years of carbon trading, therefore, transaction costs related to K-ETS act as a constraint on trading (3.3). Heindl (2012) surveyed German ETS firms and found that administrative costs for permit trading account for 19.57% of total costs, and that transaction costs were more significant in the early stages of the programme, then decreased with market maturity and participant trading familiarity (Cason and Gangadharan 2003).

The procedural issues of ETS are not significant yet, with the score of 2.9; however, this may need to be reviewed again later due to the low number of companies with actual experience in the
procedures of trading found when this survey was carried out.

Table 3: Firm’s Evaluation of the Barriers to Emissions Trading (n = 30)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description of barrier</th>
<th>Score</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>BARRIER01</td>
<td>Uncertainty over emissions volume to be traded and necessity of trading itself</td>
<td>4.0</td>
<td>1.114</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>BARRIER 02</td>
<td>Lack of supplementary emissions to buy in the market</td>
<td>4.4</td>
<td>0.932</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>BARRIER 03</td>
<td>Lack of demand for emissions in the market</td>
<td>2.4</td>
<td>1.431</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>BARRIER 04</td>
<td>Uncertainty over carbon pricing and carbon market</td>
<td>4.2</td>
<td>0.913</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>BARRIER 05</td>
<td>Complexity of trading procedure</td>
<td>2.9</td>
<td>0.907</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>BARRIER 06</td>
<td>Accounting system are not set up yet for emissions trading</td>
<td>3.4</td>
<td>1.003</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>BARRIER 07</td>
<td>Administrative requirements and internal preparations for emission trading have not taken place</td>
<td>3.5</td>
<td>1.009</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>BARRIER 08</td>
<td>Additional costs (transaction fees, accounting costs)</td>
<td>3.3</td>
<td>0.922</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

4.3.3 Supportive policies to activate emissions trading

In the survey companies were allowed to allot scores to policy measures anticipated to activate trading under ETS using a five-point scale, from 5, ‘very effective’ to 1, ‘no effect’. The results are shown in table 4. The moderate to high scores achieved for the listed measures shows that they were all regarded as useful.

Increasing the allowance is expected to be the most useful for trading activation (score of 4.3). Recently, K-ETS related law was amended along with changes to the organisational structure of the main Ministry for each sector, which could be taken as a sign that the government is reconsidering the allocation method and the allowance increment in the coming compliance periods.

Companies require tax exemptions on emissions or tax alleviation based on trading activity (4.2). In Korea, domestic transfer of emissions credit incurs VAT, as with the EU (Lee, 2013), so in order to relieve this burden and stimulate emission trading in the initial period of K-ETS, MOSF amended the Restriction of Special Taxation Act so as to be exempt from VAT incurred by GHG emission credits until the end of 2017 (MOSF, 2015).

It will be essential to provide analytical information on carbon pricing, based on its score of 4.1. Except for a small number of large-sized companies, most companies in Korea rely on governmental or industrial associations for information—in implementing a new policy instrument, the first problem is whether companies adequately understand it.
It appears the government will need to improve understanding of the system for companies, as suggested by the scores of 3.6 in the related measures—providing a simple trading system manual and training programme for enhancing policy understanding. Companies would also make use of external agencies in carrying out overall procedures for emissions trading on their behalf (3.4).

Table 4: Supportive Policies to Active Trading (n = 32)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description of supportive measures</th>
<th>Score</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUPPORT 01</td>
<td>Providing easy and simple manual for trading system</td>
<td>3.6</td>
<td>1.102</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 02</td>
<td>Training programme for enhancing policy understanding</td>
<td>3.6</td>
<td>0.971</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 03</td>
<td>Established an agency serving for the whole process of the transaction instead of company</td>
<td>3.4</td>
<td>0.817</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 04</td>
<td>Information providing of analysis of the carbon pricing in the market</td>
<td>4.1</td>
<td>0.868</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 05</td>
<td>Tax exemption for emission and mitigation tax burden of VAT or income tax</td>
<td>4.2</td>
<td>0.711</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 06</td>
<td>Expand trading participants (e.g., investment banking, personal, and etc.)</td>
<td>3.3</td>
<td>1.168</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 07</td>
<td>Diversifying the related derivatives</td>
<td>3.1</td>
<td>1.062</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 08</td>
<td>Extension of the emissions trading time</td>
<td>3.2</td>
<td>1.194</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>SUPPORT 09</td>
<td>Increasing the emission allowance allocation</td>
<td>4.3</td>
<td>0.844</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

4.4 Evaluation of the Scheme and Operation of K-ETS

In order to find out to how the companies evaluated the main issues related to scheme design and operation condition the samples were asked to give scores on a five-point scale for the pre-listed concerns regarding K-ETS, with 5 being ‘very significant’ and 1, ‘no issue at all’, the statistics of which are presented in table 5.

Table 5: Evaluation of Current K-ETS Scheme and Operation

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Variable</th>
<th>Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISSUE01</td>
<td>Double burden with the existing mandatory measures such as TMS, energy audit</td>
<td>33</td>
<td>3.94</td>
<td>0.864</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 02</td>
<td>Insufficient consideration of early emissions reduction activities (voluntary emission reductions, TMS, etc.)</td>
<td>33</td>
<td>4.18</td>
<td>0.727</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 03</td>
<td>Small number of offset programmes</td>
<td>33</td>
<td>3.55</td>
<td>0.794</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 04</td>
<td>Short allowance and necessity of reconsideration for calculation method</td>
<td>33</td>
<td>4.52</td>
<td>0.972</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 05</td>
<td>Electricity price hike due to counting of indirect emissions</td>
<td>33</td>
<td>4.27</td>
<td>0.876</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 06</td>
<td>Unclear linkage with international carbon markets</td>
<td>33</td>
<td>3.61</td>
<td>1.029</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 07</td>
<td>Lack of technology investment attraction under K-ETS</td>
<td>33</td>
<td>3.67</td>
<td>0.990</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 08</td>
<td>Uncertainty over how K-ETS contributes to national GHG mitigation</td>
<td>32</td>
<td>3.94</td>
<td>1.076</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 09</td>
<td>Uncertainty and difficulties over forecasting carbon pricing and carbon market</td>
<td>34</td>
<td>4.38</td>
<td>0.652</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 10</td>
<td>Concern over whether emissions trading will be activated</td>
<td>34</td>
<td>4.12</td>
<td>0.977</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 11</td>
<td>Lost business image and reputation due to non-compliance</td>
<td>33</td>
<td>3.70</td>
<td>1.015</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>ISSUE 12</td>
<td>Strengthening supervision over emissions</td>
<td>33</td>
<td>2.91</td>
<td>1.071</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

Overall, the companies allotted high scores to the pre-listed K-ETS related issues, with a mean of over 3.5, with the exception of ISSUE12 (need of strengthening supervision and sanction on emissions), which scored 2.91.

The key issue over K-ETS concerns allocation: ISSUE04, ‘Short allowance and necessity of reconsideration of calculation method’ achieved the highest mean of 4.52, consistent with other results in this study, and in Korea, the emission allowance allocation issue was actually the crux to progress in negotiations between the government and industry right up to start of the scheme. The major business organisations issued several joint statements, chiefly concerning disclosure of the method used for allocation estimation and requests to reconsider the current allocation plan (FKI, 2015a and 2015b). After the scheme started, 243 companies, or 46.3% of the total regulated companies, requested their allocations be increased and the allocation criteria be revised (MOEK, 2015), and several companies even filed class action lawsuits against the ministry’s allocation plan (ICAP website). Korea’s petrochemical industry in particular maintained that emissions allocation was calculated based on GHG emissions from 2011 to 2013; since 2014 witnessed a massive expansion in the petrochemical industry, annual GHG emissions increased by 9.2%, which was not reflected in the government allocation (etnews, 2016).

Uncertainty over carbon pricing and difficulties in forecasting the carbon market, ISSUE09, is ranked of second highest concern with a mean of 4.38. Unlike EU-ETS, indirect emissions are covered under K-ETS, which meant that ‘electricity price hike due to indirect emissions counting’ (ISSUE05) received a mean of 4.27. Similarly, ISSUE 02 (insufficient consideration of early emission reduction activities previously conducted via voluntary emission reductions, TMS, etc.) also received a high mean of 4.18. The ‘unreliable market activation and liquidity’ registered as a concern (ISSUE10, 4.12), since the scale of Korea’s carbon market is small and concentrated on a small portion of energy intensive entities. In reality, these high-ranked issues were at the centre of discussions in early-stage K-ETS design but still appear to be relevant factors.

The surveyed companies were also concerned over other ambiguities in K-ETS; for example, uncertainty over the mitigation effect (ISSUE08, 3.94) and the relationship between K-ETS and
existing mandatory measures such as TMS and energy audits (ISSUE01, 3.94). There seems to be lack of inducement on the part of the current scheme of K-ETS to entice companies to invest in technology (ISSUE 07, 3.67).

The K-ETS seems to be facing a number of issues which need to be addressed to ensure effective operation and company participating, which requires further clarification on the part of the government in order to achieve the understanding and support from industry.

5. K-ETS operation and emissions trading results in First Compliance Year

Korea’s emission trading market was officially opened on 12 January 2015, with the Korea exchange (KRX) being appointed as the official exchange platform in the previous year. The trade units are *Korea Allowance Units* (*KAU*); with 1 KAU equal to 1 tonne of CO₂. From April 6 in 2015, the offset credit (*Korean Offset Credit* (*KOC*)) was approved to be converted as *Korean Credit Units* (*KCU*), which became tradable on the KRX. Thus both KAU and KCU are able to be transacted in the KRX and over the counter (OTC). OTC trading is a method of trading that does not take place on an organized exchange but takes various shapes from bilateral trading to via permanent structures, such as systematic internaliser and broker networks (Emissions-EUETS.com website).

The overall trading performance during the first compliance year of K-ETS was low. In total, 1.24Mt-CO₂ was traded, of which KAU comprised about 0.32 Mt-CO₂ and KCU 0.92Mt-CO₂, which shows that the proportion of KCU transactions is three times higher than that of KAU. The total KAU allocated for 2015 was about 546 M KAU, of which only 0.06% of KAU was traded. Given that the converted offset credit in 2015 was about 1.64M KCU, 56% of KUC were traded (KRX, 2016). Overall, less than 0.3% of the total allocation was traded in the market during the first compliance year of K-ETS. OTC markets were the dominant type of trading during the first year of K-ETS. Of the total traded CO₂, 1.19 Mt-CO₂, 96% of the total, was traded through bilateral OTC negotiation (KRX, 2016), which is similar to ET-ETS. In EU-ETS, OTC was the first type of trading platform during its early phase and still accounts for the virtual market, although the share of exchange emissions volume through organised exchange such as the ECX, London exchange, gradually increased (Ellerman, and Joskow, 2008). According to interviews with companies in Korea who participated in emission trading, the main reason is that OTC is preferred by companies; first, because of the procedural convenience for large-volume transactions, while the maximum amount of registerable emissions on the KRX is limited at 5,000 t-CO₂. As shown in figure 6, a large amount of emissions were traded via OTC. The other reason that companies selected OTC was because it enables negotiation of the carbon price compared with the market price and enables flexible contracts to which extra conditions can be added.

The price of KAU on the first day of market opening started at 8,640 KRW (about 7.5 USD),
which increased to around 10,000 KRW soon after. It thereafter remained stagnant throughout the year but the reached 12,300 KRW (about 10.7 USD) in December 2015. The price of KCU was generally higher than KAU; the former reaching 9,600 KRW (about 8.3 USD) on the first day of listing and rising gradually thereafter to 13,700 KRW (about 11.9 USD) in the last month of the compliance period. The price fluctuations of KAU and KCU throughout the period are shown in figure 6. According to a KRX report (2016), it was revealed that the average trading signed price for both KAU and KCU differed, in that the OTC price was higher than that of the KRX. The average price of KAU upon entered trading was 10,998 (about 9.6 USD) and 12,073 KRW (about 10.5 USD), respectively in the KRX and OTC. For KCU, the same were 10,815 KRW (about 9.4 USD) and 12,637 (about 11.0 USD) KRW, respectively, in the KRX and OTC (KRX, 2016).

As same with the survey result in section 4.3.1 that companies indicated their trading period under consideration is during January to June ahead of the allowance submission deadline, in actual, in this period the demand of emission on the market was increased and correspondingly the carbon prices went up sharply in this period [please clarify]. From January to March, KAU and KCU trading achieved 101,600 t-CO₂ and 602,978 t-CO₂, respectively, and in April alone was about 87,800 t-CO₂ and 320,000 t-CO₂. During June, 1.66 million tons was traded (newstomato, 2016). During this period, in total 3.6 Mt-CO₂ were traded, which is 3 times larger than that of the compliance year of 2015.

Entering January 2016 the price of carbon price had increased and hike up to 19,000 KRW (about 16.6 USD) per t-CO₂ in April 2016, which is equivalent to an 88% Year-on-Year increase compared to the price (10,100 KRW, about 8.8 USD) in the same month one year previous. The price on the market closing day was 17,000 KRW (about 14.9 USD). The overall average price of emission credit was 12,028 KRW (about 10.5 USD) (newstomato, 2016).

According to a governmental analysis of emission statements submitted by K-ETS companies (523) by the June 2016, 407 companies out of 522 reportedly met the emissions allowances allocated by the government (cnews, 2016). For the remaining 115 companies have filed lawsuits against the government for the allocations. But 66 of these companies still had met the emission allowances, the remaining 49 companies have reportedly slightly exceed the emission allowance basis. Among the industry and power sectors, a total 402 companies, under the K-ETS, except for 78 companies raising complaints against the allocations, 324 companies completed the submission of verified emission credits by June 30 that met the emissions cap (newstomato, 2016). The performance results of the first year of implementation will come the final settlement in early September.

As of June 2016, unlike the initial concerns of the business community that allocated emission allowances are too low, 290 companies (55.6%) had not exhausted their allocation. Most of them, 227, banked their surpassed emissions to the next compliance year. Whereas companies that lack emissions
were 232 places (44.4%), their lack emission were 1,100 tons. Of which 183 borrowed the emission from the next compliance years or purchased in the market. Overall, although it varied by sector, it turns that emissions allowance during the first year of K-ETS were over-allocated by about 17 million tonnes (Hankokilbo, 2016).

For the market stabilisation measures, the government increased the borrowing limit from 10% to 20% for the first compliance year, and released additional emissions, 90 million tons, from the reserved emissions on the market (Kyunhhyang, 2016).
Figure 6: Credit price and trading volume during the compliance year of 2015 under K-ETS

(Depicted by author based on KRX data)
6. Conclusions and suggestions

K-ETS is a key component of climate change policy in Korea. The government stressed the scheme’s purpose to take advantage of emission trading in the wake of industrial innovation for carbon management via costs rather than environmental regulations. However, only a negligible amount of emission has been traded compared to the total allowance in the first year. This study identified the views of the companies under the regulations on major issues of the current scheme, trading barriers and corresponding supportive policies based on a survey targeting Korea’s petrochemical industry. Several key issues to be addressed for the operating emission trading market were clarified.

Korean companies is in the early stage for new market mechanisms for pollution reduction; more of them under the scheme were also unlikely to be prepared for the Scheme in terms of building in-house systems (budgeting and financial planning, internal processes for making trading decisions), making budget available, and analysing the carbon market. As witnessed in other forms of early-stage ETS, Korean companies do not consider carbon allowances as an asset that can be used to optimize the intensive for GHG management under the market mechanism. Instead, they view the cap implicit in their allowance allotment as something that merely needs to be complied with. Lack of familiarity with market-based instruments for pollutant reductions is one of the main reasons why deactivation of K-ETS needs to be considered.

There seems a need of urgent efforts of Korean companies with posing a systematic and analytic approach to response to the new carbon pricing policy. Participating companies need to plan for long term, estimate and monitor their carbon position and develop their own carbon position and as well as examine all the abatement measures available to maximise their cost-effective emissions reduction under the marginal cost condition. Considering the auction of allowances in the coming phases, using the test bed, Korean companies are urged to proactively participate in the carbon market and learn from the experience gained in order to prepare for the coming phase with auctioned allocation.

On the other hand it revealed the need of system improvement. Allocation is the key element affecting the trading decisions of ETS-regulated entities, specifically short allocation, according to the companies, hinders participation in trading, which became the primary reason of market inactivation. Considering the small number of participants actually eligible for trading in Korea’s carbon market, the government needs to extend multilateral efforts to increase the supply of emission credits. CERs (credits from CDM projects), VERs (credits from Korean domestic voluntary reduction projects), and RECs (certification of renewable energy supply) under the Renewable Energy Portfolio Scheme may be converted into tradable emission credits (E2news, 2016b).
Given the current uncertainties over policy and carbon price due to recent (June 2016) changes in related ministries, it appears that companies will adopt a conservative wait-and-see approach to market participation for the time being. Therefore, in order for the stable market settlement, the government should present the clarifications so that the company can accommodate. For the system improvement is required and monitoring of and communication with the companies targeted for the K-ETS are needed for reflecting. Government needs to enhancing companies’ policy understanding and improving capability for the carbon-oriented management.

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26