19. A survey analysis of company perspective to the GHG emissions trading scheme in the Republic of Korea

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1. INTRODUCTION

The Republic of Korea (hereinafter referred as Korea) announced in November 2009 to reduce its greenhouse gases (GHG) emissions by 30 percent from the business as usual (BAU) scenario by 2020. Korean industry used 61.6 percent of the country's total energy in 2011, making it a key target of climate policies (KEMCO 2013). The enactment of the 'Basic Act on Low Carbon Green Growth' in 2010 established a legal ground for the practice of market-based instruments (MBIs), i.e., a GHG emission trading scheme (GHG ETS) and carbon tax, etc. Korea adopted the mandatory 'GHG-Energy Target Management System' (TMS) in 2011 for large energy-consuming entities. The TMS paves the way for the introduction of GHG ETS in Korea. Accordingly, a bill of quasi-mandatory GHG ETS was approved in May 2012 and determined to launch the domestic GHG ETS at the beginning of 2015. More recently, a bill of carbon tax was also proposed, suggesting the introduction of this policy from 2016.

GHG ETS holds a theoretical advantage in cost efficiency and shall be effective for GHG mitigation referring to the experience of the European Union (EU) ETS as the largest example of emissions trading in operation, encompassing over 11,500 installations across 30 countries and covering approximately 40 percent of total EU emissions. This scheme has led to emissions reductions of 40–80 Mt-CO_2 per year, sharing about 2–4 percent of the total capped emissions. This amount is much bigger than the impact of most other individual policy instruments. According to the studies investigating the impact of the EU ETS based on managerial interviews at firms, EU ETS has captured the attention of decision-makers and brought some impact on the innovation and investment of low carbon technology

(Laing et al. 2013). However, businesses in Korea indicate less acceptability to carbon pricing policies and show limited affordability of costs originated from the introduction of MBIs (Suk et al. 2013; Suk et al. 2014). Our previous survey confirmed the marginal function of the government in enhancing Korean companies' energy saving and GHG mitigation practices (Suk, Liu and Sudo 2013). The resistance from industry was identified as the largest barrier for the introduction of GHG ETS in Korea (Liu, Suk and Sudo 2012). In practice, the acceptance level of companies, as the major policy targets, is a key factor determining the actual progress and success of climate policies. It is necessary to understand viewpoints of businesses to the policies in advance. However, few studies have been conducted at the individual company level in Korea under the emerging process of carbon pricing policies.

Aiming to bridge the existing gap, a questionnaire survey to Korean companies was arranged to clarify their perspective to GHG ETS. Two topics are discussed in this chapter. One is to monitor the opinions of Korean companies to various aspects of GHG ETS. The other is to identify the difference in companies' viewpoints due to their characteristics in organizational size, sector and ownership. Three sectors, iron and steel, cement and petro-chemical industries, were targeted since they are energy-intensive and significant for realizing the country's overall goal of GHG mitigation.

The remainder of this chapter is as follows. Section 2 describes the progress of GHG ETS in Korea and the debate for the introduction of this scheme. Section 3 outlines the questionnaire survey and the samples. Section 4 discusses the survey analysis results. Lastly, section 5 concludes this survey study.

2. THE PROGRESS OF GHG ETS IN KOREA

2.1 GHG ETS Proposals and Bill of Korea

The preliminary proposal of GHG ETS was first formulated in November 2010, suggesting its introduction in 2013 with three phases. The first phase would start from 2013 and end in 2015. Two following phases would run for five years for each from 2016. In this proposal, 10 percent of the total allowances would be allocated by auction and the remaining 90 percent for free in the initial phase, with the auction proportions increased thereafter. The penalty for non-compliance emissions is less than five times the average market price of credits. This preliminary proposal received strong opposition from industry. As a result, the proposal was revised and its stringency

was watered down in terms of starting time, the allocation of emissions allowances and the level of penalty, etc. The starting time was postponed to January 1, 2015 and 95 percent allowances would be allocated for free in the initial period. The penalty was decreased to less than three times the average market price and up to 100,000 KRW/t-CO_2 (about 90 US$/t-$CO_2$). The updated proposal called for an 'Allocation Committee', led by the Ministry of Strategy and Finance (MOSF), for determining the method of allowances allocation for each field and maintaining the stability of the carbon market. This proposal indicated one likely option for targeting the largest energy consumers or GHG emitters heading the list of TMS targets. Allowances transfer is allowable between different compliance periods.

This revised proposal was submitted to the parliament in April 2011. After slight revisions, the GHG ETS bill, namely the 'Act on Allocation and Trading of Greenhouse Gas Emissions Allowances', was finally approved by the parliament in May 2012. Later, the 'Presidential Decree', officially approved on November 13, 2012, clarified the commencement of GHG ETS since the beginning of 2015 and specified the management rules. Responsibility for operation lies within the Ministry of Environment, Korea (MOEK). The entities emitting over 125,000t-CO_2 and business sites emitting over 25,000t-CO_2 annually shall participate obligatorily. The legislation provides for allowances to be allocated fully for free in the first phase (2015–2017), at 95–97 percent for the second phase (2018–2020) and at 90 percent for the third phase (2021–2025). Banking within and between compliance periods, and borrowing within compliance periods, are allowed. Six years later, domestic and foreign individuals or corporations can join as parties for the transaction. The carbon leakage sectors will be given 100 percent free allocation. Early action for GHG reductions will be recognized. MOEK established the 'Emissions Trading Task Force' to prepare for the detailed allocation method for emissions allowances.

2.2 The Debate for the Introduction of GHG ETS in Korea

Cost effectiveness is viewed as the key merit for Korea to introduce GHG ETS. The evaluations of several core research institutes in Korea did indicate that GHG ETS would be more cost effective than the mandatory regulations, like TMS, and could save the cost by 44 to 68 percent for achieving the country's GHG mitigation target of 2020 (PCGG press 2011; Kim 2010; Lee 2009). On the other hand, Korea Energy Management Corporation (KEMCO) estimated that the additional production cost would be 5.6 trillion KRW (About 943 million US$) for main industries if 10 percent of the allowances were allocated by auction. Similarly, several

studies revealed the additional production cost increase of overall sectors in difference allowance scenarios of the ETS introduction (Kim 2009; Lee 2010; Han, Lim and Kwak 2010, Steel & Steel 2011; Cho 2011). Referring to the estimation results above, the industry argued that GHG ETS would obviously weaken the industrial competitiveness due to the increase of production costs, and increase burden to the Korean economy as a whole.

Korean industry also emphasized that early action of Korea would bring significantly adverse impacts to its competitiveness in international markets, considering the laggard policy movement of major competing economies, for example, the US, China and Japan, in the pricing of carbon emissions. Korean companies pointed out that this policy effort of Korea would not have virtual contribution to the mitigation overall, given that GHG emissions of Korea only account for 1.7 percent of global total. The other concerns of industry include the stability of carbon credit prices and the sufficient number of participants for the market to operate smoothly. Actually, the number of business sites emitting GHG emissions over 25,000t-CO_2 in 2007 was only 704 in Korea, with emissions sharing 78 percent of the total from the manufacturing sector. The top 25 business sites contributed to 40 percent of the emissions of manufacturing industry (except for the power sector). The total participants by the business sites in Korea would be no more than 600. If counted by entities, the number of GHG ETS targets would be much less. High concentration of GHG emissions emitters and small number of GHG ETS targets may cause low credit liquidity and instability of carbon prices.

Our previous study confirmed that Korean companies agree with the usefulness of governmental requirements in mandatory (Suk et al. 2013). The companies in this survey further stated that the existing regulations of Korea are strict enough and effective considering the introduction of the GHG ETS. They strongly appeal their good performance to abide by the regulations and insist on their limited potential for energy efficiency improvement and GHG mitigation. In fact, petro-chemical, cement, and iron and steel sectors have achieved comparative levels with Japan and Germany in energy efficiency (IEA 2007). The companies thus argued that GHG ETS with high stringency would discourage their investments since they have to purchase additional credits for the increased production.

3. THE QUESTIONNAIRE SURVEY AND THE SAMPLES

Based on the understanding of the Korean situation, a questionnaire was developed with main objectives of estimating the affordability of

Table 19.1 Distribution of respondents by company characteristics

Company's characteristics		Number of samples				Number (Percentage)
		Small	Medium	Large Medium	Large	
Sector	Cement	2	6	2	1	11 (17.7)
	Steel	–	8	5	3	16 (25.8)
	Petro-chemical	–	13	13	9	35 (56.5)
Number (Percentage)		2 (3.2)	27 (43.5)	20 (32.2)	13 (21.0)	62 (100.0)
TMS target or not	TMS	2	26	17	13	58 (93.5)
	Non-TMS	–	1	3	–	4 (6.5)
Number (Percentage)		2 (3.2)	27 (43.5)	20 (32.2)	13 (21.0)	62 (100.0)

companies on carbon prices and measuring their perspective to GHG ETS. Major components of the format include company general information; company's energy use and management status; the acceptability level to various energy cost increases due to carbon pricing policies; and, company's opinions of GHG ETS. This chapter summarizes the part of companies' perspective of GHG ETS.

The survey was carried out from January 25 to February 10, 2012. Questionnaires were sent via fax and email to 205 companies, including 137 TMS target companies and 68 non-TMS, intending to be filled out by environmental and energy managers. Valid answers from 62 companies were collected and used for this analysis. The distribution of the samples by company characteristics is summarized in Table 19.1.

The respondents from cement, iron and steel and petro-chemical sectors individually account for 17.7 percent, 25.8 percent and 56.5 percent respectively of the total. Twenty seven are medium-sized companies having 50–300 staff, 2 are small companies with staff numbers less than 50, and 13 are large companies with employees over 1,000. The remaining 20 companies are those with relatively larger scale than medium-sized companies but smaller than large ones, which are thus categorized as large medium-sized companies in this survey. Of the total 62 samples, 58 are TMS target companies.

Overall, the surveyed companies are large energy consumers and heavy carbon emitters. Around 95 percent of them used more than 2,000 TOE (Ton of oil equivalent) of energy in 2010. The samples consuming more than 100,000 TOE in 2010 account for 35.5 percent of the total. Most respondents (92 percent) emit over 25,000t-CO_2 annually. The companies

with emissions less than 5,000t-CO_2 only share 4.8 percent. The other companies answered that their annual CO_2 emissions are between 5,000 to 15,000t-CO_2. The companies were requested to check their potential for energy saving. A majority of them evaluated that there remains limited energy saving potential. Even 40 percent of iron and steel companies selected almost no further potential. Only 3 percent of the samples in the petro-chemical sector admit that they have very high potentials.

4. RESULTS AND DISCUSSIONS

4.1 Companies' Evaluations of Merits of GHG ETS

The companies were asked to evaluate the advantages of GHG ETS to be implemented in Korea. A five-point scale was applied, with 5 = 'very appropriate', 4 = 'appropriate', 3 = 'somewhat appropriate', 2 = 'not appropriate', 1 = 'not appropriate at all'. The average scores for the six merits listed in the questionnaire are shown in Table 19.2.

The companies evaluated the advantages of GHG ETS at low degrees and almost all the merit items achieved a mean under 3.00. The samples moderately recognize GHG ETS as an effective measure for GHG mitigation, with a mean of 3.08 for MERIT01. Although the Korean government expects to make use of the advantage of GHG ETS in cost efficiency, the businesses seem not to agree with this, with the mean for MERIT02 being 2.86. The companies do not believe that GHG ETS could generate economic revenues at the current stage and present MERIT05 the lowest mean of 2.08. This result confirms the negative attitude of Korean companies to the introduction of GHG ETS in Korea.

Econometric regressions were performed for identifying the differences in companies' evaluations of GHG ETS merits due to their various characteristics. ~~Like~~ the dependent variables, the evaluations of GHG ETS merits, MERIT01 to MERIT06, are in an ordinal measurement. An ordered logistic model is a rational choice for this analysis (Greene 1997). Company size, sector, ownership, TMS involvement and its international orientation are selected as the independent variables. The company size, SIZE, is classified into small, medium, medium-large and large, individually named as SMALL, MEDIUM, MLARGE and LARGE. Sector, SECTOR, has three categories: iron and steel, cement, and chemical, which are presented as STEEL, CEMENT and CHEMICAL. The ownership consists of two types, domestically private and foreign-funded, DOMESTIC and FOREIGN. The status of TMS involvement is indicated as TMS for the targets and non-TMS for the others. The main market

Table 19.2 Companies' evaluations of merits of GHG ETS

Item	Merits	Mean of scores			
		Overall (N=62)	Chemical (N=35)	Cement (N=11)	Steel (N=16)
MERIT01	ETS is an effective measure to mitigate GHG emissions	3.08	3.40	2.55	2.75
MERIT02	ETS is cost-effective compared with regulative policies	2.86	2.83	2.64	3.06
MERIT03	There would be an advantage to be better involved in international carbon market if introduced earlier	2.40	2.63	2.00	2.19
MERIT04	It is a global policy trend to introduce ETS	2.45	2.66	2.09	2.25
MERIT05	Compared with TMS, ETS has a possibly positive effect in generating economic revenues	2.08	2.23	1.82	1.94
MERIT06	Introducing ETS may generate the opportunities for new business and employment	2.50	2.69	2.09	2.38

of the products, EXPORT, is used as the proxy of a company's international orientation. Companies with products for the domestic market are presented a value of '0' and '1' is for the export-oriented companies. The regression coefficients are listed in Table 19.3.

The regression results of MERIT01, MERIT04 and MERIT06 are statistically significant. Compared with cement companies, the samples from the petro-chemical industry gave more positive assessment to all these three merits of GHG ETS. Company size is significantly but negatively associated with the evaluations of MERIT04. It is less likely for the companies with medium size and above to view GHG ETS as a global policy trend than the small ones. Similarly, TMS targets more negatively evaluate MERIT04

Table 19.3 Regression results of companies' evaluations of merits of GHG ETS

Independent variables		Dependent variables					
		MERIT01	MERIT02	MERIT03	MERIT04	MERIT05	MERIT06
SECTOR	STEEL	0.389	0.583	0.151	0.741	0.448	0.540
	CHEMICAL	**1.262**[a]	0.361	0.629	**1.274**[a]	0.898[c]	**0.912**[b]
SIZE	MEDIUM	−0.862	−1.291	0.577	**−1.546**[c]	−0.522	−0.812
	MLARGE	−0.407	−0.980	1.182	−1.419	−0.537	−0.594
	LARGE	−0.806	−1.325	0.918	**−1.759**[b]	−0.740	−1.305
DOMESTIC		0.301	−0.647	−0.076	0.358	0.007	0.282
TMS		−0.566	−0.217	−0.774	**−1.238**[b]	−1.426[b]	**−1.70**[a]
EXPORT		−0.178	−0.051	−0.128	−0.543	−0.126	0.208
Obs.		62	62	62	62	62	62
LR chi		**16.08**[b]	5.57	12.23	**15.42**[c]	10.16	**17.84**[b]
Pseudo R^2		0.098	0.030	0.073	0.089	0.067	0.100

Notes: a Significant at 1%; b Significant at 5%; c Significant at 10%.

and MERIT06 in comparison with the non-TMS companies. This result is consistent with intuitive perception. The companies with higher energy intensities, larger size and covered by TMS are more likely included by GHG ETS and have negative attitudes to the merits of this policy.

4.2 Companies' Evaluations of Negative Aspects of GHG ETS

In order to find out to what extent Korean businesses are concerned about the negative issues of GHG ETS, the samples were requested to evaluate 10 items of disadvantages pre-listed in the questionnaire. A five-point scale was applied, with 5 being 'highly concern' and 1 meaning 'no concern at all'. The statistics are presented in Table 19.4.

The companies revealed high concerns about the negative aspect of GHG ETS and all the items achieved a mean of nearly 4.00 and over. Among which, NEG01 is presented the highest mean of 4.52. This implies that the companies commonly and most worry about the loss of business competitiveness due to the production cost increase if GHG ETS is phased in earlier in Korea than major competition countries. The uncleanness of the detailed operation scheme, for example, method for emissions allowance allocation (NEG02), was ranked the second, with a mean of 4.39. The surveyed companies are also concerned about other ambiguous issues of GHG ETS, including the expected contribution of this policy for GHG mitigation of the country (NEG04), the relationship between GHG ETS and the mandatory TMS (NEG03), market liquidity (NEG06), carbon price stability (NEG07) and the unclear responsibilities of related authorities for the policy implementation (NEG10). This requires the Korean government to further clear these aspects for achieving the understanding and support from the industry.

Ordered logistic analyses were carried out with companies' evaluations of disadvantages of GHG ETS, NEG01 to NEG10, as the dependent variables, and the company's characteristics as independents. The regression coefficients, as listed in Table 19.5, indicate that the results of NEG02, NEG06, NEG07 and NEG10 are statistically significant.

Company size and sector significantly determine their evaluation of negative aspects of GHG ETS. Specifically, it is less likely for chemical companies to be concerned about these three negative points of GHG ETS compared with the cement industry. Steel companies are less concerned on carbon price stability (NEG07) than their counterparts from the cement sector. In comparison with small companies, the samples of the other size categories are more likely to emphasize NEG02, NEG06 and NEG07. Additionally, foreign-funded companies tend to make clear the competent authorities and their responsibilities in implementing GHG ETS (NEG10)

Table 19.4 Companies' evaluations of negative aspects of GHG ETS

Item	Negative aspects	Mean of the scores			
		Overall (N=62)	Chemical (N=35)	Cement (N=11)	Steel (N=16)
NEG01	Premature implementation and loss of business competitiveness	4.52	4.40	4.91	4.50
NEG02	Unclearness of the detailed operation scheme including emission allowance allocation method, etc.	4.39	4.17	4.73	4.63
NEG03	Unclearness of the detailed measure to avoid the possible double burdens with TMS	4.29	4.20	4.18	4.56
NEG04	Ambiguity of the contribution of ETS to national GHG reductions	4.02	3.89	4.00	4.31
NEG05	Company's lack of capacity to cope with the implementation of ETS	4.00	3.86	4.18	4.19
NEG06	Insufficient liquidity of carbon market due to the limited credit volume in total	3.98	3.71	4.27	4.38
NEG07	Instability of carbon price and the speculative trading	4.05	3.94	4.36	4.06
NEG08	Carbon leakage problem	3.97	3.89	4.27	3.94
NEG09	Foreign companies hesitate to invest in Korea and the problem of domestic deindustrialization	4.16	4.00	4.55	4.25
NEG10	Ambiguity of the competent authorities and their responsibilities in implementing ETS	3.98	3.83	4.00	4.31

than the ones with domestic ownership. TMS targets address NEG06 more than the non-TMS ones.

4.3 Companies' Preparations for GHG ETS

The companies were asked to check the activities they have practiced or plan to do for the preparation of GHG ETS. Table 19.6 lists the percentages of samples with the answer 'YES' overall and by sector.

Table 19.5 Regression results of companies' evaluations of negative aspects of GHG ETS

Independent variables		Dependent variables									
		NEG01	NEG02	NEG03	NEG04	NEG05	NEG06	NEG07	NEG08	NEG09	NEG10
SECTOR	STEEL	−1.358	−1.076	0.440	0.423	−0.131	−0.446	**−0.937**[c]	−0.833[c]	−0.756	0.641
	CHEMICAL	−1.534	**−1.958**[a]	−0.150	−0.206	−0.676	**−1.522**[a]	**−1.209**[b]	−0.946[b]	−1.236[b]	0.002
SIZE	MEDIUM	−4.604	**2.177**[b]	0.485	1.061	0.417	**2.582**[a]	**1.716**[c]	1.434	1.110	0.823
	MLARGE	−4.852	**2.277**[b]	0.311	0.610	0.382	**2.712**[a]	**1.781**[c]	1.150	0.699	0.201
	LARGE	−4.631	**2.466**[b]	0.801	1.070	0.905	**3.217**[a]	**2.467**[b]	2.059[b]	1.059	1.078
DOMESTIC		−0.234	−0.236	−0.430	−0.556	−0.023	−0.365	−0.552	−0.343	−0.568	**−1.056**[b]
TMS		1.050	0.990	−0.122	0.182	0.810	**1.377**[b]	0.903	−0.216	−0.637	−0.976
EXPORT		0.060	−0.139	−0.392	−0.416	−0.086	−0.358	−0.089	0.078	0.445	−0.879
Obs.		62	62	62	62	62	62	62	62	62	62
LR chi		11.96	**17.37**[b]	6.55	10.73	7.59	**25.82**[a]	**14.48**[c]	10.27	11.87	**20.06**[b]
Pseudo R^2		0.110	0.146	0.052	0.079	0.057	0.175	0.106	0.077	0.087	0.138

Notes: a Significant at 1%; b Significant at 5%; c Significant at 10%.

Table 19.6 Companies' preparations for GHG ETS

No.	Preparation activities	Percentage with 'YES' (%)			
		Overall (N=62)	Cement (N=11)	Steel (N=16)	Chemical (N=35)
1	Establish a specific division for TMS and ETS	38.7	48.6	27.3	25.0
2	Sign the MOU with government for the self-implementation of ETS within the group company	4.8	8.6	0.0	0.0
3	Establish the company's inventory of GHG emissions and verified by a third party	93.5	94.3	90.9	93.8
4	Participate in the pilot project of ETS or TMS	33.9	48.6	27.3	6.3
5	Develop the offset program for achieving carbon credits	3.2	2.9	0.0	6.3
6	Plan to move the factory abroad with loose carbon regulations	4.8	5.7	0.0	6.3
7	Hire or outsource external professionals or company for necessary preparations	21.0	22.9	0.0	31.3

It is encouraging that most companies (93.5 percent) have established the internal inventory of GHG emissions, which is verified by a third party. This is because most sampled companies are targeted by the TMS launched in 2011 and TMS requires the target entities to establish their inventories of GHG emissions. Companies have made some preparations for GHG ETS by institutional arrangement. Nearly 40 percent of them established a specific division for TMS and GHG ETS. Around one-third of the samples actively participate in the pilots of TMS or GHG ETS for accumulating policy practice experience. Nevertheless, the companies have not started to act by self implementation and this activity only achieved a participation ratio of 4.8 percent. The samples did not consider about achieving carbon credits by the offsetting programs, which obtained the lowest participation ratio of 3.2 percent. It is meaningful that the companies do not believe the moving of production to areas with loose regulations is an option and less than 5 percent of the samples ticked this choice.

4.4 Companies' Behavioral Changes in Response to GHG ETS

The companies' energy costs would increase while introducing GHG ETS. Aiming to understand the possible responses of companies to this policy, we requested the samples to check the possibility to take alternative actions. A five-point scale was applied with the meanings: 5 = 'very possible'; 4 = 'relatively possible'; 3 = 'moderate possibility'; 2 = 'low possibility'; and 1 = 'completely impossible'. The statistics are listed in Table 19.7.

Table 19.7 Companies' behavioral changes in response to GHG ETS

No.	Optional actions	Mean of scores			
		Overall (N=62)	Chemical (N=35)	Cement (N=11)	Steel (N=16)
1	Strengthen internal management and save energy through management measures	3.82	3.89	3.73	3.75
2	Invest in more advanced energy-saving technologies and equipment	3.58	3.71	3.45	3.38
3	Self-investment in research and ~~develop~~ of new energy-saving technologies and equipment	2.84	2.97	2.36	2.88
4	Try to use low carbon energies, adjust the company's energy use structure	2.90	3.09	2.09	3.06
5	Adjust product structure for reducing energy intensity per product	3.31	3.46	2.82	3.31
6	Raise the product price to transfer the increased costs	3.15	3.00	3.18	3.44
7	Increase production amount to reduce the energy cost in average	2.84	3.00	2.45	2.75
8	Reduce productions to alleviate market pressure due to cost increase	2.11	2.09	2.27	2.06
9	Relocate part or all the company to areas with relatively loose policies	2.32	2.43	2.18	2.19
10	Stop the production and business due to cost pressures	2.03	2.03	2.73	1.56
11	No specific reaction by accepting the loss due to cost increase	2.68	2.57	2.73	2.88

The companies would avoid the reactive behaviors, including to reduce production; move production to the areas with loose policy; close production facilities; and to take no reaction by accepting the loss. These four choices were presented average scores under 2.70. In contrast, the companies prefer to make internal efforts in energy saving to relieve the policy's negative impacts. Practicing managerial energy saving activities is the most possible choice, with the highest mean of 3.82. To invest in energy efficient technologies, self-investment in R&D and use less carbon-intensive energies are preferable options with relatively higher possibilities. Besides capping emissions, another key objective of the GHG ETS is to drive innovations in low carbon technologies, incentivize additional investments in low carbon assets and reduce investment in carbon-intensive products and processes. The companies would not like to simply transfer the policy economic burden to their clients. The option of raising product prices for cost shifting achieved a moderate mean of 2.84. De Groot, Verhoef and Nijkamp (2001) suggested that Dutch companies would more possibly charge the customers with additional costs given an energy tax increase. The different finding of this survey may be attributed to the strict competition faced by Korean companies. In this sense, our survey, to a certain degree, confirmed the effectiveness of GHG ETS in enhancing Korean companies' efforts in energy saving and GHG mitigation.

4.5 The Barriers for Companies to Implement GHG ETS

The companies were asked the difficulties they may encounter for the implementation of GHG ETS. Table 19.8 lists the percentages of samples confirming the barriers pre-listed in the survey document.

It is obvious that companies feel pressures from the introduction of GHG ETS due to the limited reduction potential, with the highest ratio of 80.6 percent. As mentioned earlier, energy intensities of the three target sectors have been improved dramatically in the past (Park and Kim 2009). The energy efficiency of the most energy-intensive petro-chemical and steel sectors in Korea has generally outpaced their counterparts in other countries (IEA 2009). The barriers with relatively high ratios of 'YES' answers are 'lack of information for the analysis of future carbon market' (64.5 percent) and 'lack of specialists on energy management and reduction potential identification' (61.3 percent). Fewer companies confirmed the 'budget shortage' (38.7 percent) and 'lack of awareness of top management' (33.9 percent) as the difficulties to implement GHG ETS.

Table 19.8 Barriers of companies for the implementation of GHG ETS

No.	Barriers	Percentage with 'YES' (%)			
		Overall (N=62)	Chemical (N=35)	Cement (N=11)	Steel (N=16)
1	Lack of information for the analysis of future carbon market	64.5	74.3	45.5	56.3
2	Lack of technology	50.0	51.4	45.5	50.0
3	Limited reduction potential	80.6	80.0	90.9	75.0
4	Lack of specialists on energy management and reduction potential identification	61.3	54.3	81.8	62.5
5	Budget shortages	38.7	48.6	45.5	12.5
6	Lack of effective incentive and support policies at national level	50.0	48.6	54.5	50.0
7	Lack of awareness at top management level	33.9	45.7	18.2	18.8

4.6 Companies' Expectations for GHG ETS

In the survey, companies were allowed to show their expectations for the implementation of GHG ETS. The results are shown in Table 19.9.

Similarly as the evaluation results of disadvantages of GHG ETS, the samples highly expect that GHG ETS could well coordinate with existing regulations, like Energy Audit and TMS (with a ticked ratio of 75.8 percent). 72.6 percent of the samples expect the government to clarify the allowance allocation method earlier for them to better understand the real policy impact. The companies are reluctant to take much economic burden from GHG ETS. Nearly three-quarters of them hope to alleviate the burdens either by reducing the penalties for the excessive emissions or by expanding the incentives in forms of tax reduction and subsidies, etc. More than half of the samples (58.1 percent) expect the government to appropriately appreciate the early actions for GHG reductions. Training programs are viewed necessary for the companies to improve their understanding of the latest policy progress and 56.5 percent of the samples expressed this expectation.

Table 19.9 Companies' expectations for GHG ETS

No.	Expectations	Percentage with 'YES' (%)			
		Overall (N=62)	Chemical (N=35)	Cement (N=11)	Steel (N=16)
1	To coordinate with existing regulations such as Energy Audit and TMS	75.8	68.6	81.8	87.5
2	To clarify the competent ministries and their specific roles	54.5	54.3	54.5	56.3
3	To provide related information	37.1	37.1	36.4	37.5
4	To conduct training programs to improve the understanding of the latest policy progress	56.5	68.6	27.3	50.0
5	To appropriately appreciate the early actions for GHG reduction such as KCER and Energy Audit	58.1	48.6	72.7	68.8
6	To diversify the offset credits	12.9	5.7	18.2	25.0
7	To clarify the allowance allocation method in earlier	72.6	80.0	63.6	62.5
8	To expand incentives policies (tax reduction, subsidies, etc.)	74.2	77.1	90.9	56.3
9	To alleviate penalties on the excessive carbon emissions	74.2	80.0	90.9	50.0

5. CONCLUSIONS

This chapter summarized the perspective of Korean companies to GHG ETS to be formally launched in 2015 in Korea. The analysis was carried out in a qualitative manner using the data collected by a questionnaire survey to energy-intensive petro-chemical, cement, and iron and steel industries. The results indicated that the companies do not appreciate the merits of GHG ETS, whereas they have strong concerns about its negative aspects. Most of the surveyed companies are still opposite to the introduction of GHG ETS although the introduction schedule has been decided by the government. Most of companies under TMS established the inventory for GHG emissions, which provides a necessary basis for the actual implementation of GHG ETS. A meaningful finding from this survey is that the companies would make internal efforts in energy saving and GHG mitigation and invest in energy efficient technologies rather than simply transfer the policy burden to their clients. This result

confirms the effectiveness of GHG ETS for enhancing a company's carbon performance in Korea. Our survey also clarified the difficulties and expectations of the industry for GHG ETS. The Korean government shall make efforts to meet these expectations for the companies to overcome the barriers. Specifically, the coordination of GHG ETS with ongoing policies, declaration of the method for emissions allowance allocation, clarification of responsibilities of authorities in charge, and capacity building are the priorities. These efforts may increase the understanding and support from the industry for smooth implementation of GHG ETS in Korea.

The current bill of GHG ETS of Korea is friendly for companies in order to minimize their resistance to the adoption of this policy. On the other hand, it is essential to have an adaptation period with loose policy requirements for the arrangement of the relevant institutional infrastructure and to test the scheme's operation at the early stage of the policy introduction. As confirmed by the interview-based studies to the companies under EU ETS, the effectiveness of this scheme is dependent on its strictness. The stringency of GHG ETS of Korea should be strengthened in later phases for achieving the policy goals in carbon mitigation and low carbon technology investment as desired.

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