Research Report
KRC_2: Policies and Business Initiatives toward the Innovation and Diffusion of Low Carbon Technologies in Northeast Asia (PIDT)

Domestic Carbon pricing in Korea and Companies' Response

Part I Carbon pricing and carbon market in Korea and review of the linkage of the carbon market

Part II Preliminary analysis of the survey results on Korean companies' response to carbon policy

Kansai Research Center/Institute for Global Environmental Strategies
POSCO Research Institute

March 2017

Contents

List of tables

List of figures

Executive Summary

Under the Paris Agreement in 2015, the Korean government pledged to reduce greenhouse gas emissions 37 percent below business-as-usual (BAU) level by 2030, a goal that is considered ambitious compared to other countries' commitments in their Intended Nationally Determined Contribution (INDC). Alongside the 2030 national target, the government has announced a number of climate policy changes which will have direct or indirect impacts on the Korean Emissions Trading Scheme (K-ETS).

The K-ETS, which is the main pillar of the Korea's climate policy started on January 1, 2015 and now in its last compliance year of the first Phase. Although the K-ETS is still in its early phase, there are several important issues which need to be addressed in an urgent manner for improving itself in achieving the policy goal. First, carbon price under the K-ETS has soared and as of February 2017, the price reached at KRW 24,000 (EUR 20) which is very high compared to prices in other major economies including, and consequently concerns about carbon leakages have been growing. Second, the K-ETS is experiencing liquidity problems with high demand and low supply. And third, frequent market intervention by the government has raised concerns about increasing the market uncertainties and consequently undermining the market credibility.

According to the survey of the K-ETS, we find that many regulated companies under the K-ETS are getting used to price on carbon. They are now realizing that reducing emissions save money. However, due to the high uncertainty of the policy changes and market volatility companies are reluctant to take actions. In order to response to the K-ETS, companies need to understand the ETS demand and supply fundamentals, possible price scenario and the impact on their business

To address challenges facing the K-ETS market - high carbon price and low market liquidity, linking to other ETSs could be considered as one of the attractive options. EU and China seems to be recognized as the potential strategic linking partners. However linkage comes with many critical issues, including distributional issues and a loss of regulatory control. It needs to be carefully reviewed and discussed further whether or not to link, moreover the role that the linkage of ETSs can play in the Korean climate policy context.

PART 1

Carbon pricing and carbon market in Korea and review of the linkage of the carbon market

1. Introduction

Korean economy has grown very rapidly over several decades and the country has become the fastest-growing greenhouse gas (GHG) emitter among (OECD) member countries. To address concerns about rising GHG emissions, Korean government put forward with its low carbon, green growth-strategy in 2008 and in the following year, announced its national GHG reduction goal of 30 percent below business-as-usual (BAU) projection by 2020. In order to achieve its GHG reduction goal, in 2012, the government introduced the GHG & Energy Target Management Scheme (TMS) as a precursor to the Emissions Trading Scheme (ETS). This scheme was designed to manage and impose specific GHG reductions and energy consumption standards on large businesses with high energy consumption and GHG emissions. This scheme covers more than 90 percent of industrial GHG emissions and 70 percent of overall national GHG emissions. The implementation of this TMS involved the development of a Measurement, Reporting, and Verification (MRV) scheme for the GHG emissions and energy consumption, which became the basis for the national ETS.

In 2012, the national assembly passed the Act on the Allocation and Trade of Greenhouse Gas Emissions Rights in 2012, establishing a domestic cap-and-trade ETS. While there were concerns that the ETS would impose additional burdens to domestic industries and as a result, it would lead to weakening competitiveness in global market, the rationale behind introduction of the ETS was that it will take us to the green growth future ahead of other countries, promoting green industry technologies and green businesses. The GHG emissions trading market was opened on January 12, 2015. For two years of operation since 2015, the K-ETS has evolved but it has also been experiencing many problems including liquidity issue, governance. Business groups and companies under the K-ETS have raised a number of issues to be fixed and as a result, some adjustments to operating rules of the K-ETS have been made since 2016. And, the government is now working on details to improve the ETS for its second phase (2018~2020).

With this background in mind, this paper examines current issues and status of Korean companies under the K-ETS and explores possible policy options in addressing issues and challenges the K-ETS is facing to improve the .

The paper first provides an overview of the current developments in Korea’s climate policy including latest changes to the K-ETS in chapter 2. This chapter also covers main design elements of the K-ETS. Then, chapter 3 discusses the status of market transactions during the first and second years of the K-ETS (2015 and 2016). The key challenges facing the K-ETS are also examined. In chapter 4, the results of a survey on the K-ETS that was jointly conducted with the Institution for Global Environmental Strategies (IGES) were summarized. . The survey assessed the general perceptions and practices of Korean companies regarding the K-ETS. And, it also touches upon the potential issues including the possibility of future linkage with other carbon markets. Subsequently, chapter 5 discusses linking schemes from Korea’s perspectives and the disadvantages and the barriers posed by design differences. Lastly, chapter 6 concludes and summarizes the main findings and provides policy implications for the K-ETS improvements. In this part of the paper, particular attention is given to linking option with other carbon markets as it could play an important role in Korea’s future climate policy.

2. Climate policy progress and status in Korea

2.1 2030 national GHG mitigation target and sectoral roadmap

On June 30, 2016, the Korean government submitted its Intended Nationally Determined Contribution (INDC) to UNFCCC, aiming to reduce GHG emissions by 37 percent relative to its estimated business-as-usual (BAU) emission trajectory for 2030. Before submitting its INDC, the government circulated four different reduction scenarios in a range between 14.7 percent and 31.3 percent from the 2030 BAU level, taking different reduction options into account in each scenario (See Table 1). In regard to the projected BAU emissions, in the absence of specific abatement action emissions, the government projected gradual rise in GHG emissions, reaching 851 Mt CO_2e in 2030, a 25 percent increase from 2013. In 2020, the level of GHG emissions will reach 783 Mt. This is slightly higher than 776 Mt estimated in the previous projection in 2009, which the current allocation of emission allowances in the K-ETS is based on.

The least ambitious Scenario 1 (14.7 percent reduction) envisages reinforcement of the current policies in each sector, reflecting impacts of cost-effective reduction technologies and a larger share of renewable sources in the energy mix. Scenario 2 (19.2 percent reduction) adds into Scenario 1 aspects of financial support measures which would lead to decrease in the share of coal power plants to the power sector and to implement energy management systems in industry and buildings. Scenario 3 (25.7 percent reduction) takes into account an increasing share of nuclear power and the introduction of Carbon Capture and Storage (CCS) technology that entail both costs and financial support from the government. Improvements in semi-conductor processes are also reflected in the scenario 3. Scenario 4 (31.3 percent reduction) includes every available reduction option and measure ranging from nuclear power capacity and replacement of coal power to LNG, etc. (See Table 1).

When these scenarios were released to the public, many observers expected that the government would choose between the two modest scenarios, in the 19 to 25 percent range. However, the INDC submitted by the Korean government ended up with a reduction target of 37 percent from the 2030 BAU, even more ambitious than the level consistent with Scenario 4. While the INDC did not elaborate much about how to deliver the target, it articulated that: Korea will reduce emissions by 25.7 percent domestically and the rest 11.3 percent reduction will be done by acquiring g international carbon credits. These targets could be translated into 218.6 Mt of reduction from domestic emissions and 96.1 Mt of international offsets in 2030.

Table 1 Korea's 2030 emissions reduction scenarios

Scenario	2030 Emissions (Mt CO_2e)	Compared to 2030 BAU	Compared to 2012 emissions
Scenario 1	726	-14.7%	+5.5%
Scenario 2	688	-19.2%	-
Scenario 3	632	-25.7%	-8.1%
Scenario 4	585	-31.3%	-15.0%
New scenario	536	-37.0%	-22.0%

Source: The Republic of Korea (ROK) government

With the trajectory of Korean INDC target to 2030, the new 2020 target becomes less challenging than the current level of national target for 2020. The new BAU trajectory projects the 2020 BAU emissions (782 Mt) slightly higher than the previous BAU projection (776 Mt) from 2009. And, the reduction target becomes far less than the previous 2020 target. In a linear reduction path, the 2020 target is 21 percent below the 2020 BAU level. Through the domestic reduction efforts with the 25.7 percent reduction target in 2030, South Korea's emissions in 2020 will be 660 Mt, 15.7 percent lower than the 2020 BAU (See Figure 1).

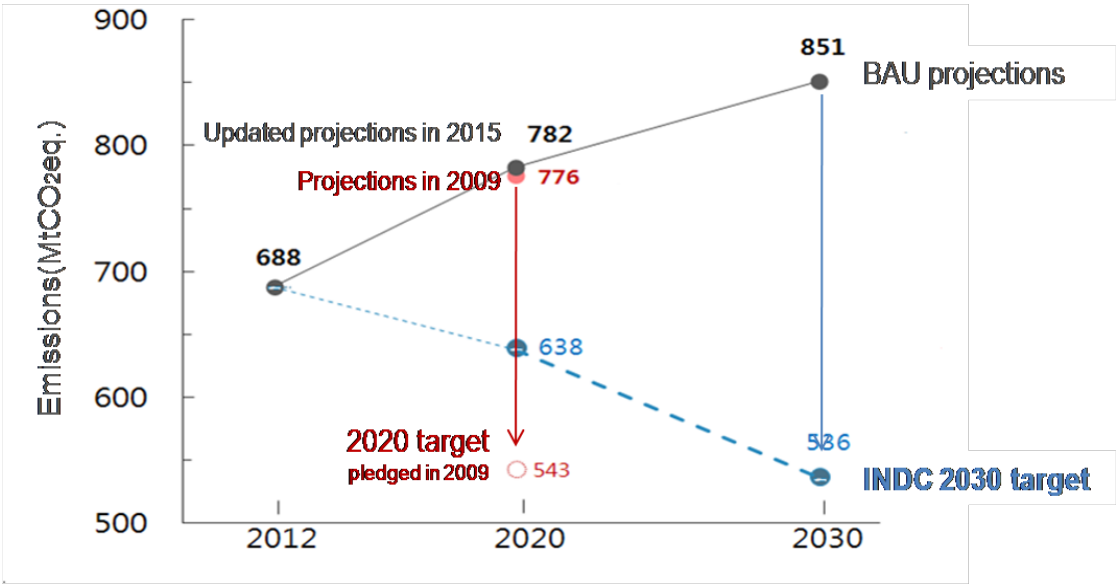

Figure 1 Korea's 2030 emissions reduction by sectors
Source: The ROK government, modified by POSRI

On December 6, 2016, the Korean government released its draft Basic National Roadmap for Greenhouse Gas Reductions by 2030. The 2030 climate roadmap breaks down the overall national target into targets for each sector which differ among sectors. Four sectors are expected to deliver a large share (59 percent) of the emissions reductions: 64.5 Mt for the energy sector, 56.4 Mt for the industry sector, 35.8 Mt for the building sector and a 28.2 Mt reduction to be achieved by new energy industries (mainly carbon capture technologies and electric vehicles). All other sectors are expected to deliver 11 percent (34.1 Mt below BAU) of Korea's 2030 target. Together, these efforts total 70 percent of South Korea's national 2030 target (See Table 2 and 3). The remainder will be met via the use of international offsets. However, according to the roadmap, in order to use international offsets, the international community would have to finalize negotiations about the new international market mechanism, and the market should be sufficiently developed and a fund-raising measure must be agreed upon.

Table 2 Korea's 2030 emissions reduction by sectors

Sector	BAU emissions (Mt CO_2e)	Emissions reduction (Mt CO_2e)	Compared to (%)	
			Sectoral BAU	National BAU
Energy	(333)	64.5	(19.4)	7.6
Industry	481	56.4	11.7	6.6
Building	197.2	35.8	18.1	4.2
New energy industry	-	28.2	-	3.3
Transport	105.2	25.9	24.6	3.0
Public and others	21	3.6	17.3	0.4
Waste	15.5	3.6	23.0	0.4
Agricultural and dairy	20.7	1	4.8	0.1

Note: Emissions from energy sector are excluded from the total emissions, instead covered in the non-energy sectors.
Source: The ROK government

Table 3 Breakdown of 2030 emissions reduction by sub-sectors

Industry	Emissions reduction (Mt CO_2e)	Industry	Emissions reduction (Mt CO_2e)
Steel	17	Cement	2.4
Petrochemistry	7	Machinery	2.3
Display	5.7	Oil refining	2.2
Electronic engineering	4.8	Agriculture, forestry and fishery	1.5
Semiconductor	4.1	Textile	1.1
Automobile	3.4	Others	4.9

Note: Others include nonferrous metal, glass, mining, shipbuilding, paper, ceramics, forestry, food, construction, industrial co-generation and other manufacturing
Source: The ROK government

The government will continue to work on the details of its national and sectoral roadmap for GHG reductions by 2030. Through this process, the ETS rules will be modified in line with the national target and some measures that encourage industry sector to reduce emissions will be considered.

2.2 Korean Emissions Trading Scheme (K-ETS)

The K-ETS is the main pillar of the Korea's climate policy and its key tool to cut GHG emissions. It currently covers around 68 percent of Korea's GHG emissions: 525 businesses in the electricity, steel, cement, petro-chemical, building, waste, and domestic aviation sectors. The scheme is divided into three initial trading periods: Phase I (2015-2017), Phase II (2018-2020) and Phase III (2021-2026). It is now in its last compliance year of the first Phase. The key elements of the K-ETS are described below:

Coverage

The K-ETS applies to individual installations emitting over 25,000 t CO_2e/year or business entities emitting over 125,000 tCO_2e/year. As such, the K-ETS covers approximately 525 business entities including 5 domestic airlines, which account for around 68 percent of national GHG emissions[1]. The K-ETS covers direct emissions of six Kyoto Protocol GHGs, as well as indirect emissions from electricity consumption.

Cap-setting

The K-ETS is a cap-and-trade system with an absolute emissions cap. Allowances are distributed within this cap and can be traded freely on the Korean carbon market. The cap amounted to 1,687 Mt CO_2e during Phase I[2], including a reserve of 89 million tCO_2e for market stabilization measures, early action and new entrants. Caps for phase two and three have not yet been announced.

Allocation

The allocation mechanism will be changed over the course of three trading periods. In phase I, 100 percent of allowances have been allocated for free. Free allocation will be reduced to a maximum 97 percent in Phase II, and further decreased to a maximum 90 percent in Phase III. Both grand fathering and benchmarking methodologies are currently applied for the allocation of

1 Official data of the Greenhouse Gas Inventory & Research Center of Korea (GIR)
2 2015: 573 MtCO_2e, 2016: 562 MtCO_2e, 2017: 551 MtCO_2e

free allowances. In Phase I, most sectors received free allowances based on the average GHG emissions of the past three base years (2011-2013). Three sectors (grey clinker, oil refinery, aviation) received free allowances based on benchmark methodology based on previous activity data from the base years (2011-2013). Additional exemptions are made for industries that are considered to be at significant risk of carbon leakage. Energy-intensive and trade-exposed (EITE) sectors will receive 100 percent of their allowances for free in all phases. EITE sectors are defined by following criteria: (a) additional production cost of >5% and trade intensity of >10%; or (b) additional production cost of >30%; or (c) trade intensity of >30%.

The K-ETS includes a reserve amounting to 5 percent of total allowances in Phase I. It can be used as market stabilization measures (14 $MtCO_2e$), early action (41 $MtCO_2e$), and other purposes including new entrants (33 $MtCO_2e$). In addition, any unallocated allowances and withdrawn allowances will be transferred to the reserve.

Flexibility

Banking is allowed without any restrictions. Borrowing is allowed only within a single trading phase with a maximum of 10 percent of entity's obligation, but not across phases. Under the K-ETS, companies can use carbon offset credits to meet their compliance obligations. However, the use of offset credit is subject to a qualitative limit. Only domestic credits from external reduction activities implemented by non-ETS entities can be used for compliance. Domestic CDM credits (CERs) are allowed to be used in the scheme. In terms of quantity, companies are only allowed to use offsets up to ten percent of their compliance obligations. International offsets will be accepted from Phase III, but only for a maximum of 50 percent of the total offset limits.

Compliance

Annual report of emissions must be submitted within three months from the end of a given compliance year. Emissions must be verified by a third-party verifier. Companies that fail to surrender the required amount of allowances will face a penalty. The penalty shall not exceed three times the average market price of allowances of the given compliance year or KRW 100,000/ton (EUR 70).

Market Stability Measures

Korean authorities are allowed to intervene in the carbon market with market-stabilizing measures if one of the following criteria meets.

- The market allowance price of six consecutive months is at least three times higher than the average price of the two previous years.
- The market allowance price of the last month is at least twice the average price of two previous years and the average trading volume of the last month is at least twice the volume of the same month of the two previous years.
- The average market allowance price of a given month is smaller than 40% of the average price of the two previous years.

The market-stabilizing measures may include:

- Hold an early allocation(s) for up to 25% of the allowance reserve
- Set minimum or maximum allowance possession limits
- An increase or decrease of the borrowing limit
- An increase or decrease of the offsets limit
- Temporary establishment of a price ceiling or price floor.

2.3 The main changes in Phase I (2015-2017)

In 2016, the Korean government has approved a number of changes to the K-ETS after one year of operation. These changes were announced in February 2016 and the revision of the Enforcement Decree was adopted in May 2016. The main changes were made mainly with respect to the ETS governance and flexibility. One of the most important changes was that authority in implementing K-ETS transferred from the Ministry of Environment (MOE) to the Ministry of Strategy and Finance (MOSF). Additionally, the Prime Minister's Office would take a more active role in operating the K-ETS. The role of overseeing emissions reduction in the respective sectors has been distributed to four ministries: Ministry of Trade, Industry and Energy (MOTIE), Ministry of Agriculture, Food and Rural Affairs (MAFRA), Ministry of Environment (MOE) and Ministry of Land, Infrastructure and Transport (MOLTI). MOTIE is responsible for industry and power sector (See Figure 2).

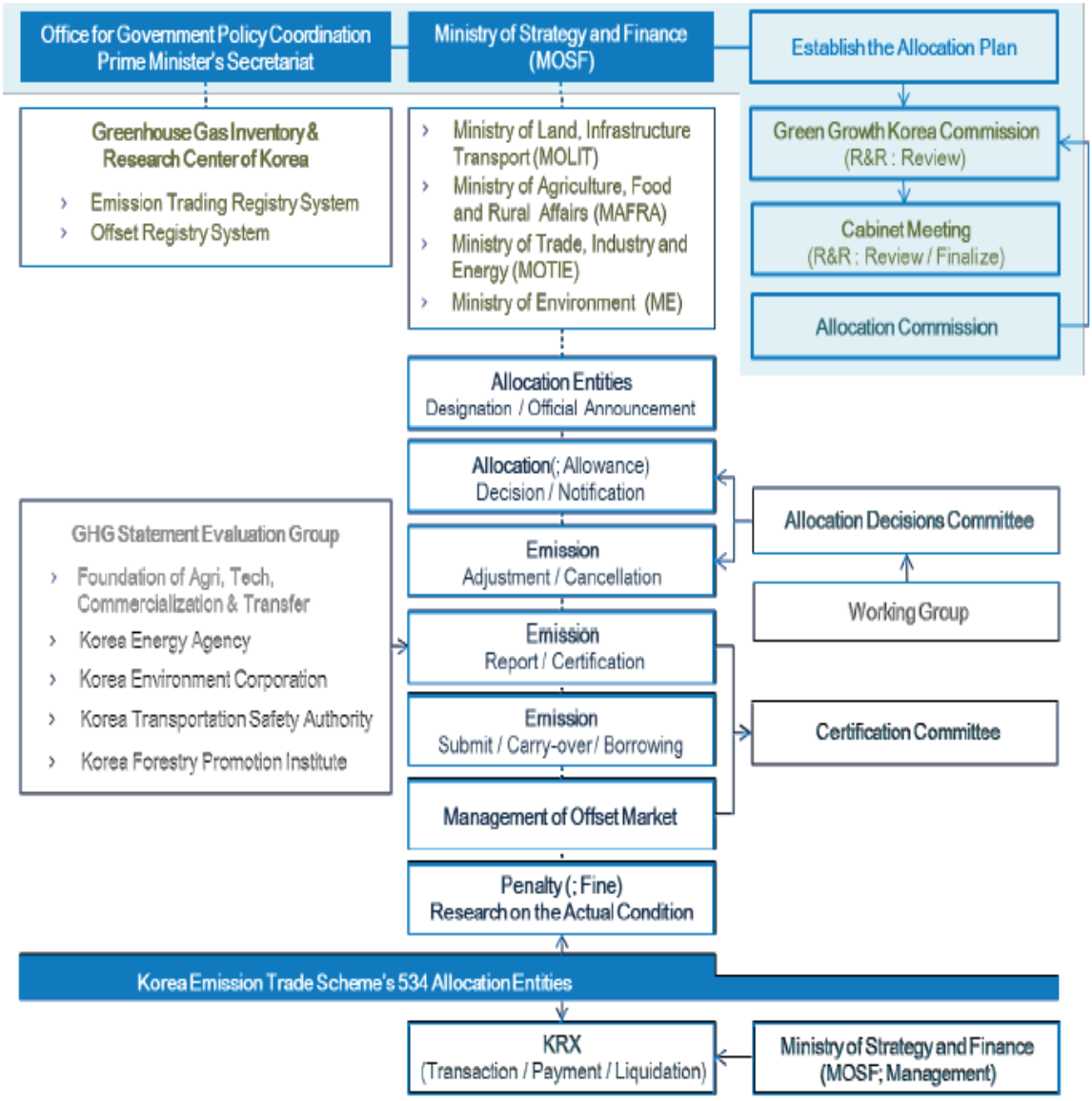

Figure 2 Korea's ETS governance

Source: IETA, modified by POSRI

In addition, efforts have been made to increase the supply of allowances in the Korean market to ease the pressure on entities that are suffering from shortage of allowances. First, it was decided to increase the amount of borrowing from 10 to 20 percent on an annual basis. Second, an additional 900,000 allowances were offered from the Allowance Reserve at a floor price of around KRW 16,200 (EUR 12). Access was limited to companies more than 10 percent short, and they could only bid for a limited volume. Finally, 2.3 million Korean Offset Credits were also added to the market.

Recently in January 2017, the government adopted the carbon credits allocation plan for the third implementation year of the first phase of the emissions trading scheme (2015-2017) and the basic plan for the second phase of the emissions trading scheme, which will run from 2018 to 2020. According to the 2017 allocation plan for the K-ETS, the total allowance allocation in 2017 is increased by 14 million above the previous goal, bringing the total to 538.9 million allowances for the 2017 compliance year. The changes in allocation follow the government's broader adjustment of the K-ETS to meet Korea's NDC target of reducing emissions 37 percent below BAU by 2030, up from an earlier reduction plan of 30 percent by 2020. The increase in allocation may also address industry concerns regarding the number of allowances required over the next year.

Table 4 Korea's ETS governance

(Unit: thousand tons of CO_2e)

	Previous (A)	Revised (B)	(B-A)
Total	521,914	535,982	14,068
Power Generation	232,523	234,273	1,750
Manufacturing	272,017	283,685	11,668
Public and Waste	9,306	9,941	635
Building	6,837	6,837	0
Transportation	1,231	1,246	15

Source: The ROK government

In phase I (2015-2017), about 5 percent of total allowances (88 $MtCO_2e$) were retained in a reserve. It was distributed to early action (41 $MtCO_2e$), other purposes including new entrants (33 $MtCO_2e$) and market stabilization measures (14 $MtCO_2e$). Under the 2017 allocation plan, some 5 to 10 million allowances from the new entrants will be transferred into the early action. Hence early action credit cap is increased up to 46 to 51 million allowances.

Table 5 Allocation of allowance reserve in Phase I (2015-2017)

(Unit: thousand tons of CO_2e)

	Early action	Other purposes incl. new entrants	Market stabilization measures
Previous	41,000	33,000	14,320
Revised	46,000~51,000	23,000~28,000	14,320

Source: The ROK government

In addition, the government decided to advance the time for allowing companies to exchange carbon credits acquired through overseas reduction efforts from 2021 to 2018 and also recognize as carbon credits the amount of reductions at companies or facilities that are not eligible for the carbon credit trading system. As the 2017 allocation will not take place until after the current compliance cycle is completed in June 2017, analysts do not expect it to affect the short-term supply or market price of allowances. The allocation plan for phase two of the K-ETS, beginning in 2018, is set to be finalized by the middle of year 2017. From 2018 onwards, benchmarking is expected to replace free allocation based on historical emissions as the main allocation method. The government also plans to gradually introduce auctioning in phase two, with 3 percent of allowances earmarked to be sold at auction in 2018.

3. Korea's carbon market trends and issues

3.1 Markets in 2015 and 2016

According to data provided by the Korea Exchange (KRX) and Greenhouse Gas Inventory & Research Center of Korea (GIR), a total 13.1 million KAU15 and KCU15 were traded in the first compliance year of the K-ETS, accounting for only 2.4 percent of the total 2015 preliminary allocation. The sum of the value traded was approximately KRW 75 billion. Overall, very little trading has taken place so far in the K-ETS, with high demand and low supply. About 8.8 million tCO_2e of credits, accounting for 67 percent of the total trading were traded in the over-the-counter (OTC) market. About 4.3 million tCO_2e of KAU15 and KCU15 were traded through KRX. Trading was most active in the period of April to June, 2016 which was right after the GHG statement verification of the companies subject to caps (See Table 6).

Table 6 Trading volumes and values of the K-ETS credits in the first compliance year

(Unit: thousand tons, hundred million KRW)

Total	KAU15	KCU15	KOC	Total
Volume	1,906	2,932	8,231	13,069
Value	307	443	-	750
OTC	KAU15	KCU15	KOC	Total
Volume	286	286	8,231	8,803
Value	42.9	30.5	-	73.4
Exchange	KAU15	KCU15	KOC	Total
Volume	1,620	2,646	-	4,266
Value	264.2	412.7	-	676.9

Note: Data between 1 January, 2015 and 30 June, 2016
Source: KRX and GIR

Between February and May of 2016, KAU prices increased most rapidly, rising from KRW 12,000 to KRW 21,000 per tCO_2e. In order to address a shortage in supply of credits, the government implemented market stability measures in early June 2016. The prices as high as KRW 21,000 were dropped down to KRW 16,500 per tCO_2e and then recovered to KRW 17,000 before the delist of KAUs (See Figure 3). Year 2016 has seen a steady flow of credits from national offset projects. Some 2.65 Mt of KCUs have been traded since the launch of this contract-- most of which was traded bilaterally –and two thirds of this volume changed hands in May 2016. Throughout 2016, KCUs were traded in a range of 15,000 KRW to 20,300 KRW. The price peaked in late May and adjusted to 18,500 KRW following the KAUs adjustment (See Figure 4). Throughout the first compliance year, approximately 8.2 Mt of KOC were traded. KOCs cannot be used for compliance, but compliance companies can convert them into KCUs. KOCs are traded more actively than KCUs for the reason that this contract is open to more market participants. All the issued KOCs were generated from Certified Emission Reductions (CERs) from CDM projects hosted domestically. Of noticeable in the first year of the K-ETS was that all three types of credits – KAU, KCU and KOC were traded at almost the same price, despite the different characteristics of the credits[3]. This is mainly due to the fact that companies are reluctant to release surplus KAUs as they can bank their KAUs as long as they want and led to the lack of supply of KAUs.

The first year of the K-ETS was long by 7 million tCO_2e and certified emissions were 100.82 percent of allocations. Despite the long market, some 236 companies were short against their 2015 emissions. Nevertheless, none of the companies subject to K-ETS caps failed to meet their allowance submission requirements as the companies are allowed to borrow allowances from their 2016 and 2017 allocation.

[3] KAU: Korean Allowance Unit, KCU: Korean Credit Unit, KOC: Korean Offset Credit

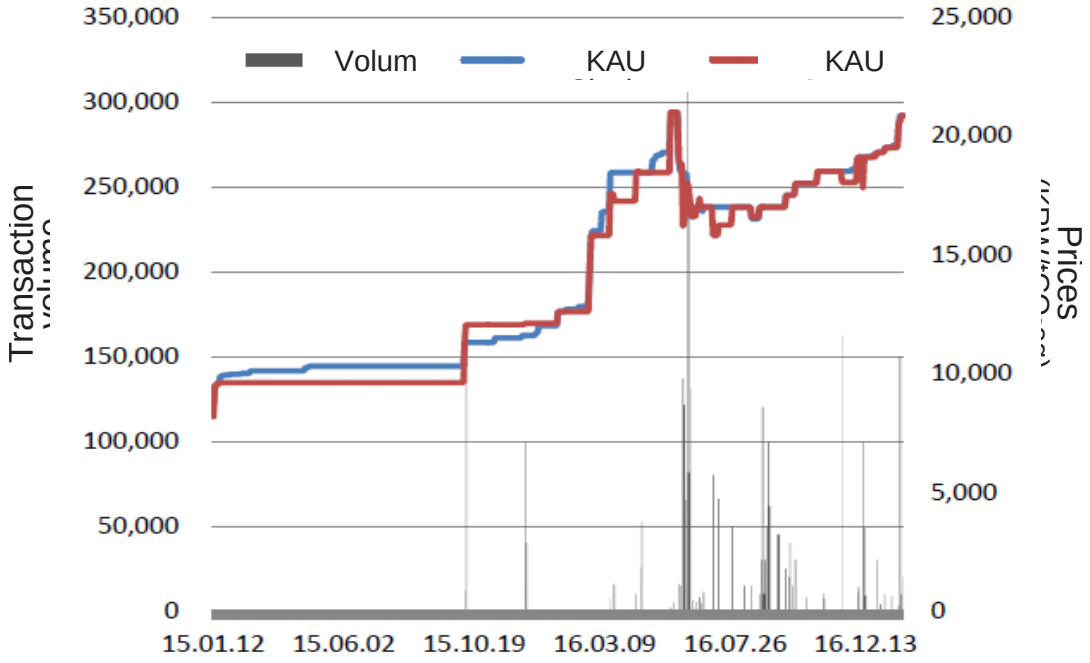

Figure 3 KAU transactions in 2015 and 2016

Source: KRX data and Ecosian, modified by POSRI

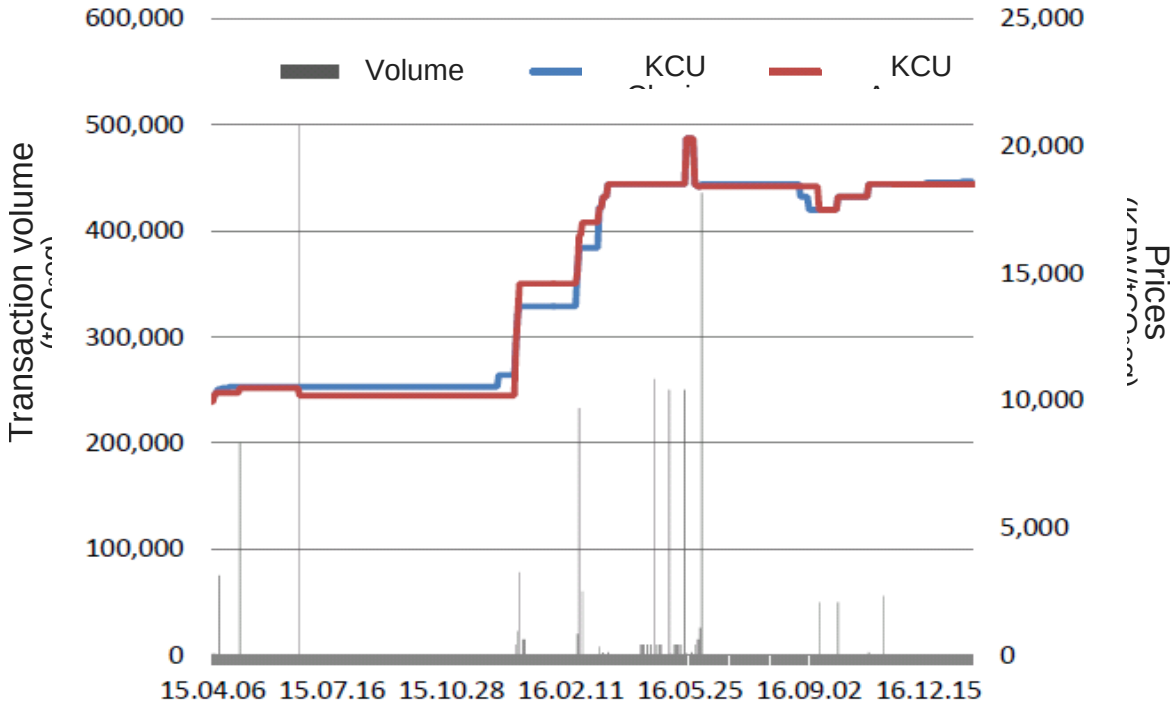

Figure 4 KCU transactions in 2015 and 2016

Source: KRX data and Ecosian, modified by POSRI

3.2 Issues to be addressed

What is policy effect of ETS to reduction GHG emissions? What about investment for low carbon technology?

The last two years of operation illustrated several problems which need close review and some improvements. There are three major issues which need to be addressed. What is proper price level in Korea? What is the marginal cost for GHG reduction by sector in Korea? What is the evidence to say that the price of credit in the market is expensive?

First, Korea is implementing one of the world's highest carbon prices. The World Bank's annual review of carbon markets indicates that there is a big gap between the carbon prices in different markets. Despite this relatively wide range, 85 percent are priced at less than US$10/tCO$_2$e. While the carbon price of the EU ETS in 2016 is US$ 5/tCO$_2$e, the K-ETS price is US$ 15/tCO$_2$e which is almost three times higher (See Figure 5). Furthermore, the K-ETS price has been increased sharply since early 2017, the exchange-trade of KAUs jumped to a record level in February 2017 at KRW 24,000. As a consequence, the compliance companies under the K-ETS are concerned about their international competitiveness. They may suffer from lowing profit margins and market share to competitors who do not face similar carbon costs abroad. Given the fact that many of the covered industries are largely dependent on export market, the risk of carbon leakage seems real. The high prices in the K-ETS was caused by several aspects such as, ambitious reduction targets, the relatively high cost of reducing emissions within the country, and restrictions on the use of offset credits from abroad. According to ICIS (2014), however, the most important factor for the carbon price development is the behavior of market participants. The fundamental supply and demand can be taken as the single indicator for price movements in the K-ETS.

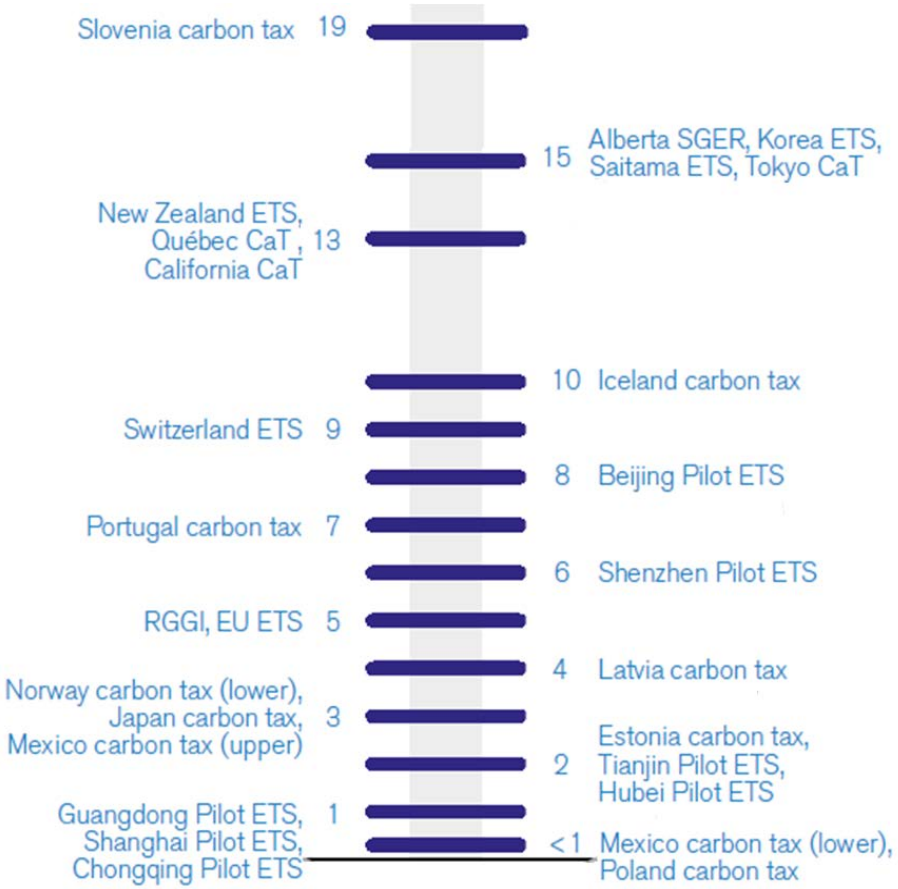

Figure 5 Prices in existing carbon pricing initiatives (Unit: US$/tCO$_2$e)

Source: World Bank, modified by POSRI

Second, the low level of liquidity remains to be a main concern for the K-ETS as a trading system. In the first compliance year of the K-ETS, only 2.4 percent of the total 2015 preliminary allocation was traded. The main reasons of such lack of liquidity in the K-ETS are discussed below:

Under the K-ETS, restrictions are placed on third-party participation in the market. Only compliance companies plus three state-owned banks[4] are allowed to trade. It was decided to minimize the chances of speculative trading by limiting access. As non-compliance players are not able to hold either KAUs or KCUs, this made it impossible for such companies to participate in the scheme. Another restriction is placed on international offset credits. During the first two trading periods, companies will not be able to use carbon offsets from foreign countries. International offsets will be accepted from Phase III (2021-2026), but only for a maximum of 50 percent of the total offset limit. With regards to the behavior of market participants, companies are reluctant to sell off surpluses to the market with the high uncertainty of the future supply and demand. Lack of information and experience of ETS also induced the market situation. Many studies suggest that if the Korean government wants to boost liquidity, it should consider following two: 1) third party participation and trading, and 2) the early introduction of international carbon credits. Markets will gain liquidity by opening up companies that do not have a compliance obligation themselves but either provide financial services to existing participants or speculate on future price movement. Introducing international carbon credits is expected to provide more ample supply of offset credits and lower the compliance cost for industry.

Finally, frequent market intervention by the government appears to be one of the main problems in the K-ETS market. According to a current plan, the government is allowed to intervene in the market with market-stabilizing measures in case of significant changes in prices or trading volumes. However, a number of direct or indirect interventions by the government have been implemented over the last two years regardless of whether or not to meet these criteria. In overall view, the K-ETS market has been quite tightly controlled by the government. Since the KAU price has continued to rise and hit a record high despite low trading, it has led to demands for intervention in the market to stabilize the price. Recently on February 10, 2017, government officials said they would closely monitor the abnormal price levels to make sure there was no market manipulation. The KAU price fell nearly 10 percent just after. On March 7, 2017, government officials indicated that companies banking too many allowances might face disadvantages in the second phase of the K-ETS. The KAU price has dipped somewhat from February's record highs to stabilize just below KRW 24,000. Even though it is true that the government intervention contributed to increasing market liquidity and lowering the unit price, it can send somewhat misleading signals to market participants. In fact, many short companies now expect that they will be able to get below market price allowances ahead of the compliance deadline from the government, so they think they do not have to buy the allowances they need in the market. It is therefore important to recognize that government intervention may undermine market credibility. In addition, any move to intervene in the market should be carefully considered and based on clear, consistent and predictable rules and procedures.

4. Linkage with other markets

For Korea, linking to other carbon markets could be an attractive option to address several issues discussed in this report. Moreover, there is a growing attention to linkage options as the government is currently deliberating on how it will meet the national target to reduce 11.3 percent of its GHG emissions through international carbon markets.

The possibility of future linkage with other carbon markets has already been entered in to debates on the K-ETS. While some design features of the K-ETS have potential to be barriers to linkage, it is worthwhile to discuss possible future linkage of the Korean scheme early on.

The Korean Act on the Allocation and Trading of Greenhouse Gas Emission Permits provides ground rules for linking the K-ETS to other carbon markets. The Article 3 which enumerates fundamental Principles states: "*the Government shall implement policies in conformity with international standards, considering the link with international carbon markets.*" Also, the Article 36 elaborates details of linking

[4] Korea Development Bank, Korea Exim Bank and the Industrial Bank of Korea

the K-ETS with international carbon markets as it reads below:

> *(1) The Government shall endeavor to link domestic emission permits markets with international carbon markets in accordance with the United Nations Framework Convention on Climate Change and relevant protocols or agreements entered into with countries recognized as countries that measure, report, and verify greenhouse gas emissions in an internationally reliable manner. In such cases, the Government shall take into consideration the protection of trade secrets of business entities eligible for allocation.*
>
> *(2) The competent authority may designate or establish and operate an institution specializing in surveys, research, technological development and cooperation for the link with international carbon markets as an institution specializing in trading emission permits, as prescribed by Presidential Decree.*
>
> *(3) The Government may subsidize an institution designated or established and operated under paragraph*
>
> *(4) As an institution specializing in trading emission permits for expenses incurred in conducting its business activities.*

While the K-ETS already has a legal basis to link with other carbon markets, potential benefits and challenges from linking have not been much explored yet due to huge uncertainties and differences between the schemes of countries.

4.1 Why linking?

Discussions on linking among carbon markets have drawn great attention from some countries that have implemented or consider adopting ETS or other carbon market mechanism. Among many possible benefits through linking carbon markets, some experts including Flachsland et al. (2008) and Jaffe and Starvins (2008) discussed key potential economic benefits of linkage such as increased efficiency, increased market liquidity, and a reduction in competitiveness distortions.

Korea particularly stands to gain from linkage with other markets because of its high carbon price and low market liquidity. Linkage with other markets could reduce the carbon cost for Korean companies. A decrease in Korea's allowance price could in turn help reduce its risk of carbon leakage. Further details are presented below.

First, economically speaking, larger market could be more efficient in that it expands the number of mitigation options and as a result, lower the costs of achieving emissions reduction target. Second, expanding a carbon market through linking could generate more liquidity of the market with more players in the market. Liquidity here means the extent to which an allowance can be bought or sold without affecting the market price. More liquidity could reduce volatility while it prevents a handful of big players from exerting market power. In addition, it could alleviated carbon leakage and competitiveness concerns. While countries are all agreed that climate change poses a great threat to everyone in the world, they have been reluctant to adopt strong domestic regulations to limit GHG emissions. The main reason is that any regulations on GHG emissions would impose additional costs to domestic companies. And additional burdens would lead to weakening competitiveness of domestic industries in the global market, comparing to companies in other countries without regulating GHG emissions or regulating but not with equivalent or similar levels. Promoting a single or equivalent carbon price, creating a larger carbon market through linking could address competitiveness concerns to some extent at least among participating countries. Also, linking carbon markets could eliminate some technical barriers between participating countries so as to promote technology transfer between the two or more.

Some political benefits of linking the markets exist as well. Flachsland *et al* (2009) noted that linking could facilitate the acceptance of climate policy at domestic level as it could address some competitive distortion issues that are both politically and economically sensitive. Also, the authors pointed that it can work as a signaling mechanism in the context of global burden sharing and help the world moving towards an international carbon market.

4.2 Disadvantages and challenges

While linking the carbon markets has great potential to benefit participating countries theoretically, there might be some disadvantages in linking the markets. For example, linking the carbon market could have distribution distortion effects among participating countries as money could flow to the country with lower carbon price. This could also result in less incentive to invest or move towards more innovative ways to reduce GHG emissions. Also, there might be political concerns that linking could lead to less reduction at domestic level. Another thorny issue is governance. Jaffe and Stavins (2007) argued that there would be need to leaving each government with sovereignty over its own system while providing linking partners adequate authority to influence changes in linked systems that would materially affect their own system.

Aside from potential economic and political concerns, many practical issues and obstacles are to be addressed in advance. First of all, each country has different features of its own scheme. As table x is shown, Goers *et al* (2013) illustrates key design elements of ETS and several relevant issues in case of linking, noting that variations or inconsistencies in structures of ETS among countries as well as legal and institutional characteristics could harm linking ETS.

While all the elements in table 8 would need to be discussed prior to linking different ETSs or carbon markets, it does not mean that it is necessary to harmonize all the aspects. PMR (2014) provides lists of design features that need to be harmonized and not necessary to be harmonized which other studies previously put forward with. Design features to be harmonized include type of cap, stringency of the cap, offset crediting provisions, commitment periods, stringency periods, stringency of enforcement, cost containment provisions etc. Design features that could differ are registries, allocation methods, sources and gases covered, compliance periods, rules governing new entrants and closures, public disclosure of information etc. There might be different opinion or view on the lists mentioned above but the key point here is that linking the carbon markets does not seek complete or near-to-complete harmonization among different systems.

Table 8. Key design issues of ETS and their effects in case of linking

Key Design Elements		Possible Linking Effects
Scheme's coverage	Gas coverage	Linking to an ETS with a broader (lower) coverage → abatement options ↑ (↓)
	Sector coverage	Double-counting is possible; competition concerns
	Mandatory/Voluntary	Voluntary market may induce leakage
	Direct/indirect emissions	Double-counting is possible, competition concerns
	Opt-in and opt-out provisions	Unrestricted provisions may distort the coverage of the system and its ecological effectiveness
Definition and recognition of trading units		Fair recognition, trading and eligibility of diverse units
Cap setting	Absolute/relative caps	Total emissions of ETS with relative cap are not known in advance → liquidity of allowance ↓
	Stringency of caps	Significant wealth transfers between linking partners
Allocation methodology		Allocation rules that entail distributional impacts
Temporary flexibility	Continuance	Same continuance levels strengthen credibility
	Banking	Market and competition distortions
	Borrowing	Destabilization of penalty and compliance system
Monitoring, reporting, and verification		Rigorous monitoring processes are a robust basis for verification and calculations
Compliance and penalty framework	Use of offsets	Market and competition distortions
	Penalty system	High penalties lead to incentives to reduce CO_2 emissions
	Price cap	Price cap will be applied in the overall linked systems

Source: Goers et al (2013) modified

While there have been some discussions on linking the carbon markets, there are only a few cases of linking so far. One example is linking carbon markets between Quebec and California. While this linkage was not national but rather sub-national levels, it has been seen as a successful case of linkage. In September 2013, the governments of California and Quebec signed an agreement to link its ETSs and on January 1, 2014, the linking agreement went into effect. To link the two markets, both agreed to have similar rules for price and supply management, coverage, compliance periods, banking and penalties etc. while allocation method and offset types remain as before. To ensure progress in harmonization, the Consultation Committee was created to monitor the coordination and release a report at least once a year. Also, both agreed to inform each other and work together when potential changes to regulatory framework occur.

4.3 Current discussions

Despite a number of issues and challenges in linking carbon markets ahead, some discussions for linking have been continued between Korea and other countries. For example, the government has been in discussion with New Zealand (formerly Australia) and is currently looking at linking with the EU ETS and a national ETS in the People's Republic of China (PRC)[5]. The governments of New Zealand and Korea launched a study on 2012 on whether the two nations can link their emissions trading schemes to make their carbon markets more effective in cutting greenhouse gases.

The EU and the Korean Ministry of Strategy and Finance (MOSF) launched a cooperation project in July, 2017[6]. Under the project which will run for three years, the EU will provide technical assistance during the early years of operation of the K-ETS. The Korean government announced that its collaboration with EU on emissions trading will be a key foundation to further promote the linkage with the EU ETS.

The discussions about linking have been actively ongoing with China. China's PMR (2015) indicates that Chinese government singled out Korea specifically for potential linkage partnership. Furthermore, the National Development and Reform Commission of the People's Republic of China (NRDC) has proposed to the Korean government to create "Northeast Asia Emission Trading Cooperation Business" in order to seek opportunities of an Asian carbon market.

However so far, the idea of linking to other ETSs has not materialized yet. There is a lack of information about government position and approach on the linkage issues. Local market experts expect that linking markets would be highly unlikely by 2020.

[5] China has launched seven regional pilot carbon markets and plans a national ETS from 2017. Though observers only expect the market to fully cover the whole country from around 2020.

[6] https://ec.europa.eu/clima/news/articles/news_2016070801_en

PART 2

Preliminary analysis of the survey results on Korean companies' response to carbon policy

1. Survey Purpose

The Institute for Global Environmental Strategies (IGES) has been conducting a study titled 'Policies and Business Initiatives toward the Innovation and Diffusion of Low Carbon Technologies in North East Asia' since 2013. For this study, IGES in collaboration with POSCO Research Institute (POSRI) developed a survey questionnaire which consists of 20 questions. The purpose of the survey is to better understand low-carbon strategy of Korean companies, their responses to the K-ETS and views on potential areas for policy improvement.

The survey was held in the period between February 13 and March 7, 2017 by Korea Data Network (KDN), a professional survey firm, 589 firms were invited to participate in the survey by e-mail and 100 firms were responded. After received the responses by e-mail, KDN conducted additional telephone interviews with the respondents who did not respond or complete.

2. Survey Result

Here is a brief summary of profile for 100 respondents. Of the 100 respondents, 95 companies are corporations; two are limited partnerships and one foreign company and so on. In terms of sector, 16 are from petro chemistry, 6 from cement, 14 from steel, 11 from paper/timer, 10 from non-ferrous metal, 7 from electrics, 5 from machinery, 2 from oil refinery, and 29 from other sectors. In terms of company size, there are 23 large-sized, 35 medium-sized, 36 medium-small-sized, and 6 small sized company. In terms of type of product, 34 companies engage in producing raw materials, while 44 and 24 companies produce intermediary goods and final consumption goods, respectively.

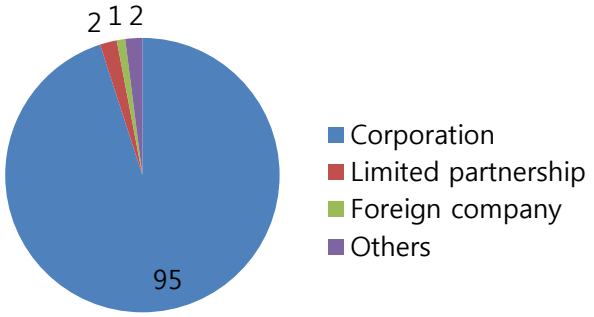

Figure 6 Survey respondents by type of company

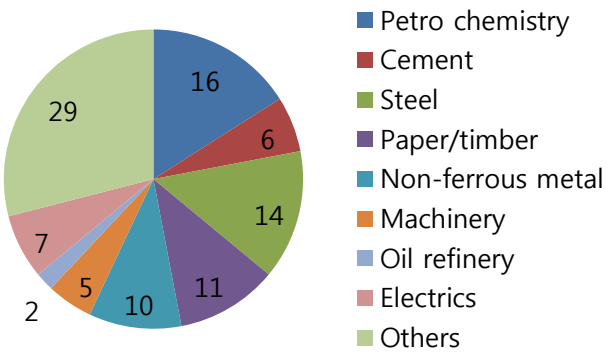

Figure 7 Survey respondents by sector

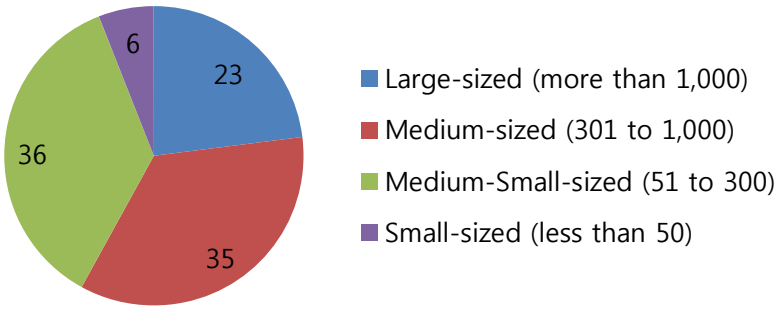

Figure 8 Survey respondents by size of company

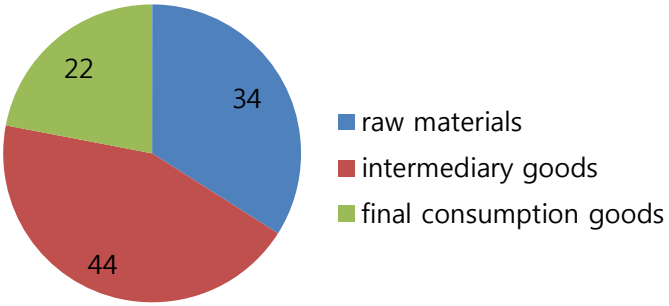

Figure 9 Survey respondents by type of product

Of the 100 respondents, 83 are currently covered under K-ETS. In terms of volume of energy consumption in 2015, 26 firms consumed less than 500TJ, 23 firms more than 500 and less than 1000TJ, 31 firms more than 1,000 and less than 5,000 TJ, and 20 firms over 5,000TJ. For volume of CO_2 emission in 2015, 56 firms emitted over 100 thousand ton per year. When asked about the marginal carbon reduction cost, about two thirds didn't respond. Of 35 respondents, 19 firms responded their marginal abatement costs as less than 100 thousand won, while 16 as more than 100 thousand won.

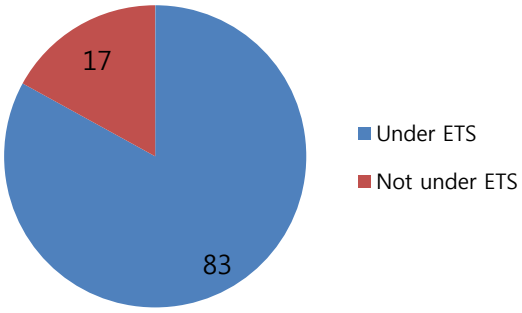

Figure 10 Survey respondents by coverage under ETS

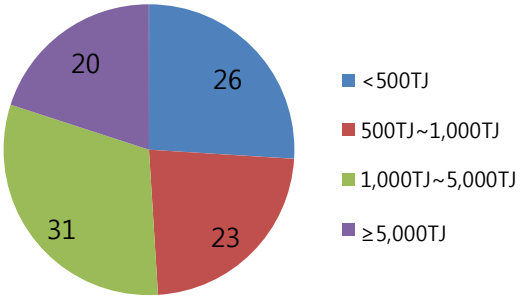

Figure 11 Survey respondents by volume of energy consumption in 2015

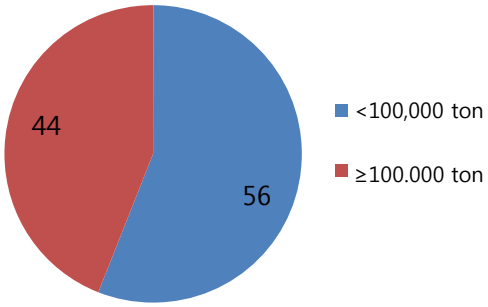

Figure 12 Survey respondents by volume of CO_2 emission in 2015

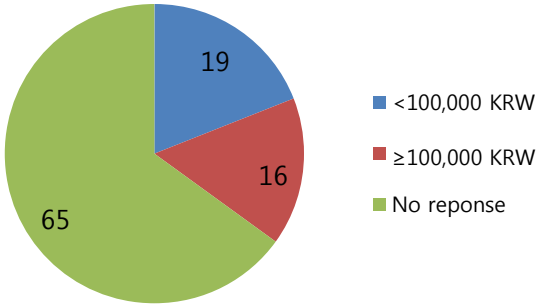

Figure 13 Survey respondents by marginal abatement cost

This survey is composed of three parts. Part 1 is for collecting the general information on respondents. Part 2 focuses on the status of carbon management for Korean companies. Part 3 is views of Korean companies on the ETS.

2.1 General information on respondents

Part 1 has 7 questions and results are summarized as below.

Question 1. How strict do you think GHG emission regulations and requirements for information management of the government are? ① Not strict at all② Not much strict③ Neither strict nor not strict ④ Strict ⑤ Very strict

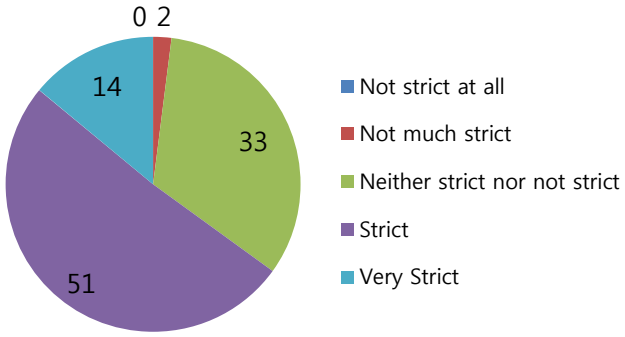

Figure 14 Assessment on government regulations of GHG

When asked how strict GHG emission regulations and requirements for information management of the government are, about two thirds of respondents answered with 'Strict' or 'Very strict'. 33 firms responded with 'Neither strict nor not strict'.

Question 2. Please specify the level of competition among companies in the same sector.

① Not strong at all ②Not much strong ③Neither strong nor not strong

④ Strong ⑤ Very strong

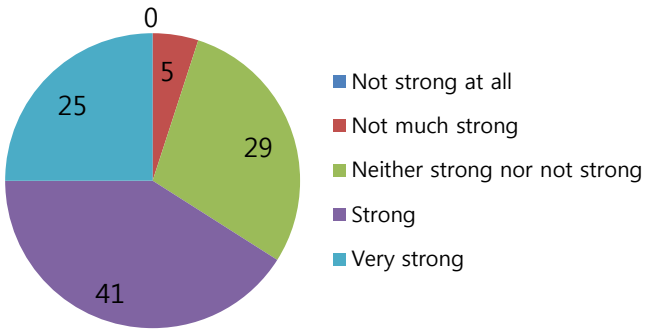

Figure 15 Level of competition among companies in the same sector

When asked the level of competition among companies in the same sector, about two thirds answered with 'Strong' or 'Very strong'. 29 firms responded with 'Neither strict nor not strict'.

Question 3. Please specify (1) the major energy source of your company (2) level of price of the energy source

1) Major energy resource:

① electricity ②coal ③oil ④natural gas ⑤steam energy ⑥renewable energy

2) Energy price:

① Very cheap ②cheap ③Neither cheapnor expensive ④ expensive ⑤

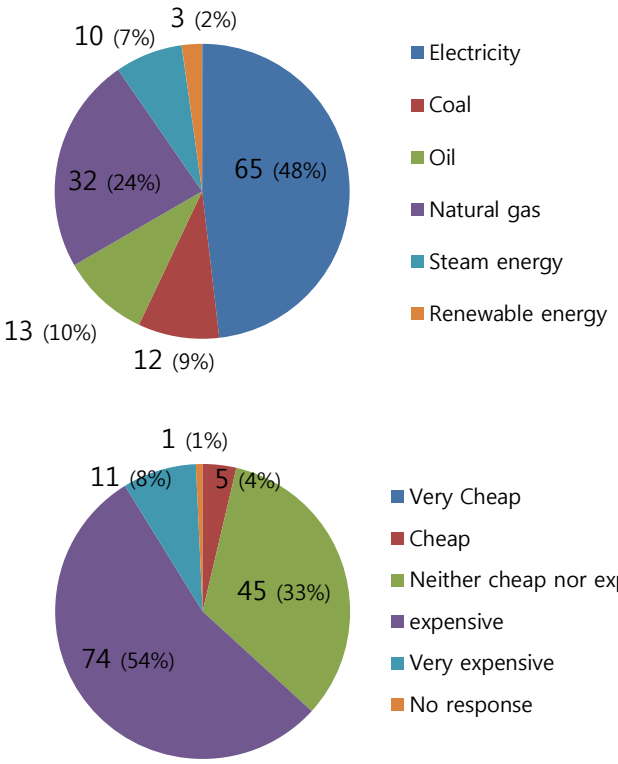

Figure 16 Major energy source and level of price of the energy source

When asked the major energy source, the majority of responses identified ‘electricity’ (48%) as a major energy source, followed by Natural gas (24%), oil (10%), coal (9%), steam energy (7%), renewable energy (2%). Reagarding the level of price of the energy source, 62% think ‘expensive’ or ‘very expensive’. 33% firms answered with ‘Neither cheap nor expensive’.

Question 4. Please specify your company’s share of exports to total shipments

① Less than 10 % ②10 to 20% ③20 to 30% ④ 30 to 50% ⑤ More than 50%

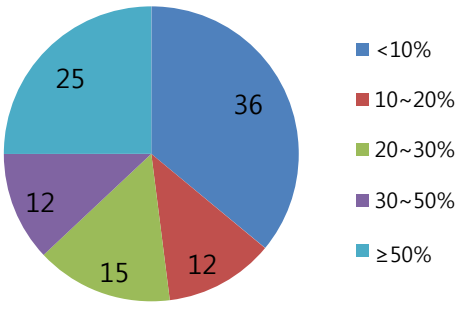

Figure 17 Company’s share of exports to total shipments

When asked the company’s share of exports to total shipments, a third of respondents answered with ‘less than 10%’, and 25% with over 50%. Only 12 firms answered with 10 to 20%, 15 firms 20~30%, and 12 firms 30~50%.

Question 5. Is the top management of your company supportive for activities of energy saving and GHG emission reduction?

① Not supportive at all ② Not much supportive ③ Neither supportive nor not supportive

④ Supportive ⑤ Very supportive

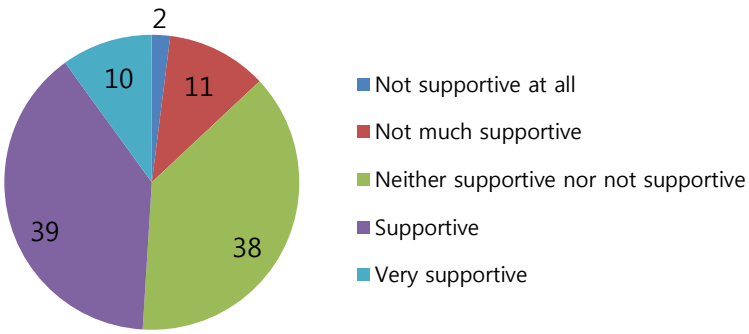

Figure 18 Support of top management for energy saving and GHG reduction

When asked the level of support of top management for activities of energy saving and GHG emission reduction, a half of respondents answered with 'Supportive' or 'Very Supportive'. 38 firms responded with 'Neither supportive nor not supportive, '13 firms with 'Not much supportive' or 'Not supportive at all'.

Question 6. Is the top management of your company aware of/ understand the Emissions Trading Scheme (ETS)?

① Not aware

② Only aware of the name of ETS

③ Aware of the fact that the company is covered under the ETS

④ Understand the structure of ETS

⑤ Relate ETS to costs and profits of the company

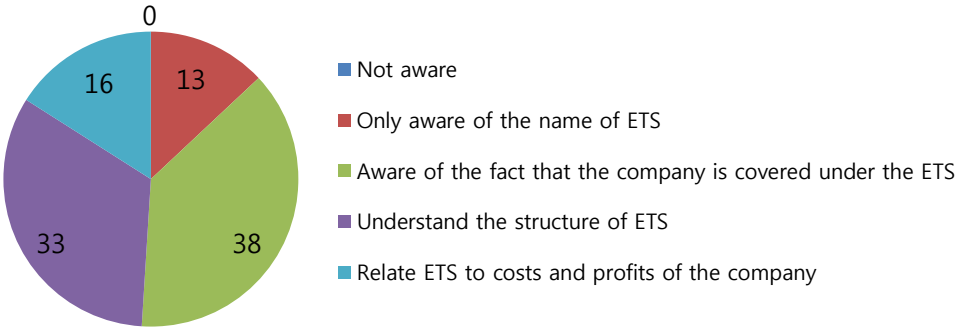

Figure 19 Awareness of top management on ETS

When asked the level of awareness of top management on ETS, 38 firms answered with 'aware of the fact that the company is covered under the ETS'. 13 firms answered with 'only aware of the name of ETS'. Top managements of 13 firms understand the structure of ETS. And, there were 16 firms that relate ETS to costs and profits of the company.

Question 7. Please specify the level of technology of facilities that your company owns

① Lower technology than average level of companies in the same sector
: Need to be improved

② About average level of companies in the same sector

③ Higher than average level of companies in the same sector
: Own advanced technologies

④ Own advanced technologies that can compete in global market

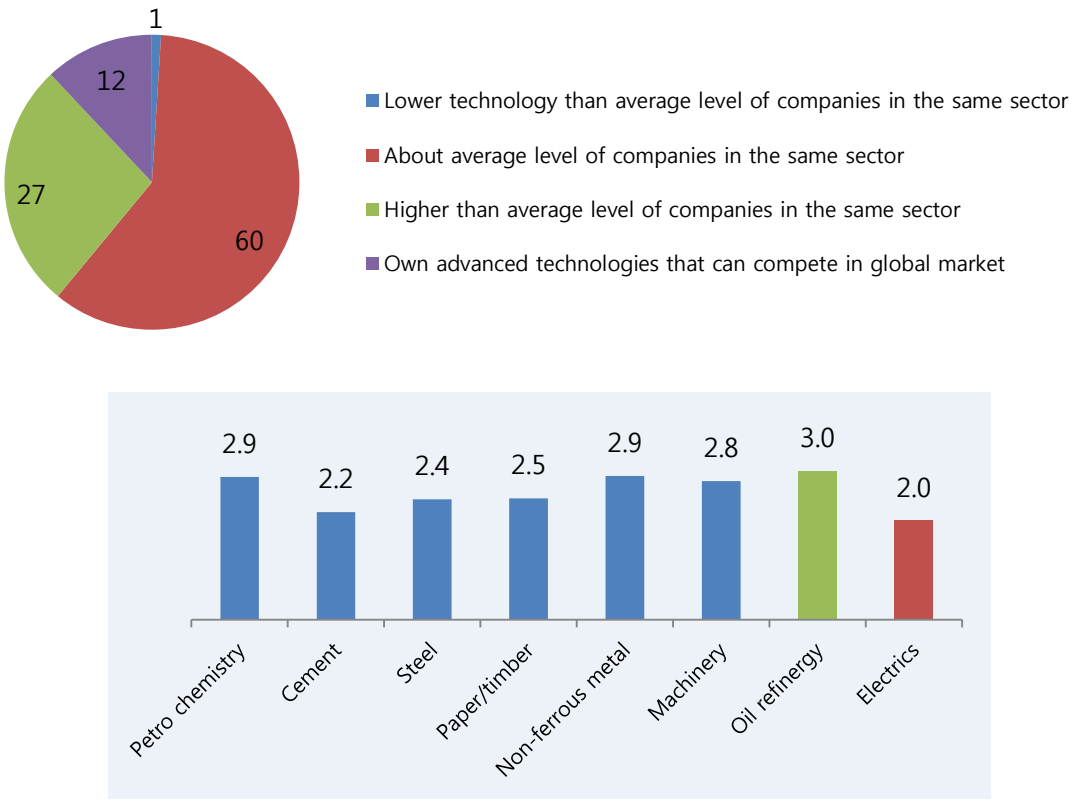

Figure 20 Level of technology of facilities and sectoral comparison

When asked the level of technology of facilities that the company owns, 60 firms believe that their level of technology is 'about average level of companies in the same sector' while 27 and 12 firms believe they own technology 'Higher than average level', and 'advanced technologies that can compete in global market' respectively. With regard to the level of technology, we assigned the lowest level with 1 point and the highest with 4 points. Results from sectoral comparison on technology aspects showed that the oil refinery is the top (average 3.0). Both petro chemistry and non-ferrous metal are scored at 2.9. Machinery, paper/timer, steel, cement, and electrics are followed. It is a noteworthy result that electrics sector perceive themselves as 'average' while they are seen as most advanced and technology oriented sector in Korea.

2.2 Status of carbon management for Korean Companies

Part 2 includes 7 questions which focus on status of carbon management for Korean companies. Question 8 asks respondents to identify activities they have involved with among 21 activities described. We grouped 21 activities into four categories - Planning of carbon management, Status analysis and investment, Response to ETS, and Voluntary reduction action.

First category the Planning of carbon management includes 7 activities. Respondents were asked if

they established short & long-term targets for energy savings and GHG emission reduction or not. 72 answered with 'Yes'. 91 firms were collecting information on policy related to energy savings and GHG emission reduction. 51 firms had the internal guidance for energy savings and GHG emission reduction in place. While only 11 firms were adopting a green or carbon management accounting system, 34 firms were answered that they were collecting information to conduct a strategic carbon management (plan-do-check-act).

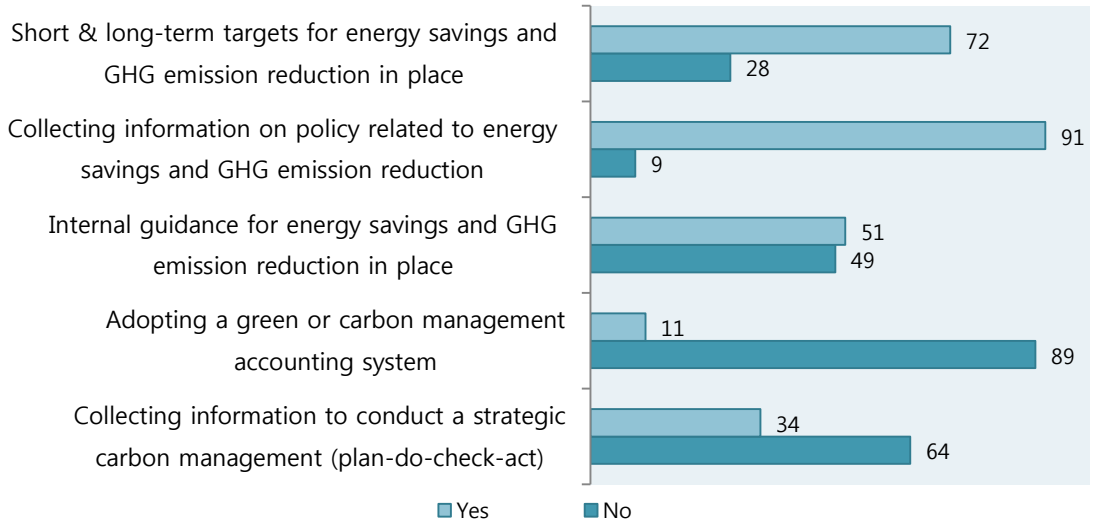

Figure 21 Planning of carbon management

Second category, the Status analysis and investment includes 7 questions. Respondents were asked if they conducted analysis on energy use and GHG emissions to identify potential areas for energy savings and emission reduction or not. 86 responded with 'Yes'. 76 firms were answered to make efforts to enhance daily facility maintenance for energy saving. 71 firms were invested to improve production process for energy savings and emission reduction. 59 firms purchased new production facilities to save energy and reduce GHG emissions and installed monitoring equipment on energy consumed facilities. 37 firms were making adjustment on energy mix to use more clean energy sources and 34 firms were enhancing optimization in transporting materials and goods were 34.

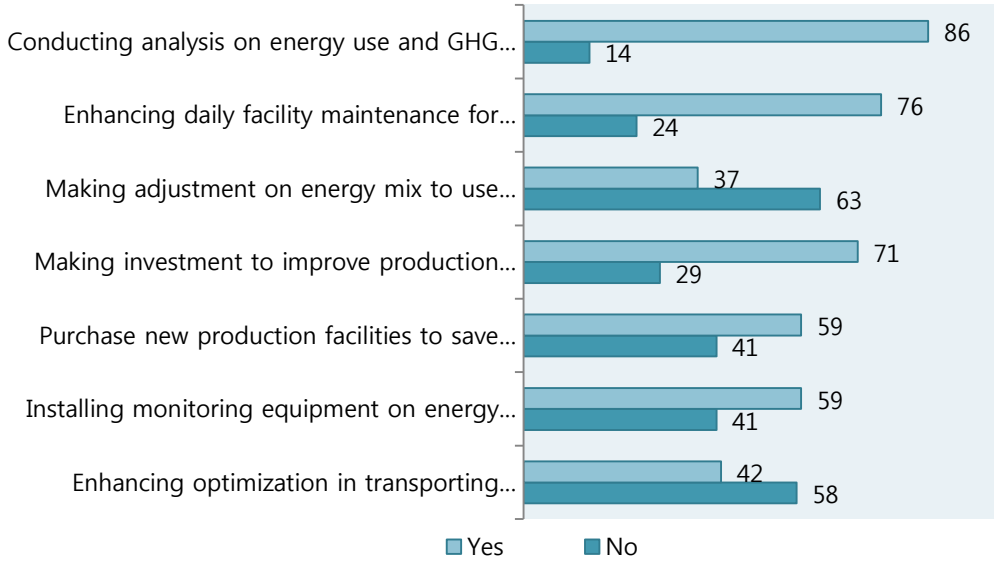

Figure 22 Status analysis and investment

Third category, the Response to ETS includes 5 questions. The ratio of answer 'Yes' to questions in this category is relatively lower than other categories. Respondents were asked if they established a unit or department in charge of carbon market or not. Only 37 responded with 'Yes'. 42 firms set up a plan and allocating budget for purchasing permits and trading. 36 firms established decision making process in relation to carbon trading; purchase, sell, price projection, and etc. 22 firms established carbon management strategy based on regular analysis on carbon market, and only 21 released environmental reports regularly that contain data for energy consumption and GHG emissions.

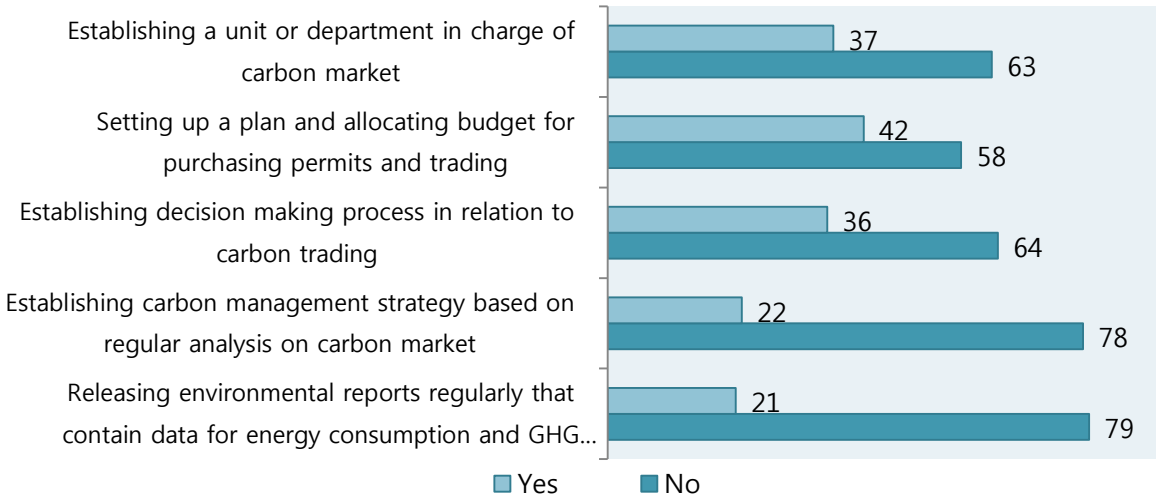

Figure 23 Response to ETS

Last category, the voluntary reduction action includes 4 questions. Respondents were asked if they had in-house training program for energy saving and GHG emission reduction in place or not. 37 responded with 'Yes'. While, firms encouraging daily energy saving activities in office (turning off lights) were 64 and participating in training programs for energy saving and GHG emission reduction hold by the government/local government were 85. Finally only 33 firms sought for subsidies/financial support from the government on energy savings.

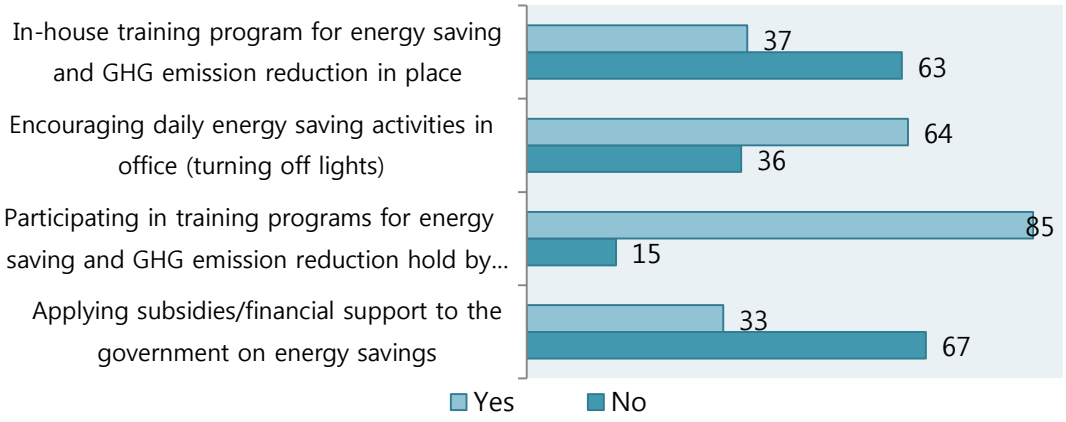

Figure 24 Voluntary reduction action

Question 9 is to assess factors to influence on decision making related with carbon management. The level of influence is evaluated in the range of 1 (no effect) to 5 (critical). Two major critical factors to decision making or activities on carbon management are governmental institution and will of top management. ETS is a key policy for accomplish national reduction target. Therefore, details of ETS determined the carbon burden to firms that covered under ETS. Also, firms with top management such as CEO, CFO which have strong will to deal with ETS have more chances to hedge the management risk from carbon burden. Other factors with minor influence include labors union in company, environmental

NGO, and international agreement. It should be noted that while GHG reduction issue may not directly relate to the conflicts between labor and management, however, environmental NGO and international agreement are seen as important factor on the design and details of ETS in reality. Although the ministry of environment considers views and opinions of the NGOs and the industries in the course of introducing ETS, it put high weight on the pursuit of environmental value. It is typical example to decide the 2020 national target that will reduce the GHG emissions 30% below business as usual.

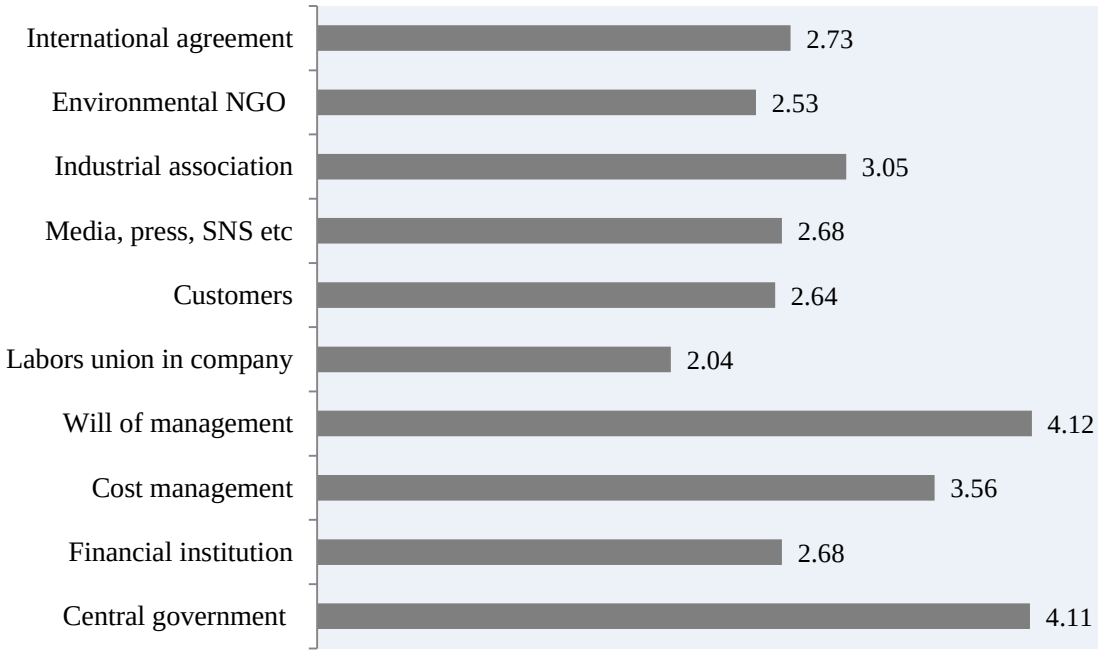

Figure 25 Factors to influence on decision making related with carbon management

Question 10 is about the major sources of information about carbon management. To answer this question, plural responses are allowed. The major source of information related with ETS is government. 25% of respondents obtained information about carbon management from government or associated agencies directly, and 21% and 18% from mass media and seminars that reported government policy, respectively. To get the details of ETS, 16% are utilized with the external experts and 13% from meetings and some exchanges with other companies such as the supply-demand balance of carbon credits.

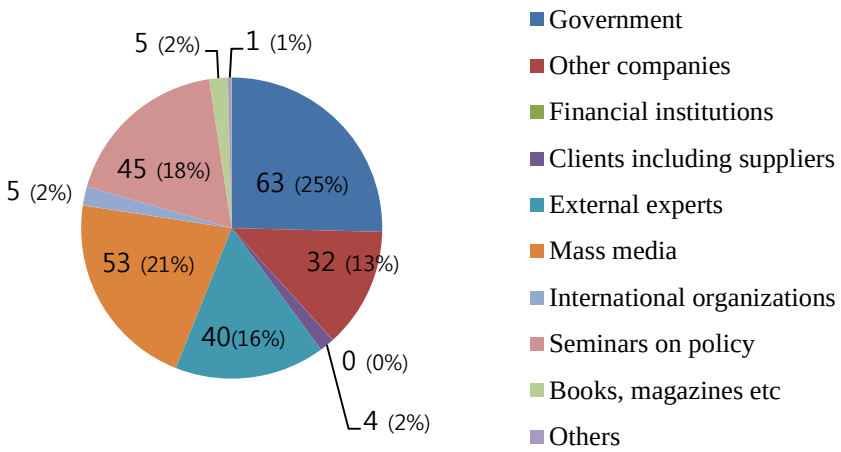

Figure 26 Major sources of information about carbon management

Question 11 asked the level of influences of carbon management activities. In this question, there was ‘overall improvement’ as a kind of median value to compare with other factors. The level of influences of carbon management activities is evaluated in the range of score, the lowest level with 1 point to the highest with 5 points.

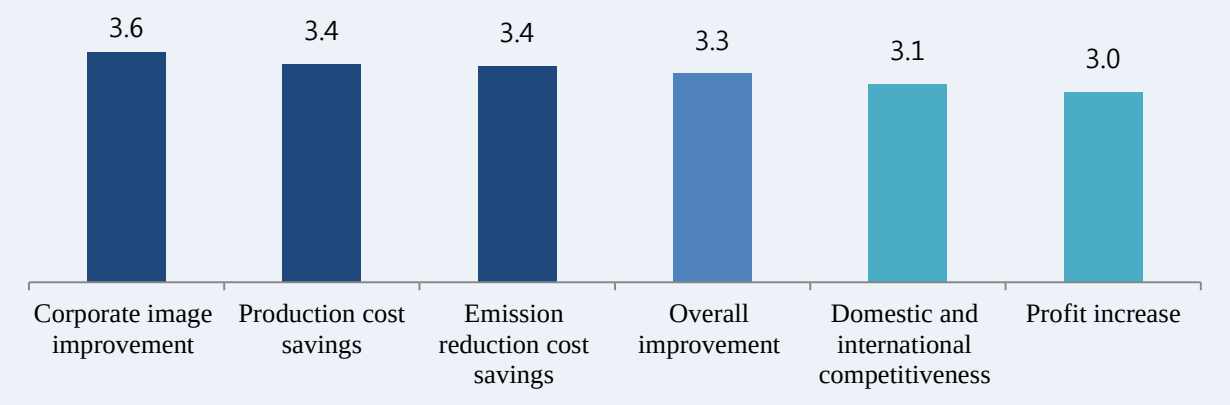

Figure 27 Level of influences of carbon management activities

Most frequent answer was ‘Corporate image improvement,’ scoring3.6 on average. Production cost savings and emission reduction cost savings is followed with score of 3.4. Overall improvement was scored indicated as 3.3. Domestic and international competitiveness and profit increase were 3.1 and 3.0 respectively. Last two factors were thought as the final goal or purpose to introduce carbon management or response to ETS. It was likely that many firms concentrated on the requirements of the moment such as accomplishment of reduction target of K-ETS Phase 1. Respondents believe that most of activities described in the question have somewhat positive impacts: corporate image improvement (3.6), production cost savings (3.4), emission reduction cost saving (3.4). Regarding profit increase (3.0), respondents does not seem to relate carbon activities with tools for increasing profit.

Question 12 asks to evaluate the level of impacts of some issues to carbon management. Many firms believe that ‘Lack of environment friendly and low-carbon technologies’ and ‘Lack of governmental support’ are somewhat influential in negative ways. To carry out carbon management with sustainability successfully, carbon management should be conducted in line with the long-term roadmap and detailed plan to develop the low-carbon technologies. Respondents think that environment friendly and low-carbon technologies are key factor to deliver the successful carbon management, and the stable and long-term support from the government is desirable to develop the low-carbon technologies.

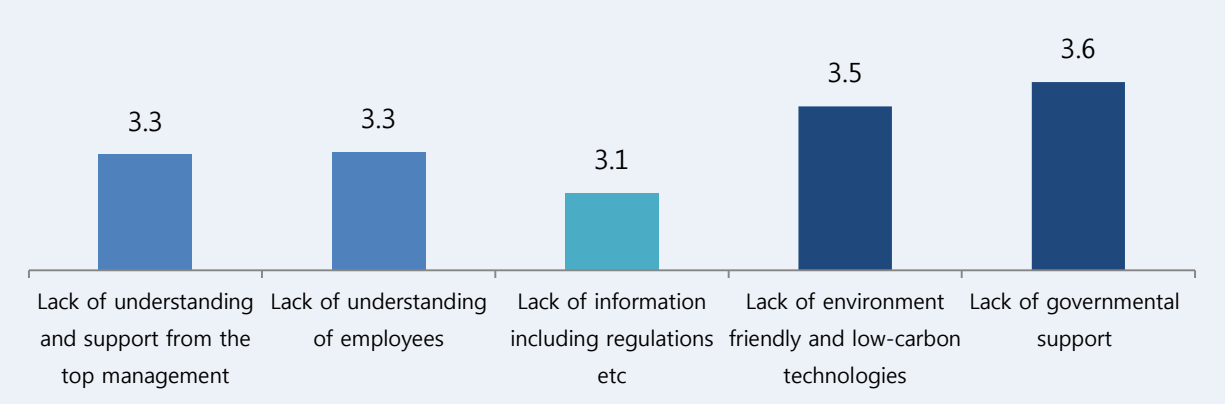

Figure 28 Hindrance factors to carbon management

Question 13 asks the level of usefulness among government support. Firms consider ‘consistency and transparency of policy’ as important factor while other supports including financial support (tax incentives, lending with low interests etc.), support mechanisms to expand low-carbon technology market,

and training about tools for carbon management are not much useful.

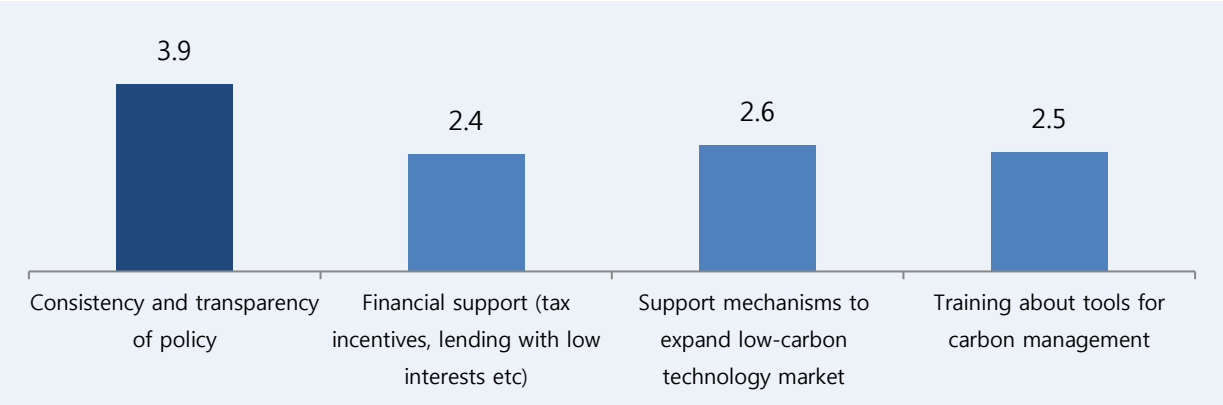

Figure 29 Level of usefulness among government support

Question 14 asks key factors related with IMM promotion. As Korea government submitted NDC with 11.3% reduction through IMM, respondents have become more interested in IMM than before Paris Agreement. Firms believe that 'linking reduction targets for GHG emissions' is important (3.5) and 'opportunities for domestic low-carbon technologies to enter global market' and 'States of following discussions to Paris Agreement' are not much important.

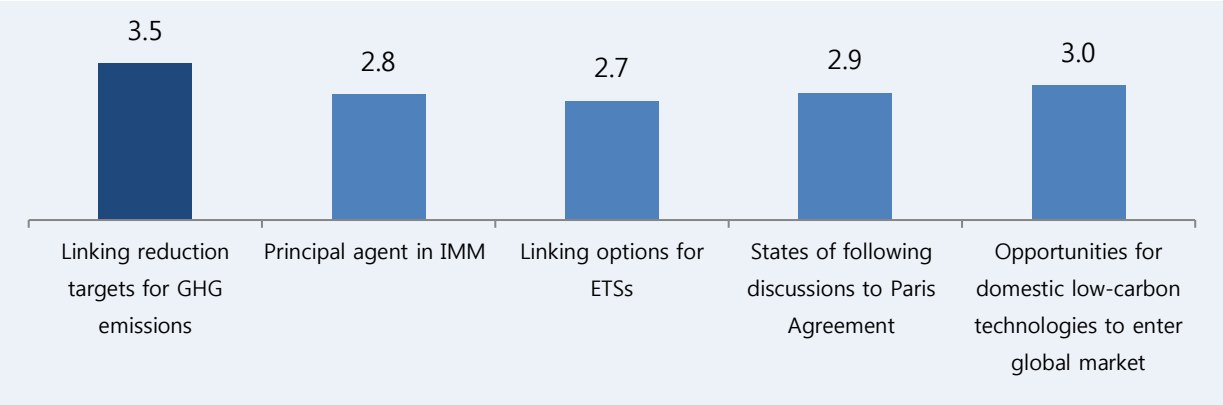

Figure 30 Key factors related with IMM promotion

2.3 Response to the Korean ETS

Part 3 contains the Response to the Korean ETS, and is composed of 6 questionnaires from Question 15 to Question 20. Question 15 is for the assessment of allowances for year 2015. Of 100 respondents, 57 responded as 'Not enough', 40 as 'Reasonable', and 2 as 'Enough'

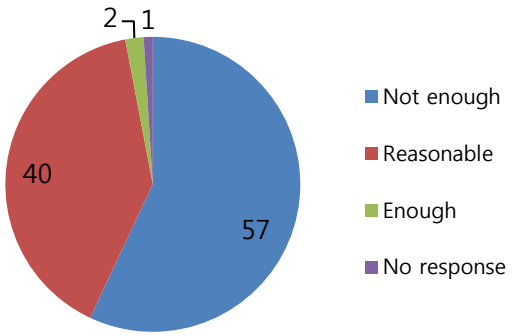

Figure 31 Assessment of allowances for year 2015

Question 16 is only for the respondents to respond as ‘Not enough’ in previous question. When asked the priorities to deal with excess emissions, 44% of respondents selected the option ‘Borrowing from following compliance year’ as first. The second option was ‘Development of low carbon technologies’ and the third ‘Purchasing permits’. In K-ETS, borrowing is allowed only within a single trading phase with a maximum of 20% of entity's obligation, but not across phases. Therefore, borrowing is not a proper countermeasure to deal with K-ETS phase 1. Nevertheless, borrowing is the simple way to deal with excess emissions. In 2015, many Korean firms actually coped with the situation in same way.

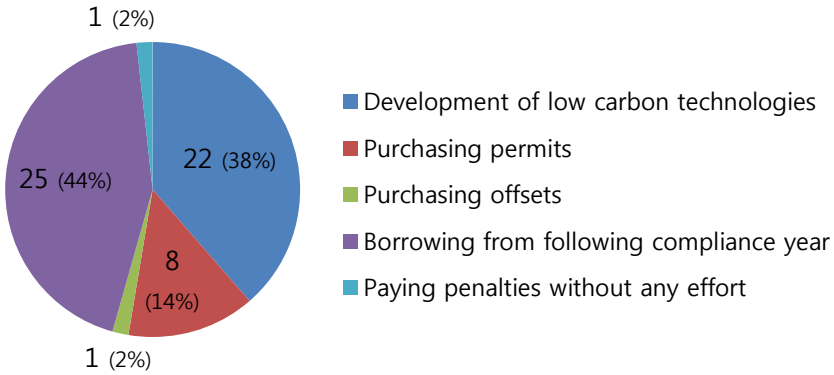

Figure 32 Options to deal with excess emissions

Question 17 is only for the respondents to respond as ‘Enough’ in Question 15. When asked the priorities to deal with surplus allowances, ‘Banking permits’ and ‘Selling in OTC market’ were selected respectively. Recently, Korean companies with surplus allowances tend to bank permits because of the increasing uncertainty from government policy related with GHG reduction. They are preparing the phase 2 to be scheduled with the stronger reduction target. Instead of banking permits, selling permits in OTC is a better alternative to get profits than selling permits in KRX trading market. Many companies prefer to hide their trading status to government and other companies because the open deal might be connected to unexpected damages as like decrease of allowances.

Question 18 is for key issues or problems under ETS operations. When we gave point as the importance of issues or the seriousness of problems, the lowest was assigned as 1 and the highest as 5.

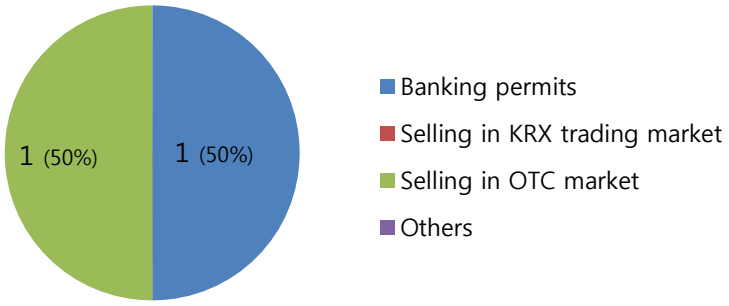

Figure 33 Options to deal with surplus allowances

Most seriously mentioned were ‘Inadequate methodology for allocation and lack of allocations while target is too ambitious’ and ‘Double burden from regulating indirect emissions and concerns for rising electricity price’. Respondents thought ‘Inadequate methodology for allocation and lack of allocations while target is too ambitious’ was the direct reason with cost rise. From ‘Double burden from regulating indirect emissions and concerns for rising electricity price’, the industrial side had more burden in comparison with the power sector. Additionally, ‘Difficulty to project carbon price and market’ and ‘Uncertainty about policy direction and frequent change in authority’ were the main issues under ETS

operations. Uncertainty from the early stage of new institution as like ETS and inconsistency of government's decision making made the carbon market unstable and projection of carbon price more difficult. Therefore, the carbon price currently determined in K-ETS did not deliver price signal properly to the players in the market.

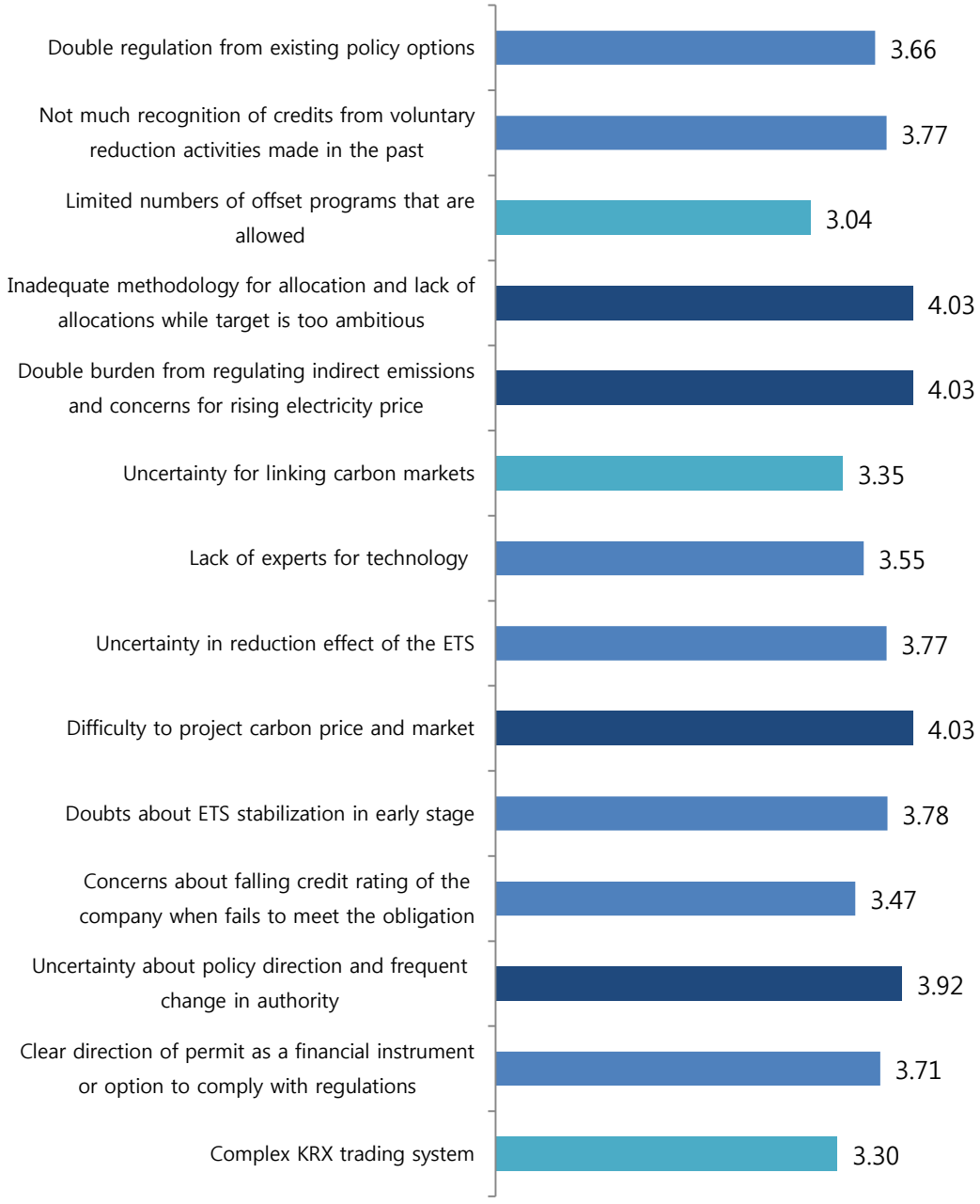

Figure 34 Key issues or problems under ETS operations

In the contrary, 'Limited numbers of offset programs that are allowed' and 'Uncertainty for linking carbon markets' were grouped as relatively less important issues. Although expansion of offset programs and linking carbon markets to solve the shortage of permit supply are good alternatives, these are not categorized as current and urgent issues by players of K-ETS.

Question 19 asked the level of possibility to purchase the permit according to price rise. Permit price was assumed to rise from 3,000 KRW to 37,000 KRW. Naturally as price went up, possibility to purchase the permit went down, but interesting downward pattern by sector was observed. Steel and chemistry

sector showed very similar pattern to average downward curve. Electrics and cement sector showed lower possibility to purchase the permit in the band under 10,000 KRW but higher possibility in the band between 10,000 KRW and 37,000 KRW. When considering average price was over 10,000 KRW in K-ETS, this band could be judge as 'real purchasing range'. These two sections showed the higher possibility until 37,000 KRW continuously, which described positive intention to purchase the permit to deal with excess of emissions. But purchasing the permit should be compared with the marginal abatement cost or profits per CO2 ton. Although electrics section had the marginal abatement cost or profits per CO2 ton than 37,000 KRW, cement did not. Therefore these results needed to be carefully interpreted.

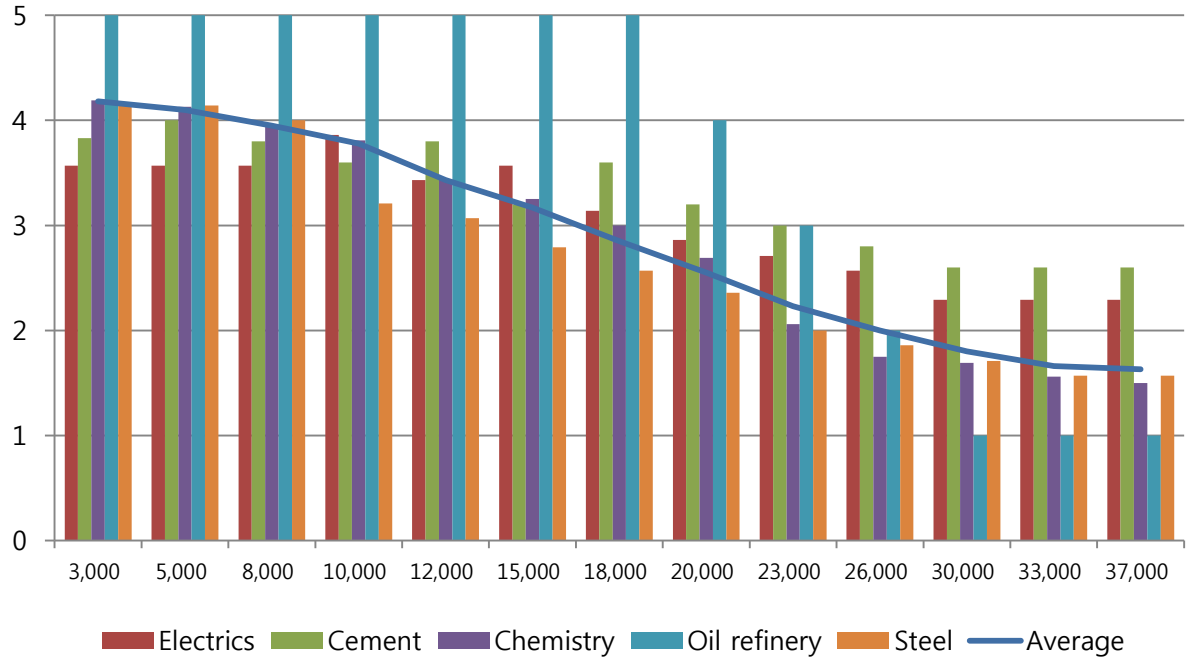

Figure 35 Level of possibility to purchase the permit

Question 20 asked whether integrated ETS in East Asia would be needed. Carbon pricing became very important as an effective tool to reduce GHG emissions and diffuse low-carbon technologies. As such, countries in East Asia had adopted or consider adopting carbon pricing mechanisms (Korea adopted ETS in 2015, China expected in 2017, and Japan to discuss again since December 2016). In addition, there had been discussion on creating East Asia carbon market. Although responses of 'Need' were more than 'No need', most responses were 'No response'.

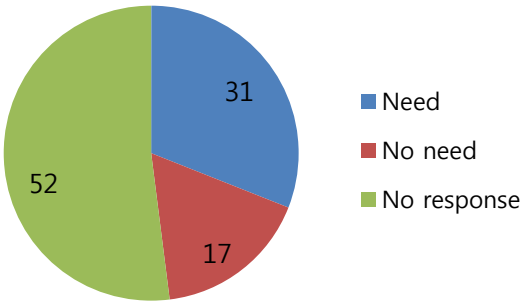

Figure 36 Needs on the integrated ETS in East Asia

3. Findings and Implications

From this survey, four key findings and implications are summarized. Although some detailed implications are not only from this survey, they are added to enrich the contents of this research.

First, Korea companies judged uncertainty from government's decision making as a critical factor to interrupt proper operation of carbon market. Firms responded 'Consistency and transparency of policy' was most important factor than any other supports. Financial support, support mechanisms to expand low-carbon technology market, and training about tools for carbon management could be real benefits for firms under ETS. Nevertheless, Respondents selected to reduce the uncertainty of carbon market as the urgent issue in K-ETS. Uncertainty from the early stage of new institution as like ETS and inconsistency of government's decision making made the carbon market unstable and projection of carbon price more difficult. The carbon price currently determined in K-ETS did not deliver price signal properly to the players in the market. Recently, Korean companies with surplus allowances tend to bank permits because of the increasing uncertainty from government policy related with GHG reduction. They are preparing the phase 2 to be scheduled with the stronger reduction target. Naturally only small volume can elevate the permit price. Actually the price in K-ETS is over four times than that in EU-ETS and China-ETS. To make carbon market properly operates and well-tuned carbon price derive the long-term investment on low-carbon technologies, decreasing the uncertainty of government policy and increasing consistency of government policy are needed.

Second, Korea companies implemented the strategic decision making considering the marginal abatement cost. It could be observed through the diverse downward pattern of possibility to purchase the permit according to price rise. Steel and chemistry sector showed very similar pattern to average downward curve. Electrics and cement sector showed lower possibility to purchase the permit in the band under 10,000 KRW but higher possibility in the band between 10,000 KRW and 37,000 KRW. When considering average price was over 10,000 KRW in K-ETS, this band could be judge as 'real purchasing range'. These two sections showed the higher possibility until 37,000 KRW continuously, which described positive intention to purchase the permit to deal with excess of emissions. But purchasing the permit should be compared with the marginal abatement cost or profits per CO2 ton. Although electrics section had the marginal abatement cost or profits per CO2 ton than 37,000 KRW, cement did not. Oil refinery sector showed higher possibility to purchase the permit in the band under 26,000 KRW but lower possibility in the band between 26,000 KRW and 37,000 KRW.

Third, although expansion of offset programs and linking carbon markets to solve the shortage of permit supply are good alternatives, these are not categorized as current and urgent issues by players of K-ETS. Among the key issues or problems under ETS operations, 'Limited numbers of offset programs that are allowed' and 'Uncertainty for linking carbon markets' were grouped as relatively less important issues. Countries in East Asia had adopted or consider adopting carbon pricing mechanisms (Korea adopted ETS in 2015, China expected in 2017, and Japan to discuss again since December 2016). In addition, there had been discussion on creating East Asia carbon market. But more than half of respondents thought linking carbon markets was not needed immediately. Nevertheless, Korea government has to prepare the global stocktaking based on the NDC submitted to UN anticipatively with IMM strategies.

Fourth, the in-house critical factor to decision making or activities on carbon management was the will of top management and main hindrance to carbon management was the lack of environment friendly and low-carbon technologies. Firms which top management such as CEO, CFO and so on had strong will to deal with ETS had more chance to hedge the management risk from carbon burden. Many firms thought that main hindrance factors to carbon management were 'Lack of environment friendly and low-carbon technologies'. To carry carbon management with sustainability, it should be based on the long-term roadmap and detailed plan to develop the low-carbon technologies. Respondents thought lack of environment friendly and low-carbon technologies as key factor to the successful carbon management, and the government stable and long-term support was needed to develop the low-carbon technologies.

Conclusion

Since 2016, the Korean government has announced several climate policy changes that have a direct or indirect effect on the K-ETS. The 2030 national target of reducing emissions 37 percent below BAU by 2030 was released, which include the use of international carbon credits accounting for 11.3 percent. Also, year 2017 allocation plan for the K-ETS has been decided to increase the total allowance allocation in 2017 by 14 million and to accept the early use of international credits.

Meanwhile, two years after its operation the K-ETS has clearly not lived up to expectations, as trading has been very thin and sporadic. A number of issues should be addressed such as high carbon price, low market liquidity and government market intervention which the market participants under the K-ETS are currently facing.

From the survey analysis, we find that many regulated companies under the K-ETS are getting used to price on carbon. They are now realizing that reducing emissions save money. However, due to the high uncertainty of the policy changes and market volatility companies are reluctant to take actions. In order to response to the K-ETS, companies need to understand the ETS demand and supply fundamentals, possible price scenario and the impact on their business

To address challenges facing the K-ETS market - high carbon price and low market liquidity, linking to other ETSs could be considered as one of the attractive options. However, a number of studies including ICTSD (2014) noted that the decision whether or not to link is a trade-off between the merits and demerits of linkage. These need to be seen in light of a government’s priorities.

When the governments consider partner countries for linking, they tend to prioritize their main trading partners. In practice, existing trading relationship between countries in the region should be an important factor. Since the Korea, Japan and China have the strongest trading links in the region, it is worth to assess the possible linkage among three countries and beyond. It would be beneficial to the region and a stepping stone towards a potential global carbon market further down the line.

Reference

CDC Climate Research. 2012. The EU ETS carbon price: To intervene or not to intervene?. Climate Brief No.12

Flachsland, Christian, Robert Marschinski, and Ottmar Edenhofer. 2009. To link or not to link: benefits and disadvantages of linking cap-and-trade systems. *Climate Policy*, 9(4), 358–372.

Garside, Ben. 2015. China′s Xie touts prospect of China-Korea ETS link. Carbon Pulse

Goers, Sebastian R., Barbara Pflunglmayer and Martine, J. Luger. 2012. Design issues for linking emissions trading schemes – a qualitative analysis for schemes from Europe, Asia and North America, *Journal of Environmental Science and Engineering*

ICIS Tschach Solutions. 2014. Korean ETS in a Nutshell

International Carbon Action Partnership (ICAP). 2017. ETS Detailed Information - Korea Emissions Trading Scheme

International Emissions Trading Association (IETA). 2006. *Linking the EU ETS with emerging emissions trading schemes*. IETA: Washington, D.C.

ITEA, Environmental Defense Fund (EDF) and Climate Change Research Institute of Korea (CRIK). 2016. Republic of Korea: An Emissions Trading Case Study

Judison, Jaffe and Robert Stavins. 2007. Linking Tradable Permit Systems for Greenhouse Gas Emissions: Opportunities, Implications, and Challenges. International Emissions Trading Association Report on Linking GHG Emissions Trading Systems.

Judison, Jaffe and Robert Stavins. 2008. Linkage of tradable permit systems in international climate policy architecture. Discussion Paper 08-07

Mehling, Michael. 2009. Global Carbon Market Institutions: An Assessment of Governance Challenges and Functions in the Carbon Market. Climate Strategies

Partnership for Market Readiness (PMR). 2014. Lessons Learned from Linking Emissions Trading Systems: General Principles and Applications

PMR. 2015. China: PMR Project Implementation Status Report

Sang-sun, Ha. 2017. Opportunities in the Korean ETS for private sector. Ecoeye

The Korean government. 2016. Basic National Roadmap for Greenhouse Gas Reductions by 2030.

Thomson Reuters. 2016 to 2017. Carbon Market Monitor

World Bank Group and Ecofys. 2016. State and Trends of Carbon Pricing 2016

Korea Exchange (KRX). https://ets.krx.co.kr

Greenhouse gas Inventory & Research Center of Korea (GIR).

https://www.gir.go.kr

Appendix

Questionnaire format

A Survey on Companies' Carbon Management Strategy in response to Korean Emission Trading Scheme

We wish your company' prosperity.

The Institute for Global Environmental Strategies (IGES) has been conducting a study titled "Policies and Business Initiatives toward the Innovation and Diffusion of Low Carbon Technologies in North East Asia" since 2013. For this study, our institute in collaboration with POSCO Research Institute (POSRI) is conducting a survey on major Korean companies. The purpose of the survey is to better understand low-carbon strategy of Korean companies, their responses to the K-ETS and views on potential areas for policy improvement.

Your answers to this survey will be strictly confidential in accordance with article 33 (confidentiality protection) and article 34 (responsibilities for employees) of Statistics Law and they are not allowed to be used for any purposes other than this study. Your cooperation is mostly appreciated.

Company name			
Address			
Respondent's name		Position/ Dep.	
e-mail		Tel/Fax	

Type of company	① corporation ② state-owned ③ limited partnership ④ foreign company ⑤ joint company ⑥ unlimited partnership ⑦ other ( )
Sector	① Petro chemistry ② Cement ③ Steel ④ Paper/timber ⑤ non-ferrous metal ⑥ machinery ⑦ oil refinery ⑧ electrics ⑨ others ( )
Size of company (# of employees)	① Large-sized (more than 1,000) ② Medium-sized (301 to 1,000) ③ Medium-Small-sized (51 to 300) ④ Small-sized (less than 50)
ETS	① covered ② not covered
Marginal carbon reduction cost	Carbon reduction cost per ton:_____(KRW/ tCO_2)
Type of product	① raw materials ② intermediary goods ③ final consumption goods
ISO Certification	① ISO 14001 (Environmental managements) ② ISO 14064 (GHG emissions inventories and verification) ③ ISO 50001 (Energy management)

PART I Company Profile

1. How strict do you think GHG emission regulations and requirements for information management of the government are?

① Not strict at all ② Not much strict ③ Neither strict nor not strict ④ Strict ⑤ Very strict

2. Please specify the level of competition among companies in the same sector

① Not strong at all ② Not much strong ③ Neither strong nor not strong ④ Strong ⑤ Very strong

3. Please specify (1) the major energy source of your company (2) level of price of the energy source

Major energy resource	Energy price
① electricity	① Very cheap
② coal	② cheap
③ oil	③ Neither cheap nor expensive
④ natural gas	④ expensive
⑤ steam energy	⑤ very expensive
⑥ renewable energy	

4. Please specify your company's share of exports to total shipments

① Less than 10 % ② 10 to 20% ③ 20 to 30% ④ 30 to 50% ⑤ More than 50%

5. Is the top management of your company supportive for activities of energy saving and GHG emission reduction?

① Not supportive at all

② Not much supportive

③ Neither supportive nor not supportive

④ supportive

⑤ Very supportive

6. Is the top management of your company aware of/ understand the Emissions Trading Scheme (ETS)?

① Not aware

② Only aware of the name of ETS

③ Aware of the fact that the company is covered under the ETS

④ Understand the structure of ETS

⑤ Relate ETS to costs and profits of the company

7. Please specify the level of technology of facilities that your company owns

① Lower technology than average level of companies in the same sector: need to be improved

② About average level of companies in the same sector

③ Higher than average level of companies in the same sector: Own advanced technologies

④ Own advanced technologies that can compete in global market

PART II Status of Carbon Management

8. Please indicate the carbon management activities listed below that your company has practiced.

No.	Carbon Management Activities	Yes	No
1	Short & long-term targets for energy savings and GHG emission reduction in place	□	□
2	Collecting information on policy related to energy savings and GHG emission reduction	□	□
3	Internal guidance for energy savings and GHG emission reduction in place	□	□
4	Conducting analysis on energy use and GHG emissions to identify potential areas for energy savings and emission reduction	□	□
5	Making adjustment on energy mix to use more clean energy sources	□	□
6	Making investment to improve production process for energy savings and emission reduction	□	□
7	Purchase new production facilities to save energy and reduce GHG emissions	□	□
8	Enhancing daily facility maintenance for energy saving	□	□
9	Installing monitoring equipment on energy consumed facilities	□	□
10	Enhancing optimization in transporting materials and goods	□	□
11	In-house training program for energy saving and GHG emission reduction in place	□	□
12	Encouraging daily energy saving activities in office (turning off lights)	□	□
13	Participating in training programs for energy saving and GHG emission reduction hold by the government/local government	□	□
14	Applying subsidies/financial support to the government on energy savings	□	□
15	Establishing a unit or department in charge of carbon market	□	□
16	Setting up a plan and allocating budget for purchasing permits and trading	□	□
17	Establishing decision making process in relation to carbon trading (eg, purchase, sell, price projection etc)	□	□
18	Releasing environmental reports regularly that contain data for energy consumption and GHG emissions	□	□
19	Establishing carbon management strategy based on regular analysis on carbon market	□	□
20	Adopting a green or carbon management accounting system	□	□
21	Collecting information to conduct a strategic carbon management (plan-do-check-act)	□	□
22	Others (please explain)		

9. Please specify the level of influence of institute or factor indicated below on your decision making or activities of carbon management

No.	Institute or factor related	Degree				
		Critical	Influential	Considerable	Influential but case by case	No effect
1	Central government	⑤	④	③	②	①
2	Financial institution	⑤	④	③	②	①
3	Internal needs for cost management	⑤	④	③	②	①
4	Will of management	⑤	④	③	②	①
5	Labors union in company	⑤	④	③	②	①
6	Customers	⑤	④	③	②	①
7	Media, press, SNS etc.	⑤	④	③	②	①
8	Industrial association	⑤	④	③	②	①
9	Environmental NGO etc.	⑤	④	③	②	①
10	International agreement, market reports released by international organizations (World bank, IEA etc.)	⑤	④	③	②	①
11	Other (please explain)					

10. What is/are major sources of information about carbon management? (Multiple choices possible)

① Government and governmental agencies

② Other companies in the same sector

③ Financial institutions

④ Clients including suppliers

⑤ External experts

⑥ Mass media (internet etc.)

⑦ Reports and papers from international organizations like World bank, IEA etc.

⑧ Seminars, symposiums, exhibitions etc.

⑨ Books, magazines etc.

⑩ Others ( )

11. Please specify the level of influences of below factors for the carbon management activities

	Very positive	Positive	Neither positive nor negative	Negative	Very negative
Domestic and international competitiveness	⑤	④	③	②	①
Production cost savings	⑤	④	③	②	①
Profit increase	⑤	④	③	②	①
Corporate image improvement	⑤	④	③	②	①
Emission reduction cost savings	⑤	④	③	②	①
Overall	⑤	④	③	②	①

12. Please specify the level of impact of below issues on your carbon management.

Issues	Very influential	influential	Neither influential nor not influential	Not much influential	Not influential at all
Lack of understanding and support from the top management	⑤	④	③	②	①
Lack of understanding of employees	⑤	④	③	②	①
Lack of information including regulations etc	⑤	④	③	②	①
Lack of environment friendly and low-carbon technologies	⑤	④	③	②	①
Lack of governmental support	⑤	④	③	②	①
Others (please explain)					

13. Please specify the level of usefulness of below supported policies in implementing the carbon management in your company

Areas to be improved	Very useful	Useful	Neither useful nor not useful	Not much useful	Not useful at all
Consistency and transparency of policy	⑤	④	③	②	①
Financial support (tax incentives, lending with low interests etc)	⑤	④	③	②	①
Support mechanisms to expand low-carbon technology market	⑤	④	③	②	①
Training about tools for carbon management	⑤	④	③	②	①
Others (please explain)					

14. The government promotes policies to acquire permits through International Market Mechanisms (IMM). Please specify the level of importance.

Potential issues when linking carbon markets occur	Very important	important	Neither important nor not important	not much important	Not important at all
Linking reduction targets for GHG emissions	⑤	④	③	②	①
Principal agent in IMM	⑤	④	③	②	①
Linking options for ETSs	⑤	④	③	②	①
States of following discussions to Paris Agreement	⑤	④	③	②	①
Opportunities for domestic low-carbon technologies to enter global market	⑤	④	③	②	①
Others (please explain)					

PART III Response to the Emission Trading Scheme

15. Do you think allocations of allowances for year 2015 were enough?

① Not enough ② Reasonable ③ Enough

16. Please answer if you checked ① in question # 15. Please specify your priorities.

No.	Options to deal with excess emissions	(eg)	Order of priority
1	Efforts through development of low carbon technologies and investment in facilities	1	
2	Purchasing permits in the market	4	
3	Purchasing offsets through participating in offset programs	3	
4	Borrowing from following compliance year[2)]	2	
5	Paying penalties without any effort[3)]	5	
6	Others (please explain)		

1) Offset: credits from external reduction activities, a maximum of 10% of entity's obligation
2) Borrowing: allowed only within a single trading phase with a maximum of 10% of entity's obligation, but not across phases
3) Penalty: three times the average market price of allowances of the given compliance year. Max. KRW 30,000/ton

17. Please answer if you checked ③ in question # 15. What is your option to deal with surplus allowances?

① Banking permits ② to sell in KRX trading market

③ to sell in OTC market ④ Others (please explain)

18. The ETS and its operation have several issues and problems. Please specify the level of importance.

No.	Problems	Degree				
		Very important	Important	Neither important nor not important	Not much important	Not important at all
1	Double regulation from existing policy options including GHG & Energy Target Management Scheme (TMS)	⑤	④	③	②	①
2	Not much recognition of credits from voluntary reduction activities made in the past	⑤	④	③	②	①
3	Limited numbers of offset programs that are allowed	⑤	④	③	②	①
4	Inadequate methodology for allocation and lack of allocations while target is too ambitious	⑤	④	③	②	①
5	Double burden from regulating indirect emissions and concerns for rising electricity price	⑤	④	③	②	①
6	Uncertainty for linking carbon markets	⑤	④	③	②	①
7	Lack of experts for technology	⑤	④	③	②	①
8	Uncertainty in reduction effect of the ETS	⑤	④	③	②	①
9	Difficulty to project carbon price and market	⑤	④	③	②	①

10	Doubts about ETS stabilization in early stage	⑤	④	③	②	①
11	Concerns about falling credit rating of the company when fails to meet the obligation	⑤	④	③	②	①
12	Uncertainty about policy direction and frequent change in authority	⑤	④	③	②	①
13	Clear direction of permit as a financial instrument or option to comply with regulations	⑤	④	③	②	①
14	Complex KRX trading system	⑤	④	③	②	①
15	Others (please explain)					

19. Please specify the level of possibility of each credit price that you may purchase it.

Price for credit (KRW/tCO_2)	Possibility for purchasing permits				
	Very high	high	modest	Low	Very low
3,000	⑤	④	③	②	①
5,000	⑤	④	③	②	①
8,000	⑤	④	③	②	①
10,000	⑤	④	③	②	①
12,000	⑤	④	③	②	①
15,000	⑤	④	③	②	①
18,000	⑤	④	③	②	①
20,000	⑤	④	③	②	①
23,000	⑤	④	③	②	①
26,000	⑤	④	③	②	①
30,000	⑤	④	③	②	①
33,000	⑤	④	③	②	①
37,000	⑤	④	③	②	①

20. Carbon pricing become very important as an effective tool to reduce GHG emissions and diffuse low-carbon technologies. As such, countries in East Asia have adopted or consider adopting carbon pricing mechanisms (Korea adopted ETS in 2015, China expected in 2017, and Japan to discuss again since December 2016). In addition, there has been discussion on creating East Asia carbon market. Please answer whether integrated ETS in East Asia is needed.

① Need ② No need ③ No idea

Explain

Thank you for your cooperation