



저작자표시-비영리-변경금지 2.0 대한민국

이용자는 아래의 조건을 따르는 경우에 한하여 자유롭게

- 이 저작물을 복제, 배포, 전송, 전시, 공연 및 방송할 수 있습니다.

다음과 같은 조건을 따라야 합니다:



저작자표시. 귀하는 원저작자를 표시하여야 합니다.



비영리. 귀하는 이 저작물을 영리 목적으로 이용할 수 없습니다.



변경금지. 귀하는 이 저작물을 개작, 변형 또는 가공할 수 없습니다.

- 귀하는, 이 저작물의 재이용이나 배포의 경우, 이 저작물에 적용된 이용허락조건을 명확하게 나타내어야 합니다.
- 저작권자로부터 별도의 허가를 받으면 이러한 조건들은 적용되지 않습니다.

저작권법에 따른 이용자의 권리는 위의 내용에 의하여 영향을 받지 않습니다.

이것은 [이용허락규약\(Legal Code\)](#)을 이해하기 쉽게 요약한 것입니다.

[Disclaimer](#)

**Master's Thesis of Public Administration**

**Environmental Effectiveness Analysis  
on Voluntary Environmental Program  
: A Case Study of the Green Enterprises Initiative**

(자율형 환경정책의 환경적 효과 분석 연구  
: 녹색기업 지정제도 사례를 중심으로)

**February 2018**

**Graduate School of Public Administration  
Seoul National University  
Global Public Administration Major**

**Boyoung Kang**

# **Environmental Effectiveness Analysis on Voluntary Environmental Program : A Case Study of the Green Enterprises Initiative**

**Academic Advisor                  Hong, JoonHyung**

**Submitting a master's thesis of Public Administration**

**September 2017**

**Graduate School of Public Administration  
Seoul National University  
Global Public Administration Major**

**Boyoung Kang**

**Confirming the master's thesis written by  
Boyoung Kang**

**December 2017**

**Chair                  Kim, Soon Eun                  (Seal)**

**Vice Chair         Kwon, Huck-ju                  (Seal)**

**Examiner           Hong, Joonhyoung                  (Seal)**

# Abstract

Voluntary environmental programs encourage companies to achieve environmental performance beyond legal standards. Unlike traditional context of environmental regulation, companies actively participate in setting up environmental targets, have flexibility in how they achieve the target, and, thus, improve their environmental performance in a cost-effective way. It also corresponds with companies' profit maximizing strategies by participating in voluntary environmental programs. Voluntary environmental programs are also beneficial to regulators because they can save their own costs. In this regard, environmental programs of voluntary approach for environmental policy have become a prevailing alternative to regulation of command (and control) approach.

There have been a considerable number of voluntary environmental programs introduced in Korea as well. The study focuses, however, on the environmental effects of voluntary environmental programs, which is a case study on the Green Enterprises Initiative, one of the oldest and most popular voluntary environmental programs in Korea.

Participants of the Green Enterprises Initiative do not necessarily achieve higher levels of environmental performance than non-participants. There is no significant difference between participants and non-participants regarding annual average air pollutant emission concentration levels of sulfur oxides and nitrogen oxides. Each participant had a different path of environmental performance from

2012 to 2016, and not all of the participants improved their own environmental performance continuously. The Green Enterprises Initiative membership also has a limited impact on regulatory compliance. Therefore, the common belief that companies participating in voluntary environmental programs have higher environmental performance than companies that are not cannot be always supported.

It is complicated to define environmental performance. For the sake of comparative purposes, this research uses emission data as environmental performance, and it was gathered from the remote monitoring system, CleanSYS. Therefore, the conclusion from the data analysis can only be applied to end-of-pipe pollutant reduction and larger companies with smokestack facilities. The remote monitoring system and the size of companies impact on the voluntary actions of companies and they may encourage non-participants to commit to environmental performance beyond compliance. Voluntary environmental programs cover more various environmental activities than conventional reduction. The environmental effects of voluntary environmental programs also can be assessed in a more comprehensive way including qualitative environmental performance. Further study of the environmental effects of voluntary environmental programs for small and medium sized-companies is needed.

**Keywords:** Voluntary environmental programs, Voluntary approach, Environmental regulation, Environmental Policy, Green Enterprises Initiative

**Student Number:** 2015-24256

# Table of Contents

## Chapter 1. Introduction

1.1. Background .....	1
1.2. Purpose of the Study .....	3

## Chapter 2. Literature Review

2.1 Definitions and Categories .....	5
2.2 Motivation of Companies .....	10
2.3 Motivation of Regulators .....	15
2.4. Efficiency and Effectiveness .....	17

## Chapter 3. The Green Enterprises Initiatives

3.1 Background .....	21
3.2 Program Design and Implementation .....	23
3.3 Current Status of the Initiative .....	26

## Chapter 4. Research Design

4.1 Hypothesis .....	30
4.2 Data and Methods .....	32
4.2 Ground of Comparison .....	34

**Chapter 5. Data Analysis**

**5.1 Emission Levels .....35**

**5.2 Emission Improvement .....41**

**5.3 Regulatory Compliance .....45**

**5.4 Conclusion .....49**

**Chapter 6 Conclusion**

**6.1 Findings and Policy Implications .....51**

**6.2 Limitation and Further Study.....54**

**References .....57**

**Abstract in Korean .....62**

## List of Figures

<b>Figure 1. The Number of Green Enterprises Initiative Members</b> .....	<b>29</b>
<b>Figure 2. The Annual Average Emission Concentration Levels – SO<sub>x</sub>①</b> .....	<b>36</b>
<b>Figure 3. The Annual Average Emission Concentration Levels – SO<sub>x</sub>②</b> .....	<b>37</b>
<b>Figure 4. The Annual Average Emission Concentration Levels – NO<sub>x</sub>①</b> .....	<b>39</b>
<b>Figure 5. The Annual Average Emission Concentration Levels – NO<sub>x</sub>②</b> .....	<b>40</b>
<b>Figure 6. Changes in the Annual Average Emission Concentration– SO</b> .....	<b>42</b>
<b>Figure7. Changes in the Annual Average Emission Concentration –</b> <b>NO<sub>x</sub></b> .....	<b>42</b>
<b>Figure 8. Changes in the Individual Annual Average Emission</b> <b>Concentration</b> .....	<b>44</b>
<b>Figure 9. The Number of Violations – SO<sub>x</sub></b> .....	<b>47</b>
<b>Figure 10. The Number of Violations– NO<sub>x</sub></b> .....	<b>48</b>

## List of Tables

<b>Table 1. The Verification of the Research Hypotheses</b> .....	<b>50</b>
---	-----------

# **Chapter 1. Introduction**

## **1.1. Background**

Command and control approach is a conventional way of environmental policy to secure environmental quality. Regulators specify environmental targets such as emission levels, and implementing tools like an abatement technology (OECD, 2000; Lyon & Maxwell, 1999). They monitor and assess companies, the regulated, and if a company fails to meet the mandate, they order legal sanctions, from fines and penalties to cancelation of business permits.

Regulations have improved environmental quality, especially in terms of air and water pollution (OECD, 2000). Because, it is natural for companies, as rational actors to avoid paying cost of own pollution. However, command and control approach is also accused of their inflexibility, which causes cost-inefficiencies, higher compliance costs and hinders environmental innovations (Lyon & Maxwell, 1999; Gunningham & Sinclair, 2002, Arimura et al., 2008, Rivera, 2002). There also has been increasing doubt about the effectiveness of command and control approach and a growing need for alternative approaches (OECD, 2000; Khanna, 2001, Arimura et al., 2008). Sceptics of command and

control approach believe that more flexible and cost-efficient ways to secure environmental performance from companies exist.

Voluntary approach for environmental policy or voluntary environmental programs were first introduced in OECD countries during the 1960s and the early 1970s (OECD, 2000). It gained popularity as an alternative to command and control approach, because it would save costs for both of companies and regulators while improving environmental performance (Lyon & Maxwell, 1999, Krarup, 2001) Companies began to actively take part in establishing and implementing voluntary environmental programs. Companies have greater flexibility to employ less-costly environmental management. Governments can also save implementation costs and compliance costs through the partnerships with companies.

The voluntary environmental programs cover almost every part of environmental policy, from existing regulations such as air and water pollutant reduction to relatively new issues such as climate change (Koehler, 2007). It is not only OECD countries but also developing countries where voluntary environmental programs have become prevalent (Rivera, 2002). The best example is the Certification for Sustainable Tourism for hotels by the government of Costa Rica. It was introduced by the government in 1997 and is the first case of the performance-based voluntary environmental programs by a developing country.

Further evidence of the popularity of voluntary approach can be shown by the significant amount of researches on this subject. However, it is still controversial whether voluntary environmental programs are actually effective as an alternative policy tool.

## **1.2. Purpose of the Study**

Voluntary approach for environmental policy was introduced and became popular in Korea, too. (KEITI, 2008). Voluntary approach has been utilized not only for environmental policy but in other policies such as energy and labor. Nevertheless, there is a relatively small amount of researches on this subject in the Korean context. Furthermore, most of the researches have been focused on the economic benefits from voluntarily establishing Environmental Management Systems (EMSs) (Kim and Oh, 2007; Kim and Oh, 2014; Kim and Kim, 2008; Chun, 2012; Kahng, 2003).

It is important to provide economic benefits for participants in terms of encouraging them to voluntarily commit higher environmental performance. Still, the primary goal of environmental policy is to improve the quality of the environment, and voluntary environmental programs need to be assessed in terms of environmental effectiveness for understanding and assessing them as a policy alternative.

This research aims to evaluate the environmental effect of voluntary environmental programs as a policy tool in the Korean context. As there is an ongoing tendency to minimize the regulatory burden of industries, voluntary environmental programs such as MOUs (Memorandum of Understandings) will continue to be widely used. It is important to review the effectiveness of voluntary environmental programs and to find the conditions that secure the greatest results.

As a case study, this research examines the environmental effectiveness of the Green Enterprises Initiative, one of the most popular voluntary environmental programs in Korea. It starts with reviewing the literature on voluntary approaches for environmental policy, from the definitions to their assessment. The next part, Chapter 3, focuses on the Green Enterprises Initiatives and how it works based on the literature review. Chapter 4 presents how this research was designed including the leading hypothesis and three sub hypotheses, and Chapter 5 demonstrates the data analysis and the verification of the hypotheses. Finally, Chapter 6 elaborates on the findings of this research and policy implications, and discusses about the limitations of this research and makes suggestions for further research.

## Chapter 2. Literature Review

### 2.1. Definitions and Categories

Voluntary approach is defined as schemes that induce companies to commit to higher environment performance beyond regulatory compliance (OECD, 2000; Krarup 2001; Koehler, 2007). However, by merely inducing companies, regulators are not guaranteed to achieve higher environmental performance from them. Voluntary environmental programs were introduced as an alternative policy tool to traditional regulatory instruments of command and control approach. Regulators monopolize decision making, and companies have little flexibility to choose their own cost-efficient strategies with command and control approach. Therefore, unlike command and control approach, voluntary approach invites companies to actively participate in establishing and implementing environmental programs.

Voluntary approach is expected to be potentially beneficial for both regulators and companies by giving greater flexibility to achieve environmental goals (Krarup, 2001; Koehler, 2007; Delmas & Terlaak, 2001). Most of all, the participation of companies is *voluntary*, and neither participation nor the achievement of targets is mandatory (Gamper-Rabindran, 2006). Not all of

companies in a given jurisdiction are subject to any voluntary environmental programs.

Different terms are used to describe voluntary approach for environmental policy such as non-mandatory approach, voluntary environmental programs (VEPs), voluntary agreements, business-led environmental strategies, corporate environmentalism, self-regulation, environmental covenants, voluntary codes, environmental charters, etc. (Khanna, 2001; Lyon & Maxwell, 1999; Koehler 2007; Delmas & Terlaak, 2001). Individual researches employ different scopes of voluntary approach. Some use different but interchangeable terms, and others use the same terms for different characteristics. In this research, the term '*voluntary approach*' is employed for the purpose of understanding them in a comprehensive way as alternative perspectives to mandatory approach and the other term '*voluntary environmental programs*' is used to call individual programs in more specific way.

In reality, voluntary environmental programs are designed into various frameworks with different participants, and there are criteria to understand them such as individual or collective actions; whether they are regional, national or globe-wide; and binding or non-binding targets. One of popular way to categorize voluntary approach is to do so into 1) public voluntary programs, 2) negotiated agreements, and 3) unilateral agreements (OECD, 2000; Lyon & Maxwell, 1999; Steelman & Rivera, 2006, Rivera, 2002). The criteria used here are those that have the initiatives to launch and implement a program, and are the parties involved.

## *Public Voluntary Programs*

Governments initiate public voluntary programs, set up targets beyond existing regulations, and invite companies to participate. The targets are either negotiable or not negotiable. Companies decide whether to participate for their own sake. In return, governments usually grant benefits such as financial or technical assistance. (OECD, 2000; Lyon & Maxwell, 1999; Krarup, 2001). Even though governments sometimes set thresholds for business to gain membership, the final decision to participate is still open to individual companies; It is an example of ‘*optional regulations*’ (OECD, 2000).

One of the popular examples of public voluntary programs is the 33/50 Program in the U.S. (Lyon & Maxwell, 1999). When, the Emergency Planning and Community Right-to-Know Act (EPCRA) was passed in 1986, the U.S. Environmental Protection Agency (EPA) started to release data covering 400 different toxic chemicals under the Act. In addition, the EPA launched the 33/50 Program, a voluntary mechanism aiming to encourage the chemical industry to reduce their emissions of toxic chemicals. The EPA set up the target to reduce 33% of the release and transfer of 17 targeted chemicals by 1992 and the 50% of them by 1995. More than 10,000 companies joined the program, and it achieved its target by 1994. The participants also enjoyed incentives such as technical assistance and publicity of their participation and the achievements of the program by the EPA.

### *Negotiated Agreements*

Governments work together with companies or industry associations to set up goals and measurement criteria (Lyon & Maxwell, 1999; Krarup, 2001). The targets and processes are decided through bargaining between the two parties, and the parties can be single or multiple (Krarup, 2001). Governments usually suggests benefits in return for participation such as R&D subsidies, technical assistance, information sharing, and the publicizing of the companies' environmental commitment (Delmas & Terlaak, 2001; Lyon & Maxwell, 1999; Krarup, 2001). Sometimes, governments even make the commitment not to bring in regulatory instruments unless the agreement fails to achieve the target (OECD, 2000).

The Treatment of End of Life Vehicles program is an example of negotiated agreements. The French Ministry of Industry and the Environment made agreement with two French car manufacturers, twelve French automobile importers, and eight trade associations including material producers and equipment suppliers. It started in 1993, and it was brought by the agreement to set the target to reduce the total weight of each automobile ending up in a landfill site to be less than 15% of the original weight by 2002.

### *Unilateral Commitments*

Unilateral commitments are more like self-regulatory action than the former two types of voluntary environmental programs (Lyon & Maxwell, 2001). Both the targets and determinations of how they are to be met and monitored are decided by the companies or industry associations themselves. This is a scheme in

which a government is involved the least among the three types of voluntary environmental programs. It is considered more to be a business strategy rather than a policy instrument (OECD, 2000).

Companies voluntarily initiate environmentally responsible actions to bring environmental benefits, and they are not bound by regulation. Sometimes, they do not necessarily lead to direct economic benefits (Giuliano & Linder.,2013). Companies take the lead to design and implement related programs independently, without any involvement of governments or regulators (Krarup, 2001). Unlike the other two types of voluntary environmental programs, it does not need multiple actors to be involved; a business can launch a unilateral commitment by own.

A retail company, Walmart, recently launched Project Gigaton to reduce emissions through its supply chain in November, 2017. The project seeks to eliminate one gigaton of emissions, focusing on areas such as manufacturing, materials, and products standards by 2030. The company also collaborated with like-minded NGOs, and created an emissions reduction toolkit, providing business cases and strategies.

Even though the three categories are most popularly used, not all voluntary environmental programs fit in each one of them. For example, they could be missing a couple of important actors of environmental policy such as NGOs, environmentalists, and academics. ISO 14000 Environment Management System (EMS) Certification is a third-party-initiated (neither a regulator or a business) voluntary program. The International Organization of Standardization (the ISO)

launched it in 1996. It provides a certification to companies that meet the program's standards to establish and implement the EMS. To become certificated, companies must be willing to make a commitment to higher environmental performance beyond basic compliance in their jurisdictions.

Additionally, it depends on regions and countries which types of voluntary environmental programs prevail. Negotiated agreements are more popular in European countries than the United States, because the relationship between government and companies is more cooperative in the European countries (Lyon & Maxwell, 1999). Public voluntary programs have also been employed more than negotiated agreements in the U.S. (Brouhle et al.,2005). The EPA has limited bargaining power as its authority boundary is under the control of the U.S. Congress. For the EPA, it is more convenient to provide non-binding incentives like publicizing positive actions.

## **2.2. Motivation of Companies**

### *Economic Motivation of Companies*

Companies decide to participate in voluntary environmental programs simply because they believe it corresponds with their profit maximizing strategies (OECD, 2000). Companies react to voluntary environmental programs because they think the participation results in increasing sales and revenue and, thus, maximizing profits (Krarup, 2001).

Participating in voluntary environmental programs creates the signal or endorsement that participants regard environmental issues as serious business and even work for the common good as well as their own profit. Various kinds of eco-labels are examples of this signaling. Eco-labels are awarded only to products that have less harmful environmental impacts during their life cycle. Customers are willing to buy more labeled products or pay more for labeled products than non-labeled substitute goods, because they believe it is the right thing to do. Signaling helps companies expand market share among green consumers (Gamper-Rabindran, 2006; Rivera, 2002, Kim & Oh, 2014) supports the profit maximizing motivation by showing that companies with final consumer are more willing to participate in voluntary environmental programs (Rivera, 2002). The greater the possibility to expand market share and improve their reputation, the more willing companies are to participate in voluntary environmental programs they are.

Participating in voluntary environmental programs for environmental policy is regarded as new business opportunity (Nawrocka & Parker, 2008). Companies review existing management systems and markets to commit to higher environmental performance, and it helps them to find new business opportunities. This is also why ISO 14000, a third- party-sponsored global voluntary approach, became popular in developing countries. After the Earth Summit in Rio in 1992, the call for the sustainable development increased and multinational corporates(MNCs) have been under severe pressure from NGOs to transform their companies in sustainable ways, including their global supply chains. It made companies in developing countries pay more attention to participate in ISO 14000 (Khanna & Liao, 2014).

Companies can save costs simply through participating in voluntary environmental programs. They will employ more cost effective mechanism to achieve targets of voluntary environmental programs, while command and control approach only allow them to utilize designated mechanisms regardless of cost effectiveness. Companies can also save costs by becoming concerned with the environmental impacts of their own activities and products through environmental-friendly means.

### *Social Motivation of Companies*

Social motivation is closely related with companies' reputation. Due to increasingly competitive markets, strengthened rights of consumers, and easier access to information, companies are becoming more and more sensitive to their reputations. Reputation can be more than signaling to expand market share. It is now a common understanding that corporate's social responsibility(CSR) is a key element of business management. A company does not exist alone but is a component of an entire society, and relies on contracts and legislations within the society. The support of the society is a critical factor for the survival of a business, and this depends on the business performing in a way that regarded as socially desirable.

Reputation gains also have an influence on stockholders, and even on employees and local communities (Gamper-Rabindran, 2006; OECD, 2000). That a business is spending significant amount of environmental cost can be a signal itself that it makes business performance so good enough to invest other than daily

management and production, and which, in long term, has positive impact on the corporate financing (Kim et al., 2014). Investors also expect less of a possibility of environmental risk in the long run when a companies appears to be environmentally responsible (Gamper-Rabindran, 2006). Moreover, the strong reputation of companies may encourage their employees' motivation, and it contributes to higher labor productivity (OECD, 2000; Kim et al., 2008).

In short, a companies's participation in voluntary environmental programs for the common good, at least for their reputation as appearing to commit to the common good, is not always counter to a profit maximizing strategy. Profit maximizing is still the ultimate goal of companies, and it is the primary motivation of companies for participating in voluntary programs for environmental policy. They are making profits while simultaneously improving their reputations.

This is why chemical industry associations of the U.S., and the U.K. quickly reacted to the mistrust in society by launching the Responsible Care after a tragic environmental accident, and promised to establish own chemical management standards to keep beyond compliance (Lyon & Maxwell, 1999; OECD, 2000). They understood that restoring their reputations would be the most urgent and critical thing to be done.

### *Legal Motivations of Companies*

Companies may choose to go beyond what is legally required by current government regulations in order to preempt future regulations (Lyon & Maxwell, 2001; Nawrocka & Parker, 2008, Darnall et al., 2008). Preemptive moves can have

benefits such as avoiding stricter regulations, weakening or pending regulations, or even disadvantaging competitors (Lyon & Maxwell, 2001). Companies are willing to invest proactively to convince regulators that additional regulation is not needed (Nawrocka & Parker, 2008). The proactive action also helps to improve relationships with regulators by sending cooperative signals, and it is not only to preempt specific regulations but also to give better opportunities to approach information and policy agendas in a broader way (Darnall et al., 2008).

However, the motivation to be preemptive comes from the fear that regulations will attempt to command and control companies in unfavorable way. Therefore, without credible threats, it is hard to secure higher performance from companies, regardless of their commitment to participation (Khanna & Liao, 2008). If the threat of future regulation is more credible and future regulations are expected to be more stringent, higher participation and better environmental performance can be achieved (Rivera, 2002; Khanna, 2001; Koehler, 2007).

At the time, the Treatment of End of Life Vehicles program was initiated in France, the European Commission was working on an auto parts recycling program (later named the Priority Waste Streams Work), which mainly included information disclosure, and the German government was introducing a legislative draft with recycling standards and requirements. The threat that the German movement could have an impact on the European Commission program and the French legislation made French companies come out quickly to negotiate with the French Ministry (Lyon & Maxwell, 1999).

Again, companies only decide to participate in voluntary environmental programs when they expect more gains from establishing them and can preempt

future regulation than complying with the future regulation (Koehler, 2007). Even though it appears to be against profit maximizing to invest in higher environmental performance, it still corresponds with their profit maximizing strategy (Toller & Bocher, 2013).

### *Conclusion*

In conclusion, even though some argue that companies should commit to higher environmental performance because it is morally right, primary motivations end up with matching profit maximizing strategies. In other words, voluntary approach can still help to generate economic benefits for encouraging companies to participate and set goals beyond compliance (Rivera, 2002).

## **2.3. Motivation of Regulators**

### *Cost Saving Motivation for Regulators*

Designing and implementing regulations requires a significant amount of administrative costs. It is almost impossible for governments to have every piece of information to achieve the optimal level of environmental performance. From the perspective of game theory, mandatory regulations put regulators and companies into the relationship of principle and client (Park, 2006). Regulators could result in merely spending resources without securing desirable levels of environmental performance.

By participating in voluntary environmental programs for environmental policy, regulators can save compliance costs because companies have the right to decide their own targets and the flexibility to choose the cost effective method that best suit them. Companies have little reason to avoid the standards they make for themselves. There are fewer costs needed for enforcement and less conflict between the regulators and companies (Krarup, 2001). If voluntary actions could be a cheaper way of achieving environmental goals, governments are also motivated to preempt regulations (Lyon & Maxwell, 1999).

It is also understandable that voluntary approach are more popular in a time of budget deficiency (OECD, 2000; Koehler,2007). For example, it was during the George H.W. Bush administration in the U.S. when voluntary approach started to expand and when the EPA budget was cut considerably.

#### *Political motivation for regulators*

Environmental policy is designed through political discourse and often leads to political disputes. Governments are willing to solve the disputes by negotiating with companies and letting them choose cost-minimizing strategies by themselves while still achieving policy objectives. Regulators are sometimes feel social pressure to enact more policy intervention, but it takes a considerable amount of time and effort to set up and implement regulatory instruments. The legislative process is a part of this, and regulators override it with voluntary approach. Non-binding approach does not require congressional or parliamentary approval, and they save regulators from persuading lawmakers (Delmas & Terlaak,

2001). Voluntary approach may appeal to regulators' political interests even though they do not always coincide with public interests.

Toller (2013) found that related institutions and political will are major motivations to choose voluntary approach over mandatory approach for German environmental policy in the 1980s and 1990s. European environmental law was still on the progress of being established in the 1980s, and the German government was not willing to establish formal legislation with the risk of having to change it later through political discourse. The sudden decrease of voluntary environmental programs after the late 1990s also appears to be a result of the resolution of the uncertainty from the European environmental law. A large number of German environmental laws corresponds with the European laws, and there is little room left for voluntary environmental programs at the national level.

## **2.4. Efficiency and Effectiveness**

Previous researches on evaluating voluntary environmental programs have been focused on two standards- economic efficiency and environmental effectiveness. The former is drawn from the fundamental characteristics of voluntary environmental programs and is not very controversial. The latter is still being debated and researchers have come up with mixed conclusions. There is a significant amount of researches that is trying to evaluate the environmental effectiveness of voluntary environmental programs, but it is still inconclusive (Alberini & Segerson, 2002; Koehler, 2007; Gamper-Rabindran, 2006; Nawracka

& Parker, 2008; Arimura et al., 2008)

The proponents argue that voluntary environmental programs induce companies to commit to higher environmental performance, and it results in better environmental quality. Whereas the skeptics insist that, without enough monitoring and sanctions, voluntary environmental programs do not guarantee higher performance from participants. There are opposite conclusions even drawn from the same program, the EPA's 33/50 program. The EPA's final report said that the program achieved its goal in 1994, one year ahead of schedule, and some research conpanies that the program succeeded in securing participants' environment performance beyond compliance (Khanna & Demon, 1999; Bi & Khanna,2017). However, Gamper-Rabindran (2006) insists that the reductions are individual outcomes, not resulting from the program.

The disagreement has various causes. For example, Nawrocka and Parker (2008) emphasizes there is no agreement for defining environmental performance. It is the fundamental characteristics of voluntary environmental programs that each business establishes its own target definitions, from emission reduction to community service. The targets do not have to be quantitative standards, and voluntary environmental programs cover different types of environmental activities. Researchers can easily be biased for how to define environmental performance.

It is more difficult to draw conclusions for environmental effectiveness. Because voluntary environmental programs cover various activities, their impact is cross-sectoral and not clear enough to be measured and analogized. Lyon and Maxwell (2007) insisted that the effectiveness of voluntary environmental programs should be assessed in terms of information diffusion among both

participants and non- participants rather than the differences between the two groups. According to them, if voluntary environmental programs works properly, information and best practices are shared from early participants to other participants, and eventually to non-participants. In this regard, it is an achievement of voluntary environmental programs that there is little difference between participants and non-participants.

Skeptics point out the institutional shortcomings of voluntary approach. Without binding monitoring and sanctioning, participants are more willing to choose opportunistic behavior (Delmas & Terlaak, 2001; Koehler, 2007) Especially, when targets are set by industrial level or collective way, free-riders take advantage of incentives provided without committing to their own environmental performance beyond compliance. Even non-participants can gain benefits from preempting future regulation (Koehler, 2007). The opportunistic behavior results in *greenwashing*. Free-riding companies achieve the reputation of being environmentally responsible while hiding inferior environmental performance (Rivera, 2002)

Environmentalists even cast doubt on the legitimacy of voluntary environmental programs. From the case study of the German strategy on invasive alien species, Hubo and Kortt (2013) conclude that regulators choose voluntary environmental programs as substitutes to regulatory instruments, even though they prefer them as supplements. Because many interests are involved, and regulators are not always more powerful actors regarding policy agenda, the limit on regulators' competence results in regulatory capture (Rivera, 2002). Companies participate in voluntary environmental programs only to avoid monitoring and

preempt future regulations. Being leading players, they play the important role in designing and implementing initiatives (OECD, 2000). They still keep away from spending more on pollution abatement, while discouraging government decisions to introduce mandatory regulations. In this case, the government is captured by the industry's interests.

In Korea, there has been a greater focus on financial or economic impact of voluntary environmental programs for environmental policy. Third-party-sponsored programs such as ISO 14000 have also been studied more than government-sponsored public voluntary programs; it has been seen from the perspective of a business management strategy more than a policy tool (Kim and Oh, 2007; Kim and Oh, 2014; Kim and Kim, 2008; Kim et al., 2010).

Kim and Oh (2014) finds out that becoming a member of the Green Enterprises Initiatives has impact on stock return. A companies get reputation as a Green Enterprise, which is followed by expanding market share, increasing sales and profit, attracting investors and improving companies value. Kim and his colleagues (2010) argues that environmental cost and investment are statistically significant factors for increasing companies value. Environmental cost and investment are helping investors informed about risk associated issues, and they have positive impact on how investors assess companies value. Kim and kim (2008) concludes that the corporate adopting EMS experience a higher productivity than that of the corporate which don't adopt EMS, and that in the year which adopted EMS, corporate experience a higher productivity.

## **Chapter 3. Green Enterprises Initiative**

### **3.1. Background**

At the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, the delegates from 172 governments, including that of the Republic of Korea, and thousands of non-governmental participants agreed upon the issue of the Rio Declaration on Environment and Development. The Declaration emphasizes sustainable development and provides guidance to equitably meet developmental and environmental needs of the present and future generations. It also advises that environmental protection should constitute an integral part of the development process.

The Declaration led to global attention on sustainable management, which promotes the balanced development of the environment and economy. Countries have made efforts to shift from conventional economic growth oriented development to environmentally sound and sustainable development. Trade regulations for products that do not meet environmental standards started to be introduced, especially by the European Union, and the environmental management

system has become an essential element, not an optional one (KEITE, 2008).

In response to this trend, research on environmental management systems has started in academia and some leading industries in Korea. Based on these circumstances, in 1995, the Korean Ministry of the Environment launched the *Eco-friendly Enterprises Initiatives* to encourage companies to adapt environmental management systems by setting environmental goals for themselves and achieving the goals through the most favorable methods (KEITE, 2008). It is based on the belief that every economic activity should be assessed from environmental perspective. The Initiative expects companies to not only reduce end-of-pipe pollution but to take the environmental impact into account and attempt to improve their processes from top to bottom.

Since the late 1990s, as Korean economy has been weak compared to previous periods and global competition has become more intense, introducing new regulations and strengthening existing regulations is perceived as negative activities by both of the government and the public as it could hinder the opportunity for economic growth.

Until recently, it has been amended and expanded through several revisions and those of related legislation, but the essence of the program has been maintained. While only manufacturing companies were qualified at the beginning, the eligible categories have expanded to service industry such as hotels, hospitals, and department stores. It also includes incentives for small and medium-sized companies(SMEs) to encourage their participation, whose resources are usually limited when it comes to establishing environmental management systems. Among the changes. the most noticeable one is that the name was changed from the Eco-

friendly Enterprises Initiative to the Green Enterprises Initiative following the implementation of the Low Carbon Green Growth Act in 2011.

Sometimes, the legislation is revised to implement the Green Enterprises Initiative in a stricter way for the purpose of well-management. For example, the membership period that originally three years was expanded to five years for the purpose of reducing the administrative burden on companies. It was shorthand again to three years in response to the congressional request for stricter management after legislative violations of former members were revealed. The recent revision in 2014 also reinforced the designation and re-designation requirements by putting higher professional standards on judges, giving stricter penalties to companies that are missing to implement all or part of their environmental management information reporting.

### **3.2. Program Design and Implementation**

The Green Enterprises Initiative was established by the law, and designed and implemented by the government. Still, it is the open choice of each companies to participate in the Green Enterprises Initiative, and neither participation itself nor the level of participation, for example, self-targeting emission level, are mandatory. None of the business are asked to participate against their own will. Participation is based on the voluntary commitment of companies. If a companies fail to meet the its own target, the biggest penalty is the cancelation of its membership in the Green Enterprises Initiative. It was established by the law only to provide some benefits

and legal exemptions to participants. Therefore, the Green Enterprises Initiative is a voluntary scheme, and more specifically has the form of a public voluntary programs as described in the Chapter 2.

Regarding Article 16.2 of the Environmental Technology Development and Support Act, '*Green Enterprises*' refer to enterprises, their branches and individual business units that contribute greatly to environmental improvement through a remarkable decrease of pollutants, reduction of resources and energy, improvement of eco-friendliness of products, establishment of environmental management systems, etc. The period of membership shall be three years and companies can apply again for membership for another three years. There is no limit on the repeating the applications.

Companies that apply for membership in the Green Enterprise Initiative are asked to submit a Green Business Report. The report is a comprehensive analysis about their current situation, targets and strategies for achieving the targets in terms of environmental managements, monitoring and measuring tools, to awareness raising inside and outside of the institutions.

Once an application for membership is received, the commissioner of the Environmental Office of its jurisdiction evaluates its conformity to the membership standards, mainly based on the Green Business Report. The applicants are also required follow strengthened emission standards. For example, they have to stick to less than 80% of current sulfuric dioxide emission level and less than 90% of current nitrogen oxide emission level.

The government provides some incentives for the participants in the Green Enterprises Initiatives. Companies are required to receive permission in advance to establish or modify on-site pollutant emission facilities by Article 23 of the Clean Air Conservation Act and Article 33 of the Water Quality and Ecosystem Conservation Act. Companies participating in the Green Enterprises Initiative may report it instead of getting permission. The participating companies are also exempted from the regular report and inspection under Article 82 of the Clean Air Conservation Act, Article 68 of the Water Quality and Ecosystem Conservation act, Article 47 of the Noise and Vibration Control Act, Article 39 of the Wastes Control Act, Article 49 of the Toxic Chemicals Control Act, Article 41 of the Act on the Management and Use of Livestock Excreta, and Article 69 of the Sewage Act, etc. Participating companies are eligible for financial and technological aid from the government to improve abatement facilities and to develop relevant cooperative projects among the companies at the domestic and international level. Exclusive Green Enterprise labeling is provided for the companies' own marketing purposes.

Companies are motivated to participate in the Green Enterprise Initiatives for several reasons. The exemption from legal obligations helps them to reduce their administrative burden and related costs. Establishing and implementing environmental management through the Green Business Report itself helps to improve companies' potential growth in terms of substantiality. Their reputation as a "green company" is expected to expand market share, increase profits, and improve relationships with stakeholders.

Park and his colleague (2007) examined the effect of the Green Company Initiative on the awarded companies' stock return through event studies. They

observed a trend of rising stock returns around an event day, the day when companies were awarded the membership of the Green Enterprises Initiatives from the Ministry of Environment. In addition, the positive effects seemed to be greater for companies with more membership experience than those with less membership experience. They concluded that companies need to recognize environmental management as a core competence of companies rather than as an increase in cost. Stock investors also prefer companies with consistent environmental management to those with inconsistent environmental management. Even though the research has very small sample size, 32 companies, and stock returns are effected by unexpected and unclarified factors, it was shown that participating in the Green Enterprises Initiative may provide companies with indirect financial benefits though public perception.

Additionally, participating companies have organized and cooperated through the Green Company Council since 1995. The council help participating companies share information and experiences, communicate with regulators, and increase public awareness. Even though there are incentives provided by the government are limited, there are more incentives shared by participants themselves. Especially, small and middle sized-enterprises that lack resources and information can take advantage of the collaborative activities.

### **3.3. Current status of the Initiative**

As of December 2016, 164 companies were participating in the Green Enterprises Initiative. Only three institutions (the former Dusan Canning Icheon factory, Samsung Electronics Giheoung Factory, and Samsung Chemicals Ulsan Factory) participated when the initiative launched in 1995, and the number of participants increased sharply up to 122 over the following two years. There was a tendency to increase membership until it reached its peak in 2011, but it has been declining over the past five years.

Even though the number of newly-participating companies has been stagnating, the loyalty of the existing members is quite strong. Out of 164 participants, 150 companies have obtained membership more than twice, and 64 companies have been members since 2000. It certainly seems that the current participants are aware of the benefits of participating in the Green Enterprise Initiatives.

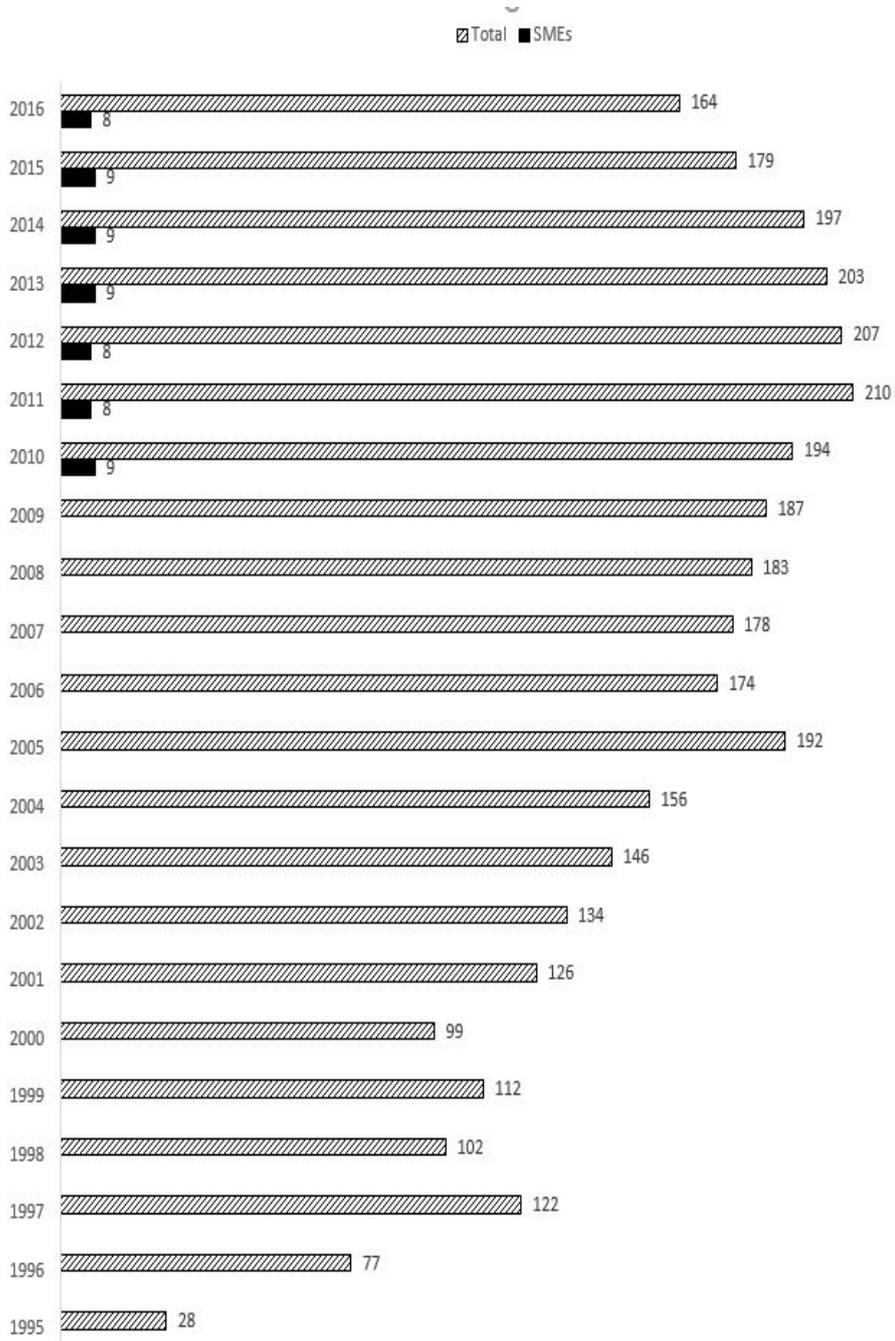
According to the survey, the reputation of being a Green Enterprise and the exemption from regulatory duties such as regular inspections are the primary motivators to participate in the Initiative. As discussed early in this paper, considering a profit maximizing strategy is the critical guideline to participate in voluntary environmental programs, improving companies' reputation provides limited motivation. Exemption from regular inspections and reporting helps participants save administrative costs. However, the savings are very limited and,

with the automatic remote monitoring system becoming prevalent, the incentive is not as convincing as it was before. Major incentives of the Green Enterprises Initiative are appealing but not enough for new comers. The participation of SMEs is more limited considering they account for the majority of companies.

Only 8 of the 164 participants were SMEs in December 2016, and the rate of SMEs has stagnated at around 5%. The motivation of SMEs is different from that of large companies, and is more challenging task to policy makers. Because large companies have extra resources to help them achievement beyond compliance, feel social pressure, and expect higher cost when a new regulation is introduced, they tend to participate in voluntary environmental programs more than SMEs (Neumayer & Perkins, 2004; Kimitaka, 2009; Koehler, 2007, Lyon & Maxwell, 2007).

On the other hand, this is why the participation of SMEs should be encouraged more. Because of their size, they face fewer inspections, and many companies slip through the regulatory net. However, SMEs have limited motivations participating in voluntary environmental programs and achieving higher environmental performance without the involvement of governments. There is more potential to be improved through voluntary commitment when governments help SMEs to commit to higher environmental performance.

<Figure 1. The Number of the Green Enterprises Initiative Members>



## Chapter 4. Research Design

### 4.1. Hypothesis

The purpose of this research is finding empirical evidence on the environmental effects of voluntary environmental programs for environmental policy and whether voluntary environmental programs actually secure higher environment performance of participating companies and improve environmental quality, especially in the context of Korean voluntary programs. Even though, by the definition as discussed earlier in this research, voluntary environmental programs are supposed to induce companies to commit to environmental performance beyond compliance that is required by law (Lyon & Maxwell, 1999; Delmas&Terlaak,2001), there is no agreement whether participants in voluntary environmental programs really achieve higher environmental performance than non-participants.

**The leading hypothesis of this research is that *companies participating in voluntary environmental programs have higher environmental performance than companies that are not.***

The Green Company Initiative was used as an example of voluntary environmental programs in this research, and the environmental performance of participants and non-participants of the Green Company Initiative was operationalized using the annual average emission concentration levels of Sulfur Oxide (hereafter, SO<sub>x</sub>) and Nitrogen Oxide (hereafter, NO<sub>x</sub>).

Identifying environmental performance is a critical factor for evaluating voluntary environmental programs, and each approach (even, each participant) has a different way of defining it. The emission concentration level was employed in this study for two primary reasons. First, air pollutant emissions are conventional environmental standards and there is no disagreement for them to be regarded as environmental performance (To be clear, reducing them is performance). Second, there is a significant amount of public-accessed quantitative data for analysis regarding air pollutant emissions. Establishing a comparative standard for various concepts of environmental performance from the participants is out of scope of this research and it is easy to be biased when assessing qualitative data.

Three sub-hypotheses were used to evaluate the leading hypothesis from different angles. The first sub-hypothesis is that *participants of the Green Enterprises Initiative have recorded lower annual emission concentration levels than non-participants during the last five years, from 2012 to 2016*. It is a main indicator of environmental performance. The second sub-hypothesis is that *participants of the Green Enterprises Initiative have decreased the annual emission concentration levels more than non-participants over last five years, from 2012 to 2016*. It is more relevant to have a reputation as committing to higher environmental performance when companies keep working on environmental

improvement. The third sub-hypothesis is that *participants of the Green Enterprises Initiative are more compliant with regulations than non-participants*. The operationalized variable of compliance is regulatory violations. It will be tested by comparing how many times participants and non-participants failed to meet the legal standards of SO<sub>x</sub> and NO<sub>x</sub> emission concentration levels respectively. companies need to stick to existing regulations before trying to achieve environmental performance beyond compliance.

## **4.2. Data and Methods**

This research is intended to find empirical evidences to verify the research hypothesis through a case study on the Green Enterprises Initiative. It was mainly conducted through a comparative analysis of the environmental performance between participants and non-participants of the Green Enterprises Initiatives. To verify similarities and difference in environmental performance between participants and non-participants, T-tests were used as a research tool.

Two sets of data were used for this research. The first set is the membership of the Green Company Initiative. The list of membership is open to the public and updated biannually through the website of the Korean Ministry of the Environment. The second set is the emission data of CleanSYS, the automatic remote monitoring system of smokestacks established by the Korean Ministry of the Environment. The emission data of CleanSYS is also open to the public but provided by request. Even though, CleanSYS was launched in 2006, data from

only the most recent five years (from 2012 to 2016) is provided in timely manner.

Since CleanSYS applies only to specific facilities with a considerably large amount of emissions by law, not every participant of the Green Enterprises Initiative has CleanSYS emission data. Environmental laws commonly require companies to document and report emissions, but it is practically beyond the boundary of this research to gather data and develop assessment criteria for various types of environmental activities. Moreover, not only manufacturers but also non-manufacturers without smokestacks are eligible for membership into the Green Enterprises Initiative. There are some members that do not actually have smokestacks such as hotels, hospitals, and airlines. So, only the participants that have relevant CleanSYS data are considered in this research.

The emission level standards are different depending on use of facility, types of fuel, amount of emission annually, etc. Therefore, it is not accurate to compare individual emission levels to others, because some are originally higher than others. Therefore, the emission outcome compared to respective regulatory standards ( $\text{variable} = \text{emission outcome} / \text{regulatory standard}$ ) are used for the sake of comparison. Since members of the Green Enterprises Initiatives are required to follow strengthened standards, the 80% and 90% of regulatory standards are used respectively for SO<sub>x</sub> and NO<sub>x</sub> analysis.

While membership into the Green Company Initiative is awarded to companies or workplace, the emission data is gathered by smokestack units. Companies or work places can have multiple smokestacks, and they often do. For the sake of convenience in analysis, the emission level was calculated by individual smokestack unit, rather than reorganized and calculated by membership unit. The

emission concentration level of a smokestack depends on the type of facility and raw materials and fuels. This will be also taken into account for data analysis.

### **4.3. Grounds for Comparison**

A company is decided whether to facilitate the remote monitoring system according to the law, Clean Air Conservation Act, depending how big it is, what kind of industry it belongs and what kind of activity mainly happens in it. Every company entitled to facilitate the system by law is also included in the data of this research regardless of its membership of the Green Enterprise Initiative. It can be considered as random sampling.

And two groups, the participants and non-participants, share similar variance of their sizes and industries, even though the latter group is about nine times bigger. However the participating group has far bigger share of thermal power plant than the non-participating group. So, additional analysis with controlling that issue is conducted.

In the end, it is safe to say that participating or non-participating in the Green Enterprises Initiative is only meaningful independent variable for assessing and comprising environmental performance of the two groups.

## **Chapter 5. Data Analysis**

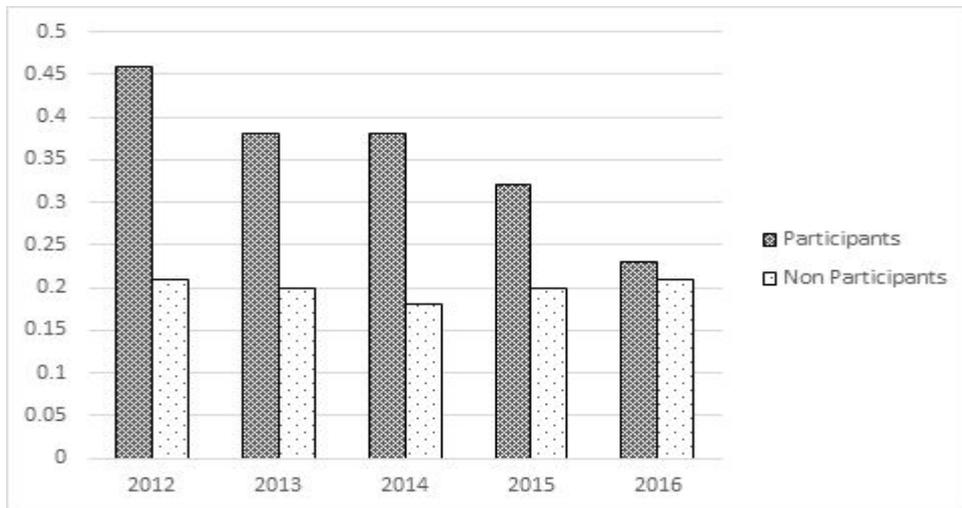
### **5.1 Emission Levels**

#### *Data Analysis on SOx emissions*

The first sub-hypothesis is that participants of the Green Enterprises Initiative have recorded lower annual emission concentration levels than non-participants during the last five years, from 2012 to 2016. It was verified by T-tests with the average annual emission concentration levels of both participants and non-participants. The null hypothesis is that the participants and non-participants had no difference in terms of the average annual emission concentrations of SOx. The alternative hypothesis is that participants and non-participant have difference regarding the average annual emission concentrations of SOx.

It turns out that the null hypothesis was rejected with a 95% confidence level, and that the two group had significant differences regarding the annual average emission concentrations of SOx. However, interestingly, non-participants had lower annual average emission concentrations, and this means they non-participants committed higher environmental performance than their counterparts, the participants of the Green Enterprises Initiative.

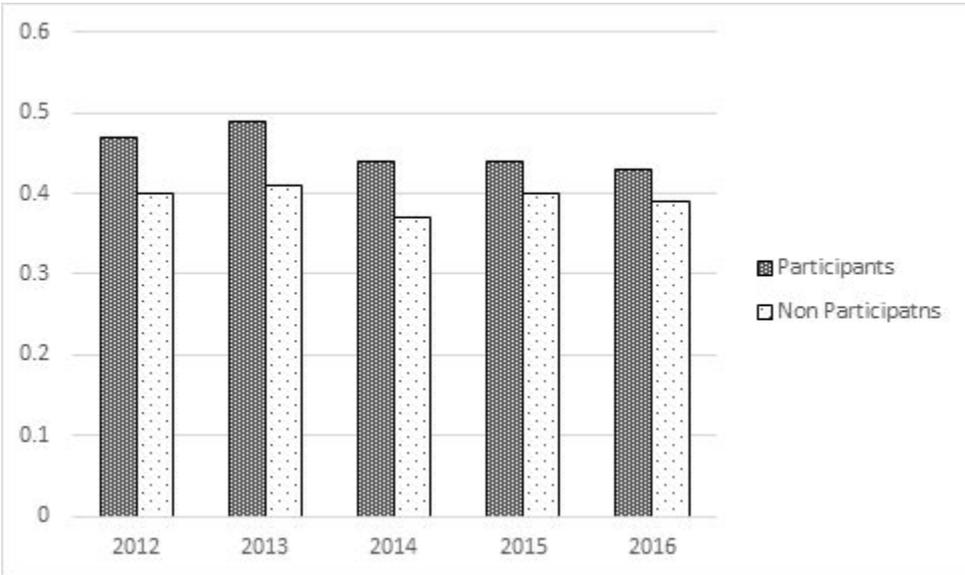
<Figure 2. The Annual Average Emission Concentration Level s– SOx ①>



	Participants	Non Participants
Mean	<b>0.354</b>	<b>0.2</b>
Variance	0.00728	0.00015
Observation	5	5
Pooled Variation	0.003715	
Hypothesized Mean Difference	0	
df	8	
t stat	3.994949705	
P(T<=t) one-tail	0.001988859	
t Critical one-tail	1.859548038	
<b>P(T&lt;=t) two-tail</b>	<b>0.003977719</b>	
t Critical two-tail	2.306004135	

The emission concentration levels depend on types of facilities, and they have an impact on environmental performance as a third variable. The emission of SOx mainly occurs at the point of fossil fuel combustion. Most of the smokestacks of the Green Enterprises Initiative participants are connected with thermal power generation facilities, while the non-participants cover more diverse types of smokestacks. Therefore, an additional test was conducted only with the data of thermal power generation facilities. Since the type of facilities is controlled, it turns out that participants and non-participants have no significant difference in the average annual emission concentration of SOx. Considering that the type of facility has an impact on SOx emissions, the second test is more reliable to assess the first sub-hypothesis.

<Figure 3. The Annual Average Emission Concentration levels – SOx ②>



	Participants	Non Participants
Mean	0.396	0.392
Variance	0.00423	0.00022
Observation	5	5
Pooled Variation	0.002225	
Hypothesized Mean Difference	0	
df	8	
t stat	0.134080305	
P(T<=t) one-tail	0.448325403	
t Critical one-tail	1.859548038	
<b>P(T&lt;=t) two-tail</b>	<b>0.896650805</b>	
t Critical two-tail	2.306004135	

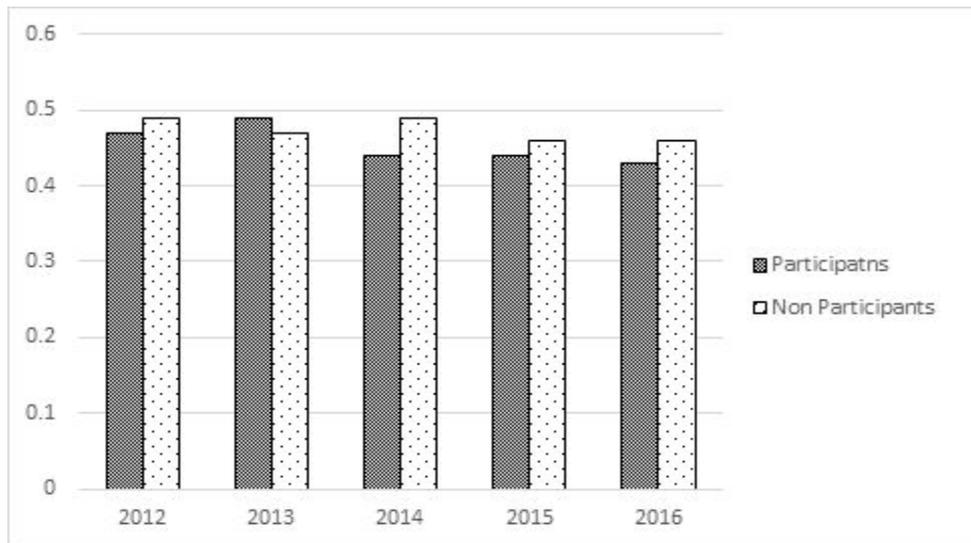
#### *Data Analysis on NOx emissions*

The data analysis on NOx emission was conducted through basically the same process as that of SOx emissions. The null hypothesis for the T-test is that participants and non-participants have no difference in the average annual emission concentration of NOx. The alternative hypothesis is that participants and non-participants have difference in the average annual emission concentration of NOx. It proved that the null hypothesis was accepted, and participants and non-participants have no significant difference in environmental performance with a 95% confidence level.

The type of facilities is not as critical for NOx emission levels as it is for SOx emission levels, and both participants and the non-participants of the Green Enterprises Initiative cover various facilities regarding NOx emission data. Still, an additional test was employed with only the smokestacks of thermal power generation facilities. It turns out that there is significant difference between

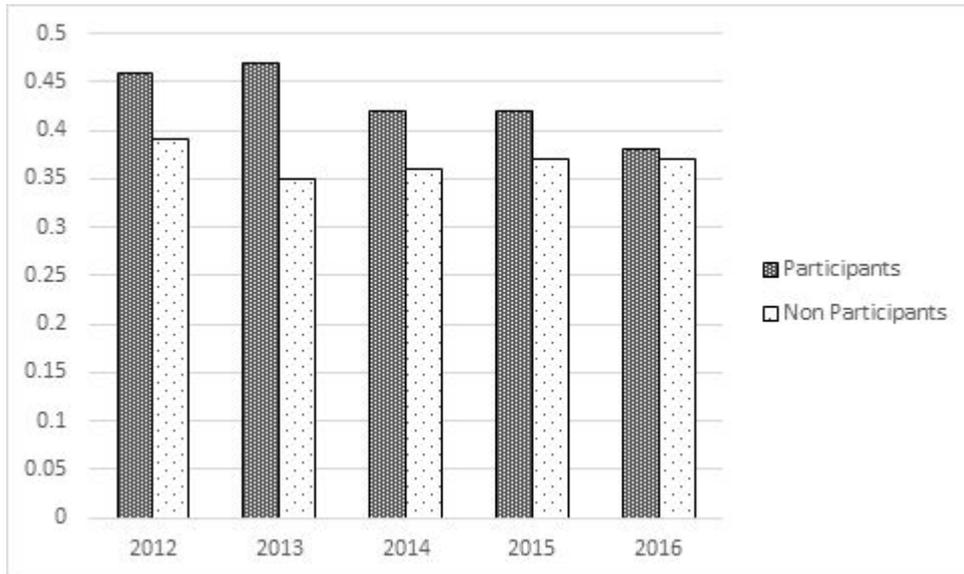
participants and non-participants, and that non-participants have been emitting with lower concentration level from 2012 to 2016.

<Figure 4. The Annual Average Emission Concentration Levels – NOx ①>



	Participants	Non Participants
Mean	<b>0.454</b>	<b>0.474</b>
Variance	0.00063	0.00023
Observation	5	5
Pooled Variation	0.00043	
Hypothesized Mean Difference	0	
df	8	
t stat	-1.524985703	
P(T<=t) one-tail	0.082885886	
t Critical one-tail	1.859548038	
<b>P(T&lt;=t) two-tail</b>	<b>0.165771772</b>	
t Critical two-tail	2.306004135	

<Figure 5. The Annual Average Emission Concentration Levels – NOx ②>



	Participants	Non Participants
Mean	<b>0.43</b>	<b>0.368</b>
Variance	0.0013	0.00022
Observation	5	5
Pooled Variation	0.00076	
Hypothesized Mean Difference	0	
df	8	
t stat	3.555943875	
P(T<=t) one-tail	0.003722308	
t Critical one-tail	1.859548038	
<b>P(T&lt;=t) two-tail</b>	<b>0.007444615</b>	
t Critical two-tail	2.306004135	

### *Conclusion*

Neither of the SOx emission data nor the NOx emission data do not support the first sub-hypothesis. There are no significant differences between the

emission concentration levels of the participants and non-participants. Surprisingly, in certain conditions, non-participants have lower average annual emission records. In conclusion, participants of the Green Company Initiative do not necessarily display higher environmental performance than the non-participants.

## **5.2 Emission Improvement**

The second sub-hypothesis is that participants of the Green Company Initiative have decreased the annual emission concentration levels more than non-participants over last five years, from 2012 to 2016. This analysis aims to give better understand of the environmental effect of voluntary environmental programs in terms of time series analysis.

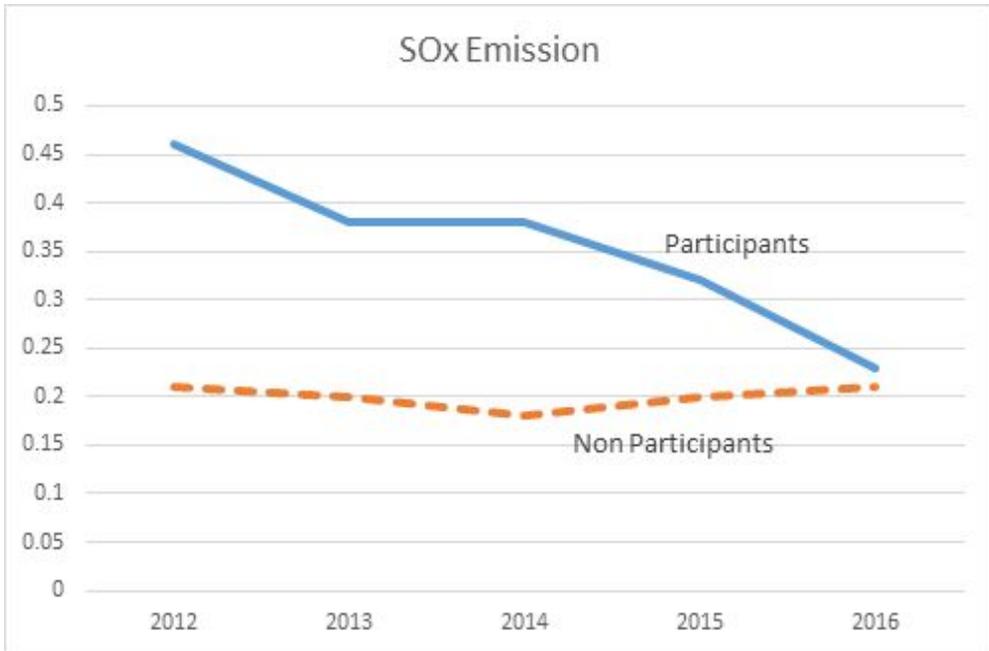
### *Data Analysis on SO<sub>x</sub> emissions*

The annual average emission concentration of participants of the Green Enterprises Initiative had tendency to decrease from 2012 to 2016, while that of non-participants of the Initiative hardly changed for the same time period. Thus, it appears the second sub-hypothesis was supported.

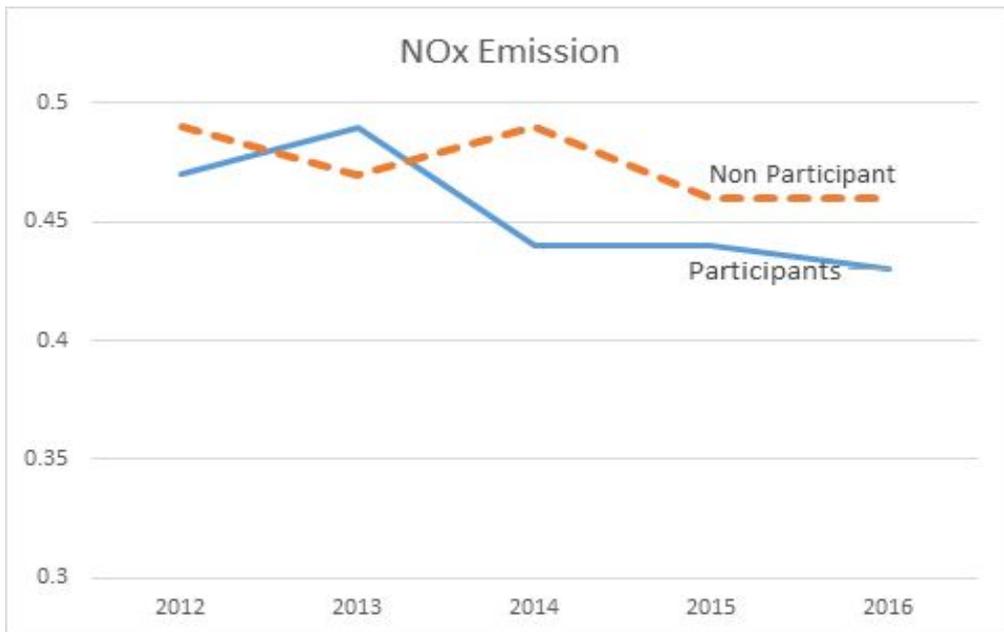
### *Data Analysis on NO<sub>x</sub> emissions*

The annual average emission concentration of participants of the Green Enterprises Initiative showed shaper decreases from 2012 to 2016 than non-participants over the same time period. It appears that the second sub-hypothesis was supported here as well.

<Figure 6. Changes in Annual Average Emission Concentrations – SOx>



<Figure 7. Changes in Annual Average Emission Concentrations – NOx>



### *Data Analysis from the chemical industry*

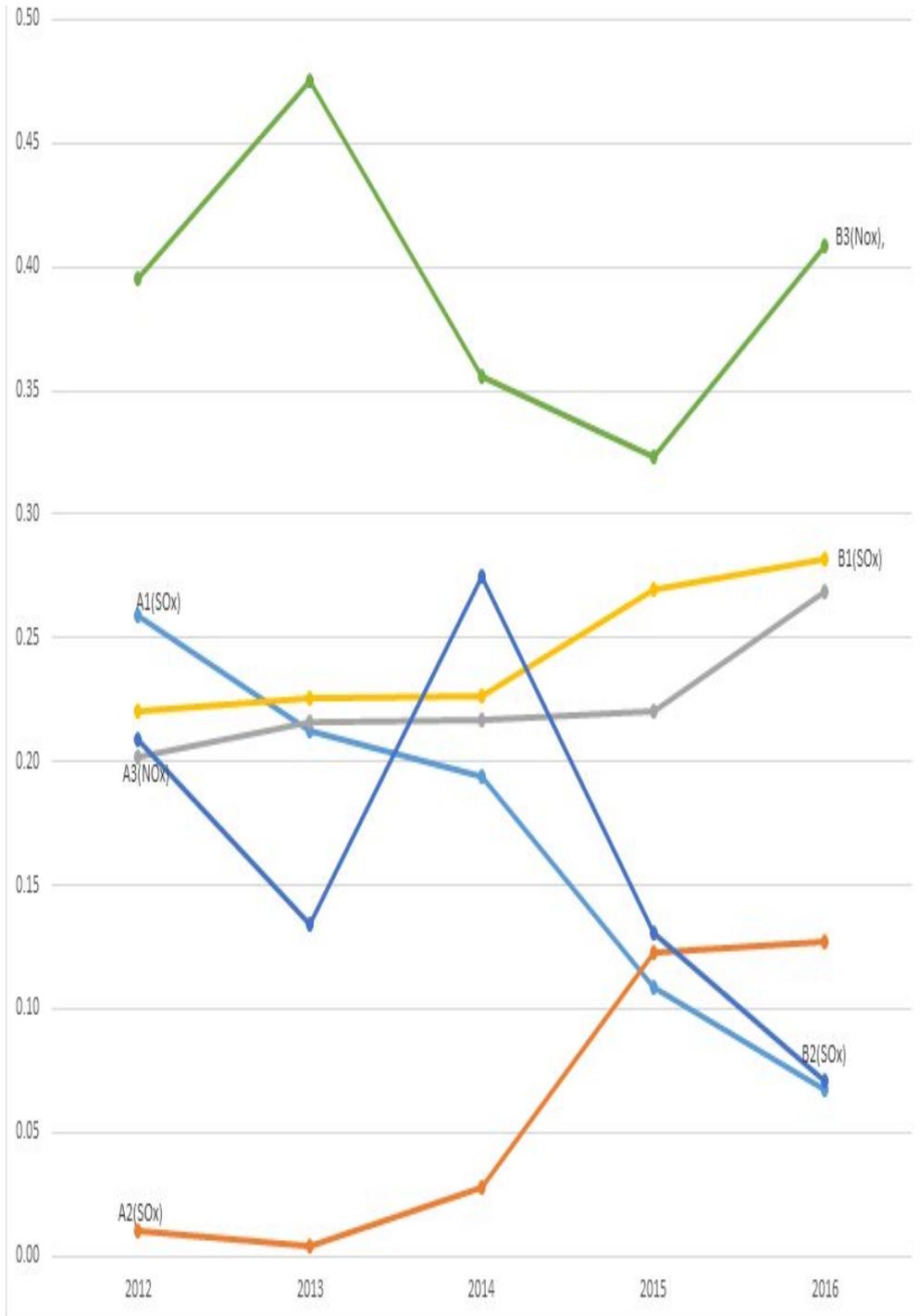
The last data assessment was conducted by smokestack unit. Three data sets of participants (A1, A2, and A3) and non-participants (B1, B2, and B3) were selected respectively. All of them were selected from facilities from the chemical industry to control for a third variable, type of industry.

Among the six data sets, only one set (A1) from the participants group had a tendency to reduce the annual average emission concentration level. The other two sets from the participants group actually had been moving in the opposite direction (A2 and A3), while A2 still had lower emission level than the others. Among the three data sets from the non-participants group, one had a tendency to increase and the other two were fluctuating.

On a smokestack unit basis, the individual data sets had different tendencies, and it was obvious that not all of the participating business in the Green Enterprises displayed higher environmental performance continuously. It is understandable that all of the participants would not make the same level of commitment beyond compliance.

Xi and Khanna(2017) argue that participating in voluntary environmental programs, in their case, the EPA's 33/50 program, encouraged participating companies to achieve their targets faster and more actively, but the levels of commitment were not same among them. The participants were generally more willing to adopt abatement facilities, and only participants who adopting the facilities reduce the release of chemicals significantly compared to non-participating companies.

<Figure 8. Changes in Individual Annual Average Emissions Concentrations>



## *Conclusion*

The second sub-hypothesis was supported to a limited extent. Participants from the Green Company Enterprises were making environmental improvements from 2012 to 2016 as a whole, while their counterparts, the group of non-participants were not. However, individual smokestacks from the participating group had mixed outcomes, and one of them had the tendency to reduce the emission concentration level but two of them did not. It is not always that participants of the Green Company Initiative have decreased the annual emission concentration levels more than non-participants. It depends on individual companies.

## **5.3 Regulatory Compliance**

The third sub-hypothesis is that participants of the Green Company Initiative are more compliant with regulations than non-participants. In other words, participants have fewer violations of emission level standards than non-participants. It is required to emit less than 80% of the current SO<sub>x</sub> emission standard and 90% of the current NO<sub>x</sub> emission standard to be eligible for Green Enterprises Initiative membership. Therefore, for the participants, the enhanced standard is applied to show regulatory violations.

### *Data Analysis on SO<sub>x</sub>*

The null hypothesis is that participants and non-participants had no difference in terms of emission standards violations, and it was accepted though T-tests. There was no significant difference in the number of the SO<sub>x</sub> emission standard violation between participants and non-participants of the Green Enterprises Initiatives.

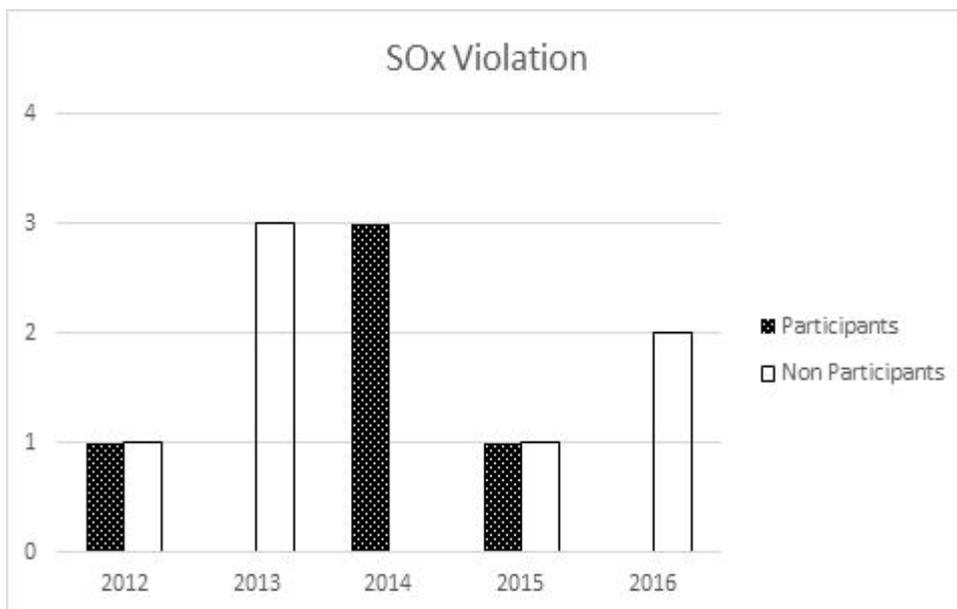
### *Data Analysis on NO<sub>x</sub>*

The null hypothesis is that participants and non-participants had no difference in terms of emission standards violations, and it was rejected though T-tests, and there was a significant difference in the number of the NO<sub>x</sub> emission standard violation between participants and non-participants of the Green Enterprises Initiatives. The participants had fewer violations than non-participants, which means that they are more compliant with emission standard regulations.

### *Conclusion*

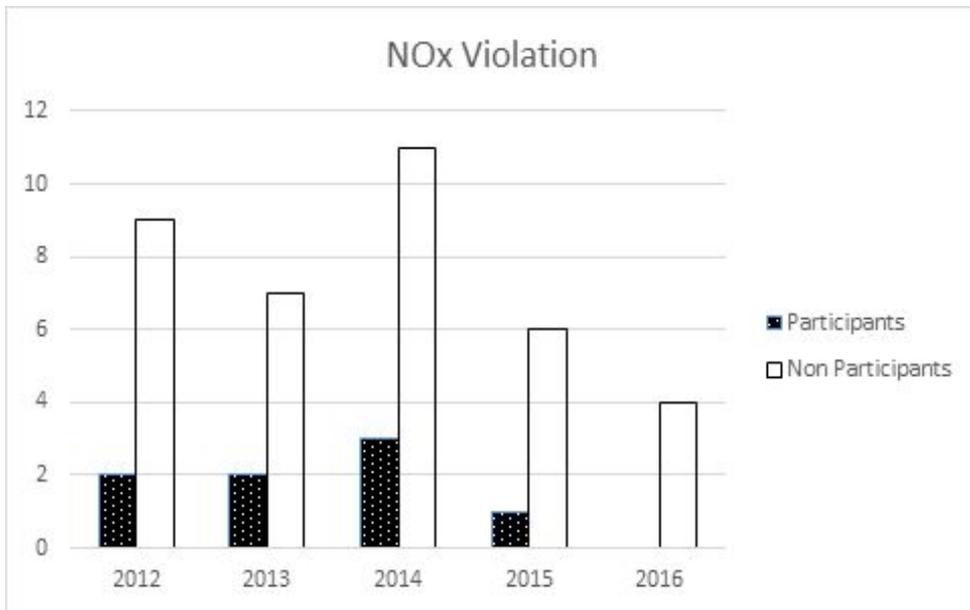
The third sub-hypothesis was accepted in a limited extent. Participants of the Green Enterprises Initiative were more willing to follow regulations, and they were more compliant with environmental regulations.

<Figure 9. The number of Violations –SOx >



	Participants	Non Participants
Mean	1	1.4
Variance	1.5	1.3
Observation	5	5
Pooled Variation	1.4	
Hypothesized Mean Difference	0	
df	8	
t stat	-0.534522484	
P(T<=t) one-tail	0.303755607	
t Critical one-tail	1.859548038	
<b>P(T&lt;=t) two-tail</b>	<b>0.607511215</b>	
t Critical two-tail	2.306004135	

<Figure 10. The number of Violations– NOx>



	Participants	Non Participants
Mean	1.6	7.4
Variance	1.3	7.3
Observation	5	5
Poold Variation	4.3	
Hypothesized Mean Difference	0	
df	8	
t stat	-4.42246	
P(T<=t) one-tail	0.00111	
t Critical one-tail	1.859548	
<b>P(T&lt;=t) two-tail</b>	<b>0.002219</b>	
t Critical two-tail	2.306004	

## 5.4 Conclusion

The leading hypothesis of this research is that *companies participating in voluntary environmental programs have higher environmental performance than companies that are not*. From the data analysis, the leading hypothesis can be rejected. There is no significant difference in the emission records between participants and non-participants. Additional T tests to control for the type of facility (among thermal generation plants) were also conducted, and the conclusion from data analysis was the same.

Non-participants even appeared to be committed to higher environmental performances under a certain condition. However, the participants as a whole have been making better improvements in environmental performance, even though not all of individual participating smokestacks were making improvements. Participants also tended to be more compliant with regulations. It is not obvious that participants showed evidence of better compliance. There is still no significant differences between participants and non-participants regarding the emission levels.

<Table 1. The Verification of the Research Hypotheses>

Research Hypotheses	Emissions Data	Conclusion
Sub hypotheses		
1 <sup>st</sup> Emissions Level	SOx	X
	SOx (Power Generation)	X
	NOx	X
	NOx (Power Generation)	X
2 <sup>nd</sup> Emissions Improvement	SOx	○
	NOx	○
	Smokestack-unit Base	X
3 <sup>rd</sup> Regulation Compliance	SOx	X
	NOx	○
Leading hypothesis		
Environmental Performance		△

\* ○: hypothesis accepted, △: hypothesis accepted limitedly, X: hypothesis denied

## Chapter 6. Conclusion

### 6.1. Findings and Policy Implications

This research aims to assess the environmental effectiveness of voluntary environmental programs. The hypothesis is that participants of voluntary environmental programs commit to higher environmental performance than non-participants. The Green Enterprises Initiatives is chosen as a case of this research, which was initiated by the Korean Ministry of Environment in 1996, and is the one of the oldest and most established voluntary environmental programs in the nation.

From the data analysis, the hypothesis is not always supported. Participants of the Green Enterprises Initiative did not necessarily commit to higher environmental performance than non-participants of the Initiative. However, the conclusion cannot be applied to all types of environmental performance and every participant, but only to air pollutant emissions (SO<sub>x</sub> and NO<sub>x</sub>) and to the participants that have relevant emission data.

It is important to collaborate different policies and bring synergy out of them. Introducing voluntary environmental programs does not always guarantee environmental improvement if it does not correspond with related programs. With the CleanSYS data, companies already have the incentive to keep emission levels

considerably lower than legal compliance, regardless of participating in the Green Enterprises Initiative. The remote monitoring system periodically measures the emission level of the individual smokestacks and sends the result to the main server. Once they are violating emission standards, companies are immediately at risk of being caught and fined. Therefore, it is not easy to encourage participating companies to commit to higher environmental performance than non-participating when non-participating companies are also committing environmental performance beyond legal compliance.

The Green Enterprises Initiative covers more than end-of-pipes pollution. Thanks to technological innovation, monitoring emissions has become easier, pollution reduction technology has improved, and abatement cost has decreased. Companies can achieve emission standards with less effort than before and they can reduce further lower than emission standards more easily than before.

The Green Business Report, the report used to apply for membership in the Green Enterprises Initiative, asks for all of direct and indirect environmental impacts from the companies' activities and strategies to reduce them. It results in inducing companies to make environmental performance improvement not only beyond compliance but also outside of conventional compliance. Applicants need to prepare a Green Business Report with comprehensive targets and strategies on both conventional and innovative environmental performance improvement. It means voluntary environmental programs can improve environmental quality in the area that regulations do not or cannot cover.

Even though participating companies did not commit to significantly higher environmental performance over the last five years, the emission levels

improved in the very last year, 2016. It mainly resulted from the cancelation of two out-of-date thermal power plants that had a negative impact on the average emission level of the participating companies. They recorded lower emission levels than compliance but higher than the average participating companies. The nationwide environmental impacts hardly change because the two thermal power plants keep running their facilities. Still, the environmental effect of participants is improved. It appears that monitoring plays an important role for making voluntary environmental programs work well.

It is also necessary to expand the participation of SMEs to the Green Enterprises Initiative. As observed earlier in this paper, the membership of the Green Enterprises Initiative has been stagnating, and the environmental effect of the Initiative will stay limited accordingly. SMEs, which make up the majority of companies, have more potential to expand the membership base of the Initiative and they will be more willing to participate if the government provide relevant assistance. Large companies already have greater motivation to participate in voluntary environmental programs without incentives, because they care more about their reputations and have extra resources to achieve targets beyond compliance (Neumayer and Perkins, 2004; Kimitaka, 2009; Koehler, 2007, Lyon & Maxwell, 2007). Local governments such as Gyeonggi province have already begun programs to help SMEs apply for the Green Enterprises Initiative membership. The benchmarking of it is highly recommended for local governments.

## 6.2. Limitations and further research

The first limitations of this research were that the only available data to be analyzed was CleanSYS data, and it was not applied to every participant of the Green Enterprises Initiatives. The environmental performance of voluntary environmental program is an open concept, and individual environmental program and participants have differing definitions of it (Nawrocka & Parker, 2008). Quantitative data helps to find out generally applicable performance and assessment, while qualitative data provides more comprehensive understanding. In the Green Enterprises Initiatives, applicants set up individual environmental performance targets based on their own management assessment. It varies from emissions reduction to energy savings, to recycling, to process-efficiency improvements.

For the sake of comparison purpose for this research, CleanSYS data is used. It is a quantitative data that is shared by multiple participants and non-participants at the same time. Still, not every participant of the Green Enterprises Initiative has CleanSYS emission data. About one third of the participants have CleanSYS data, and they are only manufacturing companies larger than a certain size. Therefore, the subject participants are not representing every sector of the Green Enterprises Initiative members.

The second limitation is that only large companies are reviewed. The finding from this research is that companies that are participating in voluntary

environmental programs do not necessarily commit to higher performance than companies that are not. However, non-participants are also large companies that have basic motivations to commit to higher performance without participating in voluntary environmental programs. As discussed earlier, Large companies have greater motivation to participate in voluntary environmental programs (Neumayer and Perkins, 2004; Kimitaka, 2009; Koehler, 2007, Lyon & Maxwell, 2007). The automatic remote monitoring system could limit voluntary commitments from companies as well. Non-participants of the Green Enterprises Initiatives also have some motivation to achieve environmental performance beyond compliance due to the higher risk of being caught and penalized. This applies to both participants and the non-participants. Still, the participants can commit to higher environmental performance than the non-participants.

The recommendations for further study start with the limitations of this research. The service industry is more likely to serve final consumers. This puts greater social pressure on companies and increases social motivation to participate in voluntary environmental programs and commit to higher environmental performance (Rivera, 2007). Therefore, an assessment on participating in voluntary environmental programs and environmental effectiveness in the service industry will provide a more vivid understanding of the subject. It can be a comparative analysis between participating and non-participating companies or between before and after participating in voluntary environmental programs.

Another recommendation for further study is an assessment on motivations and effectiveness for SMEs. As discussed earlier, participation of SMEs has more potential to make environmental improvement through voluntary

environmental programs. However, only large companies were considered in this paper due to the limitation of data. An assessment on SMEs would be a meaningful addition to this research.

Finally, it is noticeable that the participating companies organized the association called the Green Enterprises Association to share information and best practices among themselves. Cooperation helps members commit to higher environmental performance, but it is not considered in this study. Such collective contributions of voluntary approach could be a future research.

## References

- Alberini, A., & Segerson, K. (2002). Assessing voluntary programs to improve environmental quality. *Environmental and Resource Economics*, 22 (1/2), 157-184
- Arimura, Hibiki, & Katayama. (2008). Is a voluntary approach an effective environmental policy instrument? A case for environmental management systems. *Journal of Environmental Economics and Management*, 55(3), 281-295.
- Bi, X., & Khanna, M. (2017). Inducing pollution prevention adoption: Effectiveness of the 33/50 voluntary environmental program. *Journal of Environmental Planning and Management*, 60(12), 2234-2254
- Brouhle, K., Griffiths, C., & Wolverton, A. (2005). The use of voluntary approaches for environmental policymaking in the US. *The handbook of environmental voluntary agreements*, 107-134.
- Darnall, Henriques, & Sadorsky. (2008). Do environmental management systems improve business performance in an international setting? *Journal of International Management*, 14(4), 364-376.
- Delmas, M. and Terlaak, A.K., (2001) A Framework for Analyzing Environmental Voluntary Agreements *California Management Review* 43(3), 44-64
- Gamper-Rabindran, S. (2006). Did the EPA's voluntary industrial Toxics Origram Reduce Emissions? *Journal of Environmental Economics and Management* 44, 169-187

- Giuliano, Giuliano., Linder, Alison. (2013). Motivation for Self-regulation. *The clean air action plan. Energy Policy*, 59, 513-522
- Gunningham, N., & Sinclair, D. (2002). Leaders & laggards next-generation environmental regulation. Sheffield: Greenleaf Pub.
- Gunningham, N., Kagan, R.A., and Tornton, D. (2004). Social License and Environmental Protection; Why Companies Go Beyond Compliance. *Law and Social Inquiry*, 29(2), 307-341
- Hubo, C., & Krott, M. (2013). Voluntary Agreements: First Choice or Escape Strategy? - Invasive Alien Species as a Case. *German Policy Studies*, 9(2), 93-122,161.
- Khanna, M. (2001). Non-mandatory approaches to environmental protection. *Journal of Economic Surveys*.15(3), 291-324
- Khanna, & Damon. (1999). EPA's Voluntary 33/50 Program: Impact on Toxic Releases and Economic Performance of Companies. *Journal of Environmental Economics and Management*, 37(1), 1-25.
- Khanna, M., & Liao, Y. (2014). Globalization and Voluntary Environmental Management in Developing Countries. *Frontiers of Economics in China*, 9(1), 138-163.
- Kim, Geum-Soo. and Oh, Wankeun. (2007). "Environment-Friendly Company Designation System and Business Performance: Analysis by Top 5 Companies and by Industries," *Journal of Environmental Policy and Administration*, 15(2), 49~80.
- Kim, Geum-Soo., Oh, Wankeun., and Park, Seung-ho. (2014). The Effect on Stock Return by Green Company Designation, *Journal of Environmental Policy and Administration*, 22(3), 77~100.

Kim, Myung-Seo and Kim, Yeo-Hwan. (2008). The Impact of Environmental Disclosure of Environment Friendly companies on Companies Value, *Korean Journal of Business Administration*, 21(6), 2655~2679.

Kim, Myung-Seo, Kim, Yeo-Hwan and Kim, Min-Chul. (2010). The Impact of Investment and Expenses for Environmental Management Activities on Companies Value, *Korean Journal of Accounting Research*, 15(2), 119~141.

Kim, S.H., Jung, Y.K., Lee, G., (2008), The Impact of Environmental Management System on Corporate Productivity (Based on ISO14001) *Journal of Environmental policy*, 16(2), 119-149

Kimitaka, Nishitani. (2009), An Empirical Study of the Initial Adoption of ISO 14001 in Japanese Manufacturing Companies. *Ecological Economics*, 68(3), 669-679

Koehler, D. A. (2007), The Effectiveness of Voluntary Environmental Programs-A policy at a crossroads? *Policy Studies Journal*, 35(4), 689-722.

Krarup, S. (2001). Can voluntary approaches ever be efficient? *Journal of Cleaner Production*, 9(2), 135-144.

Lin, H., Zeng, S., Ma, H., & Chen, H. (2015). Does Commitment to Environmental Self-Regulation Matter? An empirical examination from China. *Management Decision*, 53(5), 932-956.

Lyon, Thomas P. and Maxwell, John W., 'Voluntary' Approaches to Environmental Regulation: A Survey (1999). Available at SSRN: <https://ssrn.com/abstract=147888>

Lyon, T., & Maxwell, J. (2007). Environmental Public Voluntary Programs

- Reconsidered. *Policy Studies Journal*, 35(4), 723-750.
- Maxwell, J., Lyon, T., & Hackett, S. (2000). Self-Regulation and Social Welfare: The Political Economy of Corporate Environmentalism. *The Journal of Law and Economics*, 43(2), 583-618.
- Nawrocka, & Parker. (2009). Finding the connection: Environmental management systems and environmental performance. *Journal of Cleaner Production*, 17(6), 601-607.
- Neumayer, E., & Perkins, R. (2004). What Explains the Uneven Take-Up of ISO 14001 at the Global Level? A Panel-Data Analysis. *Environment and Planning A*, 36(5), 823-839.
- OECD (2000), *Voluntary Approaches for Environmental Policy: An Assessment*, OECD Publishing, Paris.
- Park, Jeongyun., Park, Jinsung., Lee, Miyong. (2007). Effects of Environmental Affinity Management on Stock Returns. *Journal of Korean National Economy*. 25(3), 81
- Park, Junwoo. (2006). Equilibrium of Voluntary Agreements on Recycling Wastes. *Journal of environmental policy*, 5(4), 107-126
- Rivera, J. (2002). Assessing a voluntary environmental initiative in the developing world: The Costa Rican certification for sustainable tourism. *Policy Sciences*, 35(4), 333-360
- Steelman, T., & Rivera, J. (2006). Voluntary Environmental Programs in the United States. *Organization & Environment*, 19(4), 505-526.
- Toller, A.E. (2013), The Rise and Fall of Voluntary Agreements in German Environmental Policy. *German Policy Studies*, 9(2), 49

Töller, A., & Böcher, M. (2013). Introduction: What is the Role of Voluntary Approaches in German Environmental Policy - and Why? *German Policy Studies*, 9(2), 1-20,161.

한국환경기술원 (KEITI), (2008), 환경친화기업 지정제도 발전방안

# 국문 초록

서울대학교 행정대학원

글로벌행정 전공

장부영(2015-24256)

자율형 방식의 환경정책은 기업들이 법적 책임 이상의 환경 성과를 달성할 수 있도록 유인하기 위해 사용되는 제도이다. 기존의 명령 통제형 규제(command and control)와는 달리, 기업들이 환경성과 목표를 설정하는 것에 참여할 수 있고, 또한 목표의 달성 방법을 스스로 선택 수 있는 융통성이 있으며, 비용효과적인 방법으로 환경개선을 달성할 수 있게 된다. 이를 통해 기업은 자신에게 가장 비용효과적인 방법으로 환경 성과를 달성함으로써 비용을 절감하고, 자발적으로 사회적 책임을 수행하는 기업으로서 명성을 얻을 수 있다. 또한 정부는 기업과의 협력을 통해 행정적·정치적 부담 등을 덜 수 있다. 이러한 장점에 따라 현재 자율형 방식의 환경정책이 널리 사용되고 있다.

한국에도 많은 자율형 방식의 정책수단이 도입되었으나, 이에 대한 연구는 다른 주요 국가에 비해 부족한 편이다. 또한 대부분의 연구가 이러한 제도를 통한 기업의 경제적 편익에 관한 것이다. 이에 대해 본 연구는 대표적인 자율적 참여제도인 녹색기업 지정제도를 통해 자율형 환경정책의 환경적 편익에 초점을 맞추고자 하였다.

사례 연구 결과, 자율형 환경정책인 녹색기업 지정제도에 참여하는 기업들이 반드시 높은 환경성과를 보이는 것은 아니다. 녹색기업 지

정제도의 참여자들은 비참여자들에 비해 대기오염물질(황산화물 및 질소산화물) 배출 농도 수준에 있어서 특별한 차이점을 보이지 않았고, 오히려 더 높은 배출 농도 수준을 기록하기도 하였다. 배출 농도 개선에 있어서는 전체적으로 녹색기업 지정제도의 참여자들이 비참여자들에 비해 지속적으로 배출 농도가 감소하는 모습을 보였으나 개별 시설단위에서는 뚜렷한 경향이 없었다. 마지막으로 규제 준수와 관련하여 질소산화물의 경우는 녹색기업 지정제도 참여자들이 현저히 낮은 수의 위반사례를 보였으나 황산화물의 경우에는 뚜렷한 차이가 없는 것으로 나타났다. 따라서 자율형 방식의 환경정책에 참여하는 기업들이 참여하지 않는 기업들에 비해 더 높은 환경 성과를 보인다는 일반적인 믿음이 항상 사실로 입증되지 않는다고 할 것이다.

기존 연구에서 환경 성과에 대한 평가는 엇갈리게 나타난다. 이는 환경 성과에 대한 정의는 다양하게 가능하고 연구마다 다른 정의를 사용하기 때문이다. 이 연구에서는 비교연구를 위해 환경 성과를 판단하는 양적 지표로서 원격감시장치를 통해 수집한 배출 자료를 활용하였다. 따라서 이 연구의 한계는 녹색기업 지정제도 참여기업 중 일정규모 이상의 제조업이자 원격감시장치 설치대상기업만 분석의 대상이 되었다는 점이다. 자율형 환경정책으로서 녹색기업 지정제도는 단순한 오염물질 저감이 아니라 통합적 환경관리 제고를 목적으로 하는 만큼 향후 질적 지표를 대상으로 한 녹색기업 지정제도 등 자율형 환경정책의 환경 성과에 대한 연구가 필요하다. 또한 이번 연구에서 해당되지 못한 중소기업 참여자들의 환경성과 연구도 필요하다.