

**Proposals for a Sustainable Energy Regulatory Framework:
The Case of Carbon Pricing in South Korea**

by

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Abstract

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This dissertation focuses on analyzing the problems of the institutional structure and the process of energy policymaking for carbon pricing as a domestic implementation scheme of the global climate accord and making proposals for improvement. The case of South Korea illustrates the political and institutional challenges and conflicts that the global climate change scheme faces concerning local implementation. The country has recently experienced continued lower rate of renewable energy generation and acute political conflicts on energy options, despite ambitious commitment to reduce greenhouse gases communicated globally. This study analyzes the political and institutional causes of the current problems with the South Korean energy regulatory scheme as a case study and makes proposals for the institutional and instrumental changes required to mitigate those problems. The goal of the proposals is to build a more efficient energy policymaking process with enhanced transparency in order to make the energy generation and consumption of South Korea more sustainable, which will enable the country to contribute to global efforts concerning climate change mitigation.

The dissertation begins by reviewing energy policy documents, research papers containing cost-benefit analyses and the carbon pricing created by multiple agencies of the Korean government, which were obtained through official information disclosure requests filed with the Korean government. The analysis focuses on the less refined cost-benefit analysis, the inconsistent and unfounded method of carbon pricing in each document, and the dynamics among relevant agencies by comparing the subtle difference in the way each agency handles energy policy, including carbon pricing. This review further elaborates on the less aligned aspects of the relevant policy instruments, such as the traditional command-and-control style of environmental regulations and the status of their implementation, a newly introduced market-based emissions trading scheme, the wholesale electricity pricing mechanism with the market structure and carbon pricing methodology.

Proposals to mitigate those problems based on a comparative review of corresponding U.S. energy policy follow in three aspects, addressing the practicality and the expected political conflicts: (i) instrumental changes in energy policymaking required to make the cost-benefit analysis for energy policies more accountable, efficient, and transparent, reflecting proper carbon

pricing; (ii) improvements of the current nation-wide, market-based emissions trading scheme for CO₂, with further refinement of the relevant command-and-control type regulations, and the electricity price scheme; and (iii) institutional changes required in the structure of the relevant agencies and the electric power market required to build a more solid institutional infrastructure to effectively implement domestic climate-change policy, securing noticeable independence from political changes.

To my mentors who have been the spring of perseverance and inspiration during the journey

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CHAPTER 1

INTRODUCTION

I. Lofty Ideals and the Reality: What are the Problems?

The following three snapshots capture what South Korea (“Korea”) once aimed to be in terms of the climate change regime and discuss the current problems of the South Korean regulatory scheme in the energy sector. The substantial and procedural problems described in these episodes are closely intertwined with one another and raise questions of efficiency, sustainability, and democracy in Korean policymaking in this sector.

#1. Korea’s economy developed rapidly after World War II with a focus on manufacturing businesses; this development was led by the government, resulting in the country’s global rank of higher than 10th in CO₂ and NO₂ emissions amounts. Korea tried to make a visible contribution to the global efforts to mitigate climate change damages during the period of the country’s transformation from a middle-income country into a developed one. In this regard, Korea committed to aggressively reducing greenhouse gases to global society under the Copenhagen Accord and the Paris Agreement. Korea also brought the headquarter office of the Green Climate Fund, the financial mechanism of the UNFCCC, into the country as a symbolic measure of its willingness to join global efforts. It also made significant changes to the domestic legal and institutional scheme to respond to climate change and even launched a nationwide emissions trading scheme for CO₂, in which the energy sector is legally required to participate. But several global surveys performed in 2016 indicate that the air quality in Korea is among the lowest in the world, and the level of implementation of the Paris Agreement is also among the lowest. As of 2017, 11 new coal power plants are under construction. What is the root of this problem? Does the authority of the new domestic climate change laws matter? Does the traditional command-and-control regulation on air pollutants or the emissions trading scheme work? Which part of the government leads the climate change regime, and what is the ultimate interest of the relevant agencies?

#2. Two affiliates of large conglomerates based in Korea, both of which have a significant global presence, recently decided to build new coal power plants in regions outside the capital despite vehement opposition and continuous demonstrations from groups of neighboring residents. The central agency responsible for the energy sector encouraged the plants, while the central agency for the environment was not entirely favorable but did not explicitly object. The companies knew that the nationwide emissions trading scheme would be effective soon, and the relevant regulations would change to address climate concerns at the

time that they decided the plan. They could have chosen natural gas power plants instead of coal power plants, and, in fact, one of the conglomerates has even expanded the shale gas business in the U.S. and was thus well aware of the swift changes in the global energy sector. One interesting aspect is that the two companies have reportedly already spent almost \$1 billion on the projects even though the approval has not yet been finalized. What drove these companies to decide to build coal power plants and proceed to implement their plan with major capital investment despite the fact that final approval has not been given? What types of environmental costs did the companies assign to the electricity pricing? Why did the central agency responsible for energy encourage the new coal power plants, and why was the agency responsible for environment silent? Does the environmental impact assessment work? Why have neighboring residents not filed a lawsuit to stop the plants?

#3. The new democratic government in Korea made environment-friendly electoral commitments during the presidential election. Immediately after the election, it announced new energy policies in a decisive tone to promote renewable energy and reduce dependence on coal, which was in line with Korea's international presentation. The new plans include a proposal for changes of the two new coal power plants into natural gas power plants, but the government does not provide any estimate or evaluation of the environmental and health benefits of such policies. Thus, the announced policies do not present what value these measures would create. The descriptions of the benefits consist of vague expressions, such as stating that the newer policies will help public health and contribute to achieving the commitment made to global society. Such policy plans immediately faced challenges from the industry for the significant costs they would incur. Public opinion and reports from renowned media outlets are divided. A cost-benefit analysis scheme for regulatory oversight has been in place in the country since the late 1990s, but it was not used in making the new policy announcements. What allowed the government to announce the new policies without assessing the cost and benefits? What is the level of understanding among the general public in Korea about the required changes in the energy sector to mitigate the climate change? What should the new government do about the process of policymaking in order to garner more political support for the new policies? Have there been any efforts to reflect the social cost of carbon, or any other estimate of benefits, from reducing the greenhouse gases, given that the country has previously used the cost-benefit analysis for policymaking?

Anthropogenic greenhouse gas emissions have induced the climate change accompanied by natural disasters and ecological disorder, and the associated criteria pollutants have also caused serious local health problems. Transnational discussions over the coordinated efforts to mitigate the climate concerns continue. The environmental responsibility required for a sustainable earth and the urgent need to respond to climate change led energy generators, consumers and regulators to move away from fossil fuel energy resources into renewables and

seriously consider energy efficiency. Such drastic change introduced various new types of participants into the energy market, e.g., solar photovoltaic systems providers, demand aggregators and energy prosumers with solar photovoltaic systems on their rooftops. This change has added more variables to another axis of the long-running transformation in the market structure, i.e., deregulation and vertical disintegration accompanied by more competition.¹ Thus, the energy sector, which was once managed by the economic regulations of the government and a small number of monopolistic suppliers, faces multifaceted tasks and conflicts with more interested parties in the process of advancing to a more sustainable structure. The historical experience in the energy regulation, market structure and the systematic legal and political infrastructure in each country result in different achievements and challenges in adapting to the rapid changes.

This dissertation aims to analyze the causes of those challenges and makes proposals for institutional changes and efforts required to build a more sustainable and efficient energy sector with a more transparent and participatory process in the case of Korea in comparison with the experiences of the U.S. The policy of pricing the environmental externalities of greenhouse gas emissions in the electric power sector comprises the central discussion material.

II. Structure of the Dissertation

The following chapters focus primarily on the electricity sector, which was selected among several energy sectors for two reasons. First, the power generation sector contributes significantly to greenhouse gas emissions in Korea, as in many other countries. It is expected to account for approximately 39% of the greenhouse gas emissions in Korea in a business-as-usual scenario in 2030, which would be the most significant among all contributing sectors.² The status of efforts to electrify vehicles also explains the importance of decarbonizing the electricity grid. Korea is currently less incentivized to electrify vehicles, which is another significant source of fossil fuel consumption because the structure of the power generation sector does not allow the reduction of greenhouse gas and air pollutants emissions through vehicle electrification, due to its heavy dependence of coal.³ Second, Korea has an advanced infrastructure for

¹ Energy resources or services, once considered natural monopolies, are no longer so considered, which has made almost the entire energy sector - except for the operation of the transmission grid – deregulated and vertically disintegrated, inviting more competition to the generation, wholesale and retail markets.

² The Ministry of Environment, The First Framework Plan for Responding to Climate Change, 68 (Dec. 2016), at [http://www.me.go.kr/home/web/board/read.do;jsessionid=116rNHDx28D1cNA8S7CjLu09oZ1HCsVCa6oPRJnzZiH11EFXgXhMqA8OtXBtfQj7.meweb2vhost_servlet_engine1?pagerOffset=0&maxPageItems=10&maxIndexPages=10&searchKey=&searchValue=&menuId=286&orgCd=&boardMasterId=1&boardCategoryId=&boardId=722500&decorator=.](http://www.me.go.kr/home/web/board/read.do;jsessionid=116rNHDx28D1cNA8S7CjLu09oZ1HCsVCa6oPRJnzZiH11EFXgXhMqA8OtXBtfQj7.meweb2vhost_servlet_engine1?pagerOffset=0&maxPageItems=10&maxIndexPages=10&searchKey=&searchValue=&menuId=286&orgCd=&boardMasterId=1&boardCategoryId=&boardId=722500&decorator=)

³ Recent research has estimated that the greenhouse gas emissions of battery electric vehicles considering the generation mix in Korea is comparatively higher than the global average, regardless of the size of vehicles – subcompact, compact, full-size luxury or SUV – higher than, e.g., the U.S., U.K., Japan and Mexico. See JongRoul Woo, Hyunhong Choi, and Joongha Ahn, Well-to-wheel analysis of greenhouse

electricity and wireless communication, which would enable the country to rapidly adopt policies for higher energy efficiency. Korea has quickly developed the infrastructure for electricity transmission in recent decades and has managed the grid system quite well in terms of users' accessibility and grid reliance. The World Bank ranked Korea as the first in the "Getting Electricity" indicator among 190 countries in 2017.⁴ Thus although the electricity sector illustrates the current problems of the energy regulatory scheme, it is equipped with a strong potential to improve.⁵

Chapter 2 provides an introduction to the electricity industry in Korea as a primer for the discussions in the following chapters. The chapter first presents an overview of the energy market and the electricity generation mix, along with the status and challenges in promoting renewable energy. The primary political issues pending at this stage are also reviewed and analyzed. The U.S. electricity sector, with a focus on the market, the generation mix, and the current political controversies over the climate policy, is also briefly reviewed.

Chapter 3 analyzes the regulatory system for the energy sector as the starting point for the discussions of this dissertation, first reviewing the basic institutional design of the policymaking regime before expanding it to the roles and operations of the regulatory agencies with a focus on the energy sector. The chapter then discusses control over agencies within the executive branch through the regulatory oversight system, and, finally, the system of checks and balances by the other government branches, the legislature and the court. The Korean case is discussed in detail to identify the general problems in the policymaking process, and the U.S. case is reviewed in comparison.

Chapter 4 discusses the social cost of greenhouse gases as the central factor for climate policies. The chapter starts by discussing the significance of the concept of the social cost of greenhouse gases and the cost-benefit analysis for climate policy as a frame that reflects that cost, with a focus on the context of Korean policymaking. The approach to the social cost of greenhouse gases in Korea and the U.S is then carefully reviewed. As Korea has yet to develop an organized scheme for use of the social cost of greenhouse gases, the review of the Korean case focuses on how agencies have handled pricing damages from greenhouse gas emissions when designing the policies with climate change implications. The actual policy documents and information obtained through the Information Disclosure Request filed with the Korean government are subject to this review.⁶ The review of the U.S. approach, meanwhile, focuses

gas emissions for electric vehicles based on electricity generation mix: A global perspective, *Transportation Research Part D: Transport and Environment*, Vol. 51, 340-350, 345 (March 2017).

⁴ The World Bank, *Doing Business 2017: Equal Opportunity for All*, 217, available at <http://www.doingbusiness.org/~media/WBG/DoingBusiness/Documents/Annual-Reports/English/DB17-Full-Report.pdf>. The "Getting Electricity" indicator reflects reliability of supply, procedures to obtain an electricity connection, time required to complete each procedure, etc. *Id.* at 127.

⁵ Enhancing the grid reliability and upgrading the grid to accommodate the intermittency from the increased use of renewable energy sources are the tasks that are currently the most frequently discussed for the electricity sector. Korea has a lower burden in this regard and more capacity to focus on the decarbonizing issue.

⁶ This was made based on the Public Institutions' Information Disclosure Act (Legislation No. 14839),

on the process of how the federal government calculated the social cost of carbon and the primary substantive issues discussed during the process. This analysis interprets policy implications from the U.S. experience that should be considered when the Korean government determines and uses the social cost of carbon, both in terms of procedural and substantive aspects.

Chapters 5 and 6 set forth recommendations for reform based on the discussions of the previous Chapters. Chapter 5 proposes the required reform efforts in the policymaking process, as well as the structure of the energy agency and the market required to properly utilize the social cost of greenhouse gases. Chapter 6 proposes reforms for the current market-based regulation mechanism to make firms properly internalize the social cost of greenhouse gases in business decisions. The chapter first reviews the problems of the current, central, market-based mechanism in Korea, the nationwide cap-and-trade scheme for carbon dioxide and the pricing scheme in the half-deregulated wholesale market, including the formula for compensating power generators' costs of securing emissions rights. Next, the proposals for reform to properly reflect the social cost of carbon on the electricity price are discussed, which would eventually affect the dispatch order. Finally, the problems in the retail-pricing scheme for industrial customers are reviewed and analyzed to assess the acceptability of the potential increase in electricity prices if the social cost of carbon is more properly reflected.

which has a function similar to that of the U.S. Freedom of Information Act.

CHAPTER 2

PRIMER: OVERVIEW OF THE ELECTRICITY SECTOR

This Chapter introduces the Korean energy industry with a focus on the electricity sector as a primer for the discussions that follow. The historical status of the energy market, economic regulations, the current and future needs in terms of energy procuring and spending, and the primary political issues pending at this stage are explained. The U.S. electricity sector is also briefly introduced.

I. Korean Energy Sector with New Tasks

The population of Korea was estimated to be 51 million in 2016, the 27th largest in the world and 9th among the OECD countries.⁷ The Gross Domestic Product (GDP) was measured as \$1,411.25 billion USD in 2016, representing 2.28% of the world economy.⁸ The GDP per capita was \$25,458.9 USD the same year, 13th among the G20 countries.⁹ The country is known for its rapid economic development, led by the government, from the extreme degradation after the Korean War in 1950s.¹⁰ The manufacturing business was estimated to account for 29.75% of the GDP, higher than Germany (23.06%), Japan (20.54%) and the U.S. (12.27%) in 2015.¹¹ Electronic, optical, and computer instruments; vehicles; primary metals and chemicals are primary in manufacturing and are recognized as higher energy consumption businesses.¹²

Korea is an energy island for geopolitical reasons, which means it does not have adjacent countries to which it can sell surplus electricity or from which it can purchase electricity in case of urgent needs.¹³ It is also notable that Korea's level of energy independence is extremely low,

⁷ The World Bank, Gross Domestic Product 2016 and Population Ranking 2016.

⁸ Trading Economics, South Korea GDP, at <https://tradingeconomics.com/south-korea/gdp> (last visited April 10, 2018).

⁹ Trading Economics, South Korea GDP per capita, at <https://tradingeconomics.com/south-korea/gdp-per-capita> (last visited April 10, 2018). The 12 countries with GDP per capital higher than Korea include the Euro Area.

¹⁰ For the general overview of the Korean economic development history from 1950's up until 2000's, see Bruce Cumings, *Korea's Place In The Sun: A Modern History* (updated ed.), 299-341 (2005).

¹¹ The World Bank, Manufacturing, value added (annual % growth) - World Bank Open Data, at <https://data.worldbank.org/indicator/NV.IND.MANF.KD.ZG> (last visited April 10, 2108).

¹² Jung-Eun Park, and Sung-Hee Min, *Analysis and Implication of the Domestic and Foreign Manufacturing Business in 2016*, Korea Development Bank Monthly Report, 56 (Feb. 2017). The recent flourishing of the semi-conductor supports the ratio of manufacturing business.

¹³ All of its natural gas importation is through marine transportation, and the country does not have a

and it imports most of the petroleum and natural gas needed by the domestic market, and the coal for power generation, as well.¹⁴ These natural and geopolitical conditions have thus far supported the centralized management of the energy sector.

A. Historical Origins of the Electricity Sector in Korea

The first supplier of electricity on the Korean peninsula, Hansung [meaning *capital*] Electricity Power Company, was incorporated in 1898, and the whole interest was held by King *Gojong* of the Lee Dynasty.¹⁵ The recognition of government ownership and control of energy resources were reflected in the first Constitution of Korea enacted in 1948,¹⁶ which declared that “natural resources and power belong to the state” and “the enterprises of important transportation, telecommunication, electricity, water, gas, and other publicness shall be operated by the government or the public,”¹⁷ which emphasizes the public aspect and stability of such utilities without mentioning efficiency and other values concerning public utility regulation.

The focus of Korean electricity business regulation until the 1990s focused on the stable supply of electricity to residential and industrial customers. The aforementioned provisions of the first Constitution were amended in the 1954 Constitution, and the provisions declaring government ownership of natural resources and public utilities enterprises were removed. Those provisions were further refined and amended in the most recent 1987 Constitution, which provides the grounds for government intervention in private use of natural resources and the

pipeline for importing natural gas. There has been discussion on a possible electricity grid and natural gas pipeline connection among South and North Korea, Japan, China and Russia, which was initiated by a Japanese entrepreneur after the Fukushima disaster. However, this goal seems unlikely to be realized soon given the current political situation in the Northeast Asia. See, e.g., Y.H. Kim, *The Northeast Asian Super Grid Project, Forming a Regional Energy Community*, Fortune Korea, Jan. 2018, <http://www.sedaily.com/NewsView/1RUDXWFKUL> (last visited Feb. 20, 2018); K.M. Park, “*Northeast Asian Electric Grid Connection Discussion Resumed?*”, Electric Times (Dec. 16, 2016), available at <http://www.electimes.com/article.asp?aid=1481778153140242002>.

¹⁴ According to the statistics published by the Korea Energy Economy Research Institute, the energy independence of Korea is 11.7% even if nuclear power generation is counted as domestic supply. See Ministry of Trade, Industry & Energy and Korea Energy Economics Institute, 2015 Yearbook of Energy Statistics, 216-17 (Dec. 2015).

¹⁵ Korea Electric Power Corporation, History of Korean Electricity, available at <https://home.kepco.co.kr/kepco/EN/A/htmlView/ENAAHP002.do?menuCd=EN010102>, <https://home.kepco.co.kr/kepco/PR/F/htmlView/PRFAHP00203.do?menuCd=FN0605030103>.

¹⁶ The first Constitution of Korea became effective on July 17, 1948. See Articles 85 and 87.

¹⁷ The first Constitution did not clarify what type of economic system Korea would adopt because the country was still exploiting the political and economic system that would best suit the nation after the Japanese colonial period ended. Therefore, those provisions cannot be immediately interpreted as principles based on a social market economy.

basis of modern energy regulation, and stresses the balanced development and utilization of natural resources and gives the authority to establish a plan for such use to the government.¹⁸

The historical movement of the initiative in the energy sector made electricity generally recognized as a public good similar to the national security service, rather than a natural monopoly whose use should be properly paid for to reflect the balance of the supply and demand. The term “electricity tax” has been used to refer to the electricity charges and even acknowledged by the government as a standard language term that can be used for government documentation due to its historically pervasive use, despite its misleading nature.¹⁹ Both the centralized management of the energy sector, due to the historical origin and the scarcity of energy resources, and the government’s strong leadership, the general economic development has contributed to keeping the general energy policymaking process opaque and made participation from the public or the other industrial sectors passive. This explains contemporary social culture in Korea, in which deregulation, privatization or competition in the electricity industry are not so actively discussed and face political resistance. Such aspects of legal culture affect the dynamics of the electricity industry and have slowed the speed of systematic adjustments needed to respond to the diversification of the electricity sector with environmental concerns.

B. The Structure of the Korean Electric Power Market

In addition to the origin of the electricity sector, the tradition of government-led economic planning has contributed to the current shape of the energy sector. Korea’s overall economic development after the Korean War was made under the government’s “Five Year Plan for National Economic Development,” which was published once every five years from 1963 to 1992, and the last plan, which also covered the energy sector, was effective until 1997.²⁰ After the final such plan ceased to be effective, the “National Basic Energy Plan” has been announced once every five years under the relevant energy framework laws to determine the policy direction.

On the continuum of the historically centralized ownership of the electric power business, the electric power market was completely monopolized by the government-owned corporation

¹⁸ Constitution of Republic of Korea, Article 120(1) states that licenses to exploit, develop or utilize minerals and all other important underground resources, marine resources, water power and natural powers available for economic use may be granted for a period of time under the conditions as prescribed by statutes; Article 120(2) states that the land and natural resources shall be protected by the State, which should establish a plan necessary for their balanced development and utilization.

¹⁹ The Standard Korean Language Dictionary prepared by the National Institute of Korean Language defines the “electricity tax” as “a usually used term for the electricity charge.” See National Institute of Korean Language, Standard Korean Language Dictionary, at http://stdweb2.korean.go.kr/search/List_dic.jsp.

²⁰ See National Archives of Korea, Archives of Five Year Plans for National Economic Development, available at <http://theme.archives.go.kr/next/economicDevelopment/primary.do>.

Korea Electric Power Corporation (KEPCO)²¹ until the government opened the wholesale market to private companies in 2001 as part of a sweeping structural change of the electric power market at the request of the Organization for Economic Co-operation and Development (OECD) and International Bank for Reconstruction and Development (IBRD).²² The OECD examined the member states' regulations of the public utilities industry as part of its regulatory reform program and recommended the separation of generation from the transmission/distribution and also retailing and marketing from transmission/distribution of electricity.²³ The IBRD reportedly required the Korean government to restructure the public utility industries, including the electricity market, as a condition for certain loans.²⁴

The KEPCO's power generation business unit was divided into six separate entities, one for nuclear and water power generation, and the other five for fossil fuels, but ownership is still held by the KEPCO.²⁵ The market share of the government-owned generators still amounts to 90%, and all electricity generators are required to sell electricity through the Korea Power

²¹ The KEPCO was incorporated in 1961, merging three government-owned electric power companies. The government listed partial shares in The KEPCO in Korea in 1989, and in the New York stock market in 1994. The current government ownership is 51%. Korea has many government-owned corporations that helped the rapid development of its economy during in recent decades. Private ownership in government-controlled corporations does raise questions over how to protect the rights and interests of the minority shareholders and how to manage conflicts between the public interest purpose of those entities and the private investors' interest, which has not yet received enough attention in Korea. As energy efficiency and conservation policies in the retail sector draw more notice, which will lead to the decrease of the KEPCO's revenue from retail sales, those governance issues in the government-owned or controlled corporations will be more actively discussed in the near future.

²² Ministry of Industry and Resources, Basic Plan for Restructuring Electric Power Market (Jan. 21, 1999); OECD, Restructuring Public Utilities for Competition, 31-37 (2001) at <https://www.oecd.org/competition/sectors/19635977.pdf>.

²³ OECD, *Id.*

²⁴ Ministry of Industry and Resources, *supra* note 22.

²⁵ The partial IPO or sales of the shares in the five fossil fuel generation corporations have been actively discussed with no tangible result yet. The most recent plan for privatization was virtually withdrawn in 2017. (See J.B. Kwon, "The Plan for Listing the Public Energy Corporations Foundered," Energy News, Sep. 16, 2017, <http://www.energy-news.co.kr/news/articleView.html?idxno=49985>, last visit, Feb. 25, 2018.) The government only considered sales of less than 50% in each generation corporation, with the control remaining with the government. The primary reasons that the sales have not been realized can be summarized in three aspects. First, there have been concerns over the situation in which Korean conglomerates would have significant ownership of the generation corporations that the highly concentrated domestic market structure of Korea dominated by a few *chaebol* conglomerates would be vulnerable to economic fluctuations, making the energy security even weaker. Second, the idea of inviting foreign investors into this privatization plan also raised concerns, given that the energy sector is the basic industry, as is typically seen in many other jurisdictions. These two restrictions on potential investors made it difficult to make the corporations half-public. Third, strong concerns over the possibility of an electricity price increase played a significant role in the discussion with some political background.

Exchange (KPX) and only to the KEPCO, which the government controls, and no over-the-counter, direct transaction between a generator and an end-user has been made yet.²⁶ Thus, the wholesale market is monopolized by the KEPCO.

C. The Current Status and the Future Needs in the Energy Generation Mix

Another distinct characteristic of the Korean energy sector is that it has developed the economy mostly based on manufacturing industries with a higher dependence on coal for electricity and thermal generation.²⁷ As a result, Korea ranked fourth among OECD countries and seventh worldwide for CO₂ emissions from fuel combustion as of 2015.²⁸ The worldwide contribution ratio is around 1.8%, which is comparatively far less significant than the countries higher in the ranking, but the contribution is still higher than most other countries in the world. Given that the scale of Korean GDP is 14th and the population is 27th in the world, the ranking of CO₂ emission is relatively higher than the comparative economy scale and population.²⁹ The current energy mix in the electricity generation is seen in Table 1, which shows high dependence on coal and slow development in renewable sources. The ratio of genuine low-carbon renewable sources is much lower, given that renewable sources in Korea typically include waste fuels due to the legislative definition.³⁰

²⁶ The legislative ground for such direct transaction has been in place, but the formula for the retail rate for such transactions is set much higher by the government than the KEPCO's retail rate, also set by the government, which made no customer buy from electricity directly from generators on the KPX for 13 years, until May 2016. See Electric Power Business Act (Legislation No. 6283, amended in 2000), and Deuk-gwan Goh, It is not likely the Direct Purchase System of Electricity will negatively affect the KEPCO's business, Maeil Business News Korea, May 24, 2016, <http://news.mk.co.kr/newsRead.php?year=2016&no=370917> (last visited February 23, 2018).

²⁷ The central products has changed from steel, chemicals, and vehicles to components and devices with information and communications technology. However, the ratio of manufacturing business in the total economy continues to grow. See Hyundai Research Institute, Weekly Economic Review, Issue 16-27 (May 27, 2016).

²⁸ IEA, CO₂ Emissions from Fuel Combustion (2017 Edition), 94-96. Korea ranked fourth following the U.S., Japan and Germany among the OECD countries, and seventh worldwide following China, the U.S., India, Russia, Japan and Germany, and followed by Saudi Arabia, Iran and Brazil.

²⁹ The World Bank, *supra* note 7.

³⁰ Article 2, Sub-para 2 of the Act on Development, Use, and Diffusion of the New and Renewable Energy (Legislation No. 7284 amended by Legislation No. 14670). Consistent statistics have not been available on the exact ratio of each specific renewable energy source, but recent statistics published by the New and Renewable Energy Center at the Korea Energy Agency show that waste fuels accounts for 61.7% and biomass accounts for 19.5% of the total new and renewable energy sources generated in 2016. See New and Renewable Energy Center, 2016 Statistics on New and Renewable Energy Supply, http://www.knrec.or.kr/pds/statistics_read.aspx?no=70& (last visited Feb. 20, 2018). It has been debated whether a full credit should be provided to waste fuels as the other renewable source for the Renewable Portfolio Standards system.

[TABLE 1] ELECTRIC POWER TRADING VOLUME BY FUEL TYPE (UNIT: %)³¹

	NUCLEAR	COAL ³²	LNG ³³	OIL	HYDRO ³⁴	RENEWABLE	TOTAL
2014	30.4	40.2	23.4	1.5	1.0	3.4	100
2015	31.7	40.6	21.5	1.9	0.7	3.6	100
2016	30.3	40.6	22.0	2.6	0.7	3.8	100

The need for energy conservation and efficiency policies in Korea is more urgent than anywhere else in the world, considering the extreme scarcity of land and relatively high demand for electricity for manufacturing businesses. The density of the country is extremely high, which has been considered as an obstacle for certain types of renewable energy sources. The population density of South Korea is 525 people per km² of the land area, ranking second, after Bangladesh, among the 88 countries with a population of 10 million or more.³⁵ If we consider that 67% of the whole territory is mountain area and not available for locating power plants or utility-scale renewable energy generation facilities, the problem of density is even greater. Thus the practical availability of inland utility-scale solar power generation is limited, while rooftop solar generation with storage technologies should be pursued.³⁶ Inland wind power generation utilizing ranches and sizable reclaimed agricultural lands appears to be more promising than

³¹ Korea Power Exchange, 2016 Annual Statistics on the Electric Power Market 8, (2017), at <http://epsis.kpx.or.kr/epsisnew/selectEkifBoardList.do?menuId=090140&boardId=003140> (last visited Feb. 25, 2018).

³² Most of the coal for power generation is imported.

³³ Korea imports almost the entire natural gas demand in a liquefied form by tankers, mostly from the middle-east nations, Indonesia, and Australia, and, since 2016, from the U.S., which is expected to be a notable change in the domestic LNG market because of the differences between the major terms and conditions of the LNG supply from the middle-east nations and the U.S. The price term for importation from the U.S. is known to be more flexible. The domestic LNG market is partially open to private parties where the importing for self-use is permitted, while the overall wholesale and the retail business is still monopolized by the government-owned corporation, Korea Gas Corporation. The market is expected to open more to the private sector in 2025, a development which will be subject to the further domestic discussion.

³⁴ It only includes the inland pumped-storage types.

³⁵ See the World Bank, Population Density, meta data available at <https://data.worldbank.org/indicator/EN.POP.DNST> (last visited January 10, 2018). The total area of South Korean territory is 100,210km² while the population is 51 million as of 2017. The area is slightly larger than a third of Nevada, while the population is similar to the combined populations of California, Nevada, and Arizona.

³⁶ Rooftop solar projects for schools have expanded most recently.

rooftop solar, and some notable projects have been developed, primarily in the northeastern and southwestern areas of Korea with better wind speed than other regions.³⁷

Locating renewable sources offshore could be more actively considered, given that Korea is a peninsula.³⁸ The offshore wind power projects, however, have faced intense conflicts with the coastal fishery industry and the surrounding area, as well as regulatory hurdles besides other typical political challenges that slowed down the initial projects.³⁹ Thus it will take some time to build offshore wind facilities with sizable capacity with a more sophisticated economic and scientific assessment on the benefits of the projects, impact on the environment and fishery, better communication with the region, and a more aligned regulatory environment.

Nuclear power generation in Korea features lower costs of construction, yielding the lowest cost of electricity in the world, primarily due to the fact that multiple units are constructed together in each site, which helps to reduce the maintenance cost, as well.⁴⁰ This indicates the high efficiency of power generation and, at the same time, more risk in the case of accidents. Further, the region with the most nuclear power plants was recently found to have the highest seismic risk in the territory of South Korea.⁴¹ The International Energy Agency (IEA) visited

³⁷ For example, wind farms with 140 MW of capacity in total will be completed in Yeonggwang County, South Jeolla Province, located in southwestern Korea by the end of 2018. See Kang-Hee Cho, The CEO of Korea East-West Power, Il-Joon Park, Checking in the Construction Site on the Western Coast, Korea Energy News (Mar. 16, 2018), at <http://www.koenergy.co.kr/news/articleView.html?idxno=95594> (last visited April 11, 2018). The less refined procedures for the business approval and environmental assessment for wind projects have yet to address the diverse interests surrounding those projects depending upon the location of the sites, which will be one of the important issues addressed in the coming years. For example, a project building 22 wind turbines with 75.9MW capacity in total has been on hold in North Gyeongsang Province because of concerns over endangered species, landslides, and the challenges from the adjacent residents after 11 wind turbines were installed. See Kwon-Pil Chun, Destructing the environment for green energy?: braking the spring-up of wind turbines, Joongang Ilbo, Mar. 15, 2018, at <http://news.joins.com/article/22445638> (last visited April 10, 2018).

³⁸ The potential offshore wind power generation was recently estimated to be 33.2GW, which is almost a third of the entire generation capacity of electricity registered with the Korea Power Exchange as of 2016, 108,246 MW. However, the annual wind velocity is 70% of the European region, which indicate the necessity of a cost-benefit analysis for each project. See, for the estimation, J.K. Sung, Overview and Future Plan for Korean Offshore Wind Development, Korea Institute of Energy Technology Evaluation and Planning, in Korea National Congress New and Renewable Energy Forum, the discussion material for the conference “Industrialization of Off-shore Wind Power Generation: Prospects and Tasks” (June 8, 2017).

³⁹ One of the projects near Jeju Island, where the wind velocity is one of the highest in Korea, took 11.5 years to complete construction. *Id.*

⁴⁰ For a general and relatively neutral overview of the nuclear power plants in Korea, see World Nuclear Association, Nuclear Power in South Korea (Updated Dec. 2017), at <http://www.world-nuclear.org/information-library/country-profiles/countries-o-s/south-korea.aspx> (last visited Jan. 15, 2018).

⁴¹ Julian Ryall, Warning that Korean peninsula could become new quake zone after series of tremors in the South, The Telegraph (Sep. 13, 2016), at <https://www.telegraph.co.uk/news/2016/09/13/warning-that->

Korea in 2017 to examine the seismic risk of the relevant sites and recommended changing the maintenance methods to enhance safety after recent notable seismic activities.⁴² Securing the repository sites for nuclear wastes is another significant imminent task in the dense country.⁴³ Given the high density, expanding nuclear power is not a preferable option without groundbreaking technology development for the safety of seismic risks or waste disposal. On the other hand, deciding the timing to close down existing nuclear power plants is another topic to study and discuss with more economic assessment.⁴⁴

D. The Status of the Climate Change Policy

Korean people began a full-fledged discussion on more sustainable energy law and policy in the mid-2000s, when the Kyoto Protocol became effective through international discussions and agreements, although it was grouped with the non-Annex I nations.⁴⁵ Despite the relatively short history of industrialization, Korea initially wished to be an active participant in the climate change regime in international society and voluntarily became the secretariat country of the Global Climate Fund launched by the United Nations Framework Convention on Climate Change (“UNFCCC”) in 2012.⁴⁶ Korea also reorganized its energy laws to introduce sustainability principles and prepared the legal grounds to establish and implement policies to reduce greenhouse gas emissions and promote renewable energy around 2010. The country actively participated in the Paris Agreement and submitted the Intended Nationally Determined Contribution (INDC) containing a plan to reduce greenhouse gas emissions by 37% from the business-as-usual (BAU, 850.6 MtCO₂-eq) level by 2030 to the UNFCCC on June 2015 in order to prepare for the Paris Climate Change Conference of the UNFCCC in December 2015.⁴⁷ The

korean-peninsula-could-become-new-quake-zone-after/ (last visited Feb. 5, 2018); World Nuclear News, “IAEA reviews seismic safety at Korean plants, World Nuclear Association News (Au. 24, 2017), at <http://www.world-nuclear-news.org/RS-IAEA-reviews-seismic-safety-at-Korean-plants-24081701.html> (last visited Feb. 5, 2018).

⁴² World Nuclear Association, *supra* note 40.

⁴³ *Id.*

⁴⁴ The new administration vigorously pursues phasing out nuclear power generation, which has become more of a political issue than a scientific one, which is further discussed later in this section.

⁴⁵ Korea was categorized as a non-Annex I country together with Mexico and exempted from the official reduction obligation under Kyoto Protocol. The systematic changes for introducing alternative energy sources have been discussed since the 1970s but were nominal until recently. One of the earlier efforts is the enactment of the Act for Promotion of the Alternative Energy Technology Development in 1987 (legislation no. 3990).

⁴⁶ UNFCCC, Green Climate Fund: Background, at http://unfccc.int/cooperation_and_support/financial_mechanism/green_climate_fund/items/5869.php (last visited Feb. 10, 2018).

⁴⁷ See Submission by the Republic of Korea, Intended Nationally Determined Contribution, June 30,

nationwide cap-and-trade program to reduce CO₂ emissions was launched in 2015 and enters its second phase in 2018.

However, primarily due to the institutional design problems in the energy sector and the relevant government agencies' continued strong preference for economic growth rather than materializing the sustainability principle in energy laws,⁴⁸ implementation plans remain at an initial stage, and fossil fuel consumption increased until very recently. The basic framework law for the climate policy in Korea, the Low Carbon and Green Growth Act (LCGGA) provides an explicit legal ground to assess and reflect on the climate change impact of policies,⁴⁹ but the practical utilization of the provision is insufficient. The average annual increase rate of greenhouse gas emissions from the industrial sector between 2010 and 2014 amounted to 6.5% in Korea, where one of the primary causes was found to be increasing coal use.⁵⁰ A recent statistical survey revealed that Korea ranked 173th in total air quality, 170th in CO₂ emissions per kWh of electricity, 174th in average exposure to Particulate Matter (PM), and 180th in average exposure to NO₂ among 180 countries.⁵¹ The Index of Average Exposure to NO₂ of Korean people is 91.87, more than double the U.S. (45.83) and Japan (32.13), and much higher than Mexico (55.54).⁵²

2015, at <http://www4.unfccc.int/submissions/INDC/Submission%20Pages/submissions.aspx> (last visited Feb. 10, 2018); Hong Sik Cho and Gina Jeehyun Choi, A Brief Overview of Korean Regulatory Regimes on Climate Change, Ministry of Justice, Recent Trends in Law & Regulation in Korea (RTLK), Vol. 22, 1 (Apr. 2016).

⁴⁸ Korea has developed environmental principles since the 1990s that try to balance economic growth and environmental values. See Hong Sik Cho, An Overview of Korean Environmental Law, Environmental Law, Vol. 29, 501, 503-506 (1999). However, it takes time to make sustainability principles work in energy laws.

⁴⁹ Article 38, Legislation No. 15101.

⁵⁰ Korea Institute for Industrial Economics and Trade (KIET), Analysis on Recent Changes in the Industrial Greenhouse Gas Emissions, Industrial Economic Issues, No. 2017-14, p. 3-5 (Apr. 17, 2017).

⁵¹ Yale Center for Environmental Law & Policy, Environmental Performance Index, 2016, available at <http://epi2016.yale.edu/downloads> (last visited March 14, 2018). According to the Index, it is a project led by the Yale Center for Environmental Law & Policy (YCELP), the Yale Data-Driven Environmental Solutions Group at Yale University (Data-Driven Yale), the Center for International Earth Science Information Network (CIESIN) at Columbia University, in collaboration with the Samuel Family Foundation, McCall MacBain Foundation and the World Economic Forum.

⁵² *Id.* There is another important dimension in the air quality issue in Korea: transboundary air pollutants from China. The specific contributive ratio of Chinese pollutants varies depending on seasonal factors, including the demand of fossil fuel-based heating in China and the status of the westerlies from China to Korea; however, it is generally recognized that the contribution of particulate matters from China is quite significant. No comprehensive research has been published on the ratio of the pollutants from China and emitted from Korean territory; however, a recent research result performed by the National Institute of Environmental Research shows that the contribution from China for PM_{2.5} between January 15-17, 2018 ranged between 38 and 57% based on the observational data and 48 and 75% by estimation through a modeling. See, National Institute of Environmental Research, Press Release (Feb. 7, 2018), at <http://nier.go.kr/NIER/cop/bbs/selectNoLoginBoardArticle.do> (last visited Feb. 10,

These figures show two problems. First, the current status of emissions is far behind the ambitious goal to achieve a low-carbon society that Korea once presented to international society, where it aimed to be one of the world's seven greenest countries by 2020 and five greenest by 2050.⁵³ It would be a critical difference from some other countries participating in the Paris Agreement with historical, geographic or natural similarities with Korea. Mexico, which was categorized in the same group with Korea under the post-Kyoto Protocol, recently introduced a sweeping restructuring plan for its energy and electricity sector to promote the development of technologies for renewable energy deployment.⁵⁴ Second, the impact of the greenhouse gas emissions on the ecology, agriculture and fisheries have not been properly recognized by the public or addressed by the government. Most recently, some climate damages in Korean territory have been reported by governmental research institutes, e.g., the noticeable reduction in agricultural lands suitable for certain types of popular fruits⁵⁵ and the rapid ocean desertification due to global warming.⁵⁶ Given that the seaweeds inhabiting in the coastal sea have been an

2018). Joint research performed by a Korean university (delegated by the National Institute of Environmental Research) and the Chinese Research Academy of Environment and Science in 2016 shows a meaningful correlation and sequentiality between the particulate matters in Chinese cities and Korea. See National Institute of Environmental Research, Korea-China Joint Research for Transboundary Air Pollutants Mitigation II, 2016 Research Report, 26-27 (June 2016). The discussion with the Chinese government over this issue has not yet produced an efficient solution, and the public perception of the air quality in Korea is that almost all air pollutants come from China, which has become another hurdle for the climate policies.

⁵³ IEA, Policies and Measures: Korea, available at <https://www.iea.org/policiesandmeasures/pams/korea/name-38998-en.php>; Ministry of Environment, Press Release (July 6, 2009), available at http://me.go.kr/home/web/board/read.do;jsessionid=x8NaHtHexarK2sa1unX91ri9QnwXazKaVR8tnc9zwdlZmRKgJrahgGUmzFh14uF.meweb2vhost_servlet_engine1?pagerOffset=6700&maxPageItems=10&maxIndexPages=10&searchKey=&searchValue=&menuId=286&orgCd=&boardId=169044&boardMasterId=1&boardCategoryId=&decorator=.

⁵⁴ As part of its climate change policy and energy reform, Mexico enacted the General Climate Change Act (Ley General de Cambio Climático) in 2012, which contains the goal that the electricity generated from clean energy will be 35% by 2024. See Nicholas S. Bryner, People of the Sun: Leveraging Electricity Reform to Promote Renewable Energy and Climate Change Mitigation in Mexico, *Natural Resources Journal*, Vol. 56, 329-350, 330-31 (2016). Mexico participated the joint announcement on North American Climate, Clean Energy, and Environment Partnership with the U.S. and Canada in 2016, where the three nations agreed to align approaches to account for the social cost of carbon use, similar methodologies and many others subjects.

⁵⁵ Statistics Korea, Press Release, April 10, 2018, at http://kostat.go.kr/portal/korea/kor_nw/2/1/index.board?bmode=read&aSeq=367060 (last visited April 10, 2018).

⁵⁶ Significant ocean desertification on the coasts of Korea has been reported since 2015. FIRA reportedly found that the desertification of coast grows at the speed of 27.1% annually. See Yonhap News, The Entire Ocean is Sick ...the Ocean Floor 65 times larger than Yeosu-Do region is being devastated (July 17, 2017), at <http://www.yonhapnews.co.kr/bulletin/2017/07/14/0200000000AKR20170714034600054.HTML> (last visited March 21, 2018).

important part of the ecological chain in the ocean, the seriousness of this issue is not minimal. The details of the research, however, are not publicly available. The Korea Fisheries Resources Agency (FIRA) did not directly answer my request for the research result made through the Information Disclosure Request, responding instead with a brief note that 39.5% of the entire coast of South Korea was found to be desertified in the examinations performed during the past several years until 2017.⁵⁷

Third, the serious local health and ecological impacts of the associated criteria pollutants have not attracted enough attention either. NO_x creates tropospheric ozone, also known as ground-level ozone, at the ground level through its chemical reaction with volatile organic compounds, which is known to have harmful impact on human health, forests and crops.⁵⁸ Scientific research has reported that ground-level ozone causes both “immediate and long-term changes in lung function” and increases acute respiratory symptoms.⁵⁹ Little clinical research is publically available on the causality between NO_x emissions and the health problems in a certain area. Thus the status of Korean climate policies and implementation lags far behind the required level to address local damages from greenhouse gas emissions, not to mention global ones.

In sum, the current status of climate policies in Korea results in a serious gap between the domestic framework statutes introduced as an implementation legislation for the commitment made to global society and the status of the actual implementation, and perhaps more seriously, intensifying domestic health problems and damages from global warming and associated pollutants. It also contributed to the lower level of public recognition about climate damages, including health problems from greenhouse gas emissions.

⁵⁷ See Korea Fisheries Resources Agency, *Response to the Information Disclosure Request No. 4597637*, Mar. 29, 2018; an electronic copy is on file with the Author. The Ministry of Ocean and Fisheries, the supervisory agency of the FIRA, did not make an official briefing on the research result and instead started a so-called “costal plantation to prevent desertification,” which required significant spending. The cost-effectiveness or potential harm to the coastal environment of the “coastal plantation” project is unknown.

⁵⁸ U.S. EPA, Basic Information about Ozone, at <https://www.epa.gov/ozone-pollution/basic-information-about-ozone#what%20where%20how> (last visited March 20, 2018). As N₂O, NO₂ and NO are typically emitted together from stationary sources, assessing the emitted amount of each of those compounds is known to be technically complicated. Thus, the regulation on multiple types of nitrogen oxides typically occurs together.

⁵⁹ See for the harmful impact of the ground-level ozone on human health, forests and crops, U.S. Congress, Office of Technology Assessment, *Urban Ozone and the Clean Air Act: Problems and Proposals for Change*, (April 1988); a PDF copy is available at <https://www.princeton.edu/~ota/disk2/1988/8841/8841.PDF> (last visited March 10, 2018); Alan J. Krupnick, Ambient ozone and acute health effects: evidence from daily data, *Journal of Environmental Economics and Management*, Vol. 18, Issue 1, 1-18 (1990).

E. Recent Energy Transition Policies with Procedural Controversies

The progressive proposals to significantly increase renewable sources and reduce dependence on fossil fuels and nuclear energy of the new administration, which started in May 2017, may be a starting point for the most notable phase in Korean energy policy.⁶⁰ The new president promised during the presidential election in April 2017 to stop building new coal and nuclear power plants and to suspend construction of nuclear power plants.⁶¹ He further suggested that he would increase the ratio of renewable energy in the energy mix up to 20% by 2030 and restructure the industrial electricity price scheme in order to enhance energy efficiency.⁶² Implementation efforts began directly after the election. The new government suspended the operation of some of the oldest coal power plants for a month in June 2017 as a temporary measure to reduce particulate matter and greenhouse gases.⁶³ The oldest nuclear power plant has been shut down, and the construction of the two nuclear reactors at Kori Nuclear Power Site, Shin-Kori 5 and 6, has been suspended as promised.⁶⁴

It was found problematic that all of these events happened swiftly, within 50 days of the President's inauguration, without the involvement of energy experts, discussions between relevant government agencies, public hearings or any other procedures arguably required by the relevant laws.⁶⁵ No explanation was presented to the public for the reasoning behind such decisions, their possible impact on the supply and demand of electricity or any other type of cost and benefit analysis before such events took place.⁶⁶ The events of the first 100 days of the

⁶⁰ Jae-in Moon, the candidate of the Democratic Party, was elected as the 12th president of the Republic of Korea in May 2017 after his predecessor, Geun-hye Park, was impeached in March 2017.

⁶¹ Ki-heung Kim, Moon Jae-in to Nullify Construction Plans of New Nuclear and Coal Power Plants, Korea Broad Casting (April, 22, 2017), available at <http://news.kbs.co.kr/news/view.do?ncd=3468609>.

⁶² *Id.* Restructuring the industrial electricity price scheme for energy efficiency seems to mean an increase in electricity prices for industrial use, which has caused serious challenges from the general industry.

⁶³ Jane Chung, (Christina Schmollinger ed.), S.Korea to temporarily close 10 old coal-fired power plants in June, Reuters, May 15, 2017, at <https://www.reuters.com/article/southkorea-politics-energy/s-korea-to-temporarily-close-10-old-coal-fired-power-plants-in-june-idUSL4N1IH13D> (last visited Feb. 10, 2018).

⁶⁴ Jane Chung (Henning Gloystein and Richard Pullin eds.), South Korea retires oldest nuclear reactor on its 40th birthday, Reuters, June 16, 2017, at <https://af.reuters.com/article/africaTech/idAFL3N1J92EJ> (last visited Feb. 10, 2018).

⁶⁵ The current administration did not have a Commission on the Presidential Transition because the preceding president was impeached, and there was rather an urgent need for transition. It instead had an "Advisory Committee for Government Administration National Planning," which in fact operated as the Commission of the Presidential Transition. Most of the initial steps taken in the energy sector mentioned above are known to have come from that the Advisory Committee for Government Administration Planning, in which no experts from the energy sector participated. See the Advisory Committee for Government Administration Planning, White Paper, 476-77 (Aug. 2017).

⁶⁶ The administration only explained that the residential electricity price would not go up during the

current administration might be described as a clear snapshot of how energy policy in Korea has been shaped and what the procedural and institutional problems of policymaking have been. It was not unexpected that such changes would have faced serious challenges from interested parties, or even from the public.

The new administration's initial energy policy disregarded the existing institutional system in order to quickly overcome political challenges, and it simultaneously inherited the institutional shortcomings of previous administrations. One salient example is the way the administration quickly implemented its initial nuclear energy policy and responded to fierce challenges. The administration belatedly formed a temporary institution called the "Committee for public hearings on Shin-Kori 5 and 6" (Public Hearings Committee), comprised of 500 randomly selected citizens, to address the vehement challenges.⁶⁷ The legal authority to decide whether to grant or withdraw a permit to construct, operate or close a nuclear reactor or a power plant lies with the Nuclear Safety and Security Commission, which passed a resolution to approve the construction of the Shin-Kori 5 and 6 reactors in 2016.⁶⁸ In this regard, if the new administration planned to reconsider those approvals, it should have referred the matter to the Nuclear Safety and Security Commission, even after the vote of the Public Hearings Committee. The administration, however, promised that it would follow the result of the Public Hearings Committee's vote on whether to permanently suspend or resume the construction of the Shin-Kori 5 and 6 reactors, without addressing the rationale of bypassing the Nuclear Safety and Security Commission process.⁶⁹ The Public Hearings Committee voted against the suspension

coming five years because the government-owned electric retail company with 100% market share, the KEPCO, would absorb any additional costs incurred. Given that those five years correspond to President Moon's term, such a promise shows how hastily the energy policy was made. See S.H. Lee, and Y.K. Chae, *The Administration and the Ruling Party Says "No Electricity Price Increase for Five Years Even After Reducing Nuclear Energy", but What's Next?*, JoongAng Ilbo (Aug. 1, 2017), at <http://news.joins.com/article/21806042> (last visited Jan. 20, 2018).

⁶⁷ World Nuclear News, *South Korean president accepts public decision*, World Nuclear Association, Oct. 23, 2017, at <http://www.world-nuclear-news.org/NP-South-Korean-president-accepts-public-decision-2310175.html> (last visited Feb. 25, 2018). The official website of the committee is at <http://www.sgr56.go.kr/npp/index.do> (last visited Feb. 10, 2018). It is notable that the administration nominated as the chair of the committee a renowned senior lawyer practicing labor law with no expertise or experience in the energy sector, which shows that the committee was operated as a general political poll with little consideration about the scientific characteristics of the energy sector.

⁶⁸ Article 3, 10, 17, 20, 24, 27, 28, Nuclear Power Safety Act (Legislation No. 10911 amended as Legislation No. 14839). A lawsuit filed by the NGOs challenging the validity of the approval is pending.

⁶⁹ The Nuclear Safety and Security Commission has not secured independent status from the Ministry of Industry and Trade or the presidency yet, as it has relatively a short history; it was established in 2011 after the Fukushima disaster, whose legal status was downgraded in 2013 from the Presidential commission to the agency with a similar status to the cabinet departments with the supervision of the prime minister. It seems that the new administration tried to find a way to deviate from the process of the Nuclear Safety and Security Commission because it worried about the regulatory capture of the Nuclear Safety and Security Commission through other ministries and the remaining influence from the conservative party, given that it was the initial stage of the new administration.

of construction, and the construction resumed as promised, which made the arguments on the procedural defects moot in the end. However, the case of the Public Hearings Committee is notable because the administration explicitly preferred a random jury forum for policymaking in place of the statutory procedures.⁷⁰

The second example is the administration's blueprint of the renewable energy policy, "Renewable Energy 3020 Implementation Plan."⁷¹ The draft Renewable Energy 3020 Implementation Plan, published for public comments in December 2017, contains various new ideas about promoting renewable energy, including reviving the Fid-In-Tariff system, promoting electric vehicles and creating a new service industry to manage the big data of electricity usage through building the smart grid networks.⁷² The Plan also contains the estimated cost to be incurred by the government and the private sector. However, it does not explain the benefits of these new policies. The purpose of the Plan, according to the draft, is presented as "enhancing the quality of life," "switching to a participatory energy system"⁷³ and "meeting the standards of the developed countries," according to press reference material published by the Ministry of Industry and Trade.⁷⁴ Further, no meeting minutes or the essence of discussions over the economic or scientific review of the draft have been provided, even though the administration wanted to stress that the draft Plan was prepared through a much-improved governance than the energy policies of the previous administrations, in that more people from the academic and private sector participated.⁷⁵

The way in which the draft Plan was developed and communicated provides two issues to consider. First, the fact that no benefits have been measured for each or all of the draft Plans indicate that the overall policy has been driven by a not necessarily scientific purpose, and that it is questionable whether each policy would survive a properly conducted cost-benefit analysis. It is thus perhaps impossible to review and assess various policy options because the government does not set the purpose of its renewable energy policy. This problem becomes serious if we consider the de-facto binding authority of the plans published by the Ministry of Industry of Trade on energy policy, discussed in detail in Chapter 3. Second, the opaqueness of the energy policymaking process has been maintained, given that no reasoning has been provided for the

⁷⁰ The advocates of the Public Hearings Committee maintain that it was an excellent example of deliberative democracy; however, it left much to be desired even as such a forum.

⁷¹ The Ministry of Trade, Industry, and Energy, Announcement of the Renewable Energy 3020 Implementation Plan (Dec. 20, 2017), at <https://www.gov.kr/portal/ntnadmNews/1279625> (last visited Feb. 1, 2017). The plan explains that it aims to increase the renewable energy generation up to 20% of the entire power generation by 2030, which is the background of the slogan "Renewable Energy 3020."

⁷² *Id.*

⁷³ *Id.* at 3.

⁷⁴ The Ministry of Trade, Industry and Energy, Reference Material: Discussion on How to Achieve 20% New and Renewable Energy by 2030 (June 29, 2017), at http://www.motie.go.kr/motie/ne/presse/press2/bbs/bbsView.do?bbs_seq_n=159430&bbs_cd_n=81¤tPage=1&search_key_n=&cate_n=&dept_v=&search_val_v= (last visited Feb. 28, 2017).

⁷⁵ The Ministry of Trade, Industry and Energy, *supra* note at 71.

draft Plan. It may be true that the draft Plan as prepared with the participation of more people than the energy policies made by previous administrations, but this does not necessarily indicate enhanced transparency.

The comparison chart between the energy mix in electric power generation in 2016 and 2017 in Table 2 shows a decrease in the use of natural gas and an increase in coal, which signals that the policy direction of the new administration, which began in May 2017 and pursued rapid changes in the energy mix, should be seriously reviewed and reconsidered while it remains in an early stage, given the president’s five-year term.

[TABLE 2] ELECTRIC POWER GENERATION BY FUEL TYPE (UNIT: GWh, %)⁷⁶

	NUCLEAR	COAL	LNG	OIL	HYDRO	NEW & RENEWABLE	TOTAL
2016	161,995 (29.97)	213,803 (39.56)	120,852 (22.36)	14,221 (2.63)	6,634 (1.23)	22,936 (4.24)	540,441 (100)
2017	148,427 (26.80)	238,919 (43.13)	118,659 (21.42)	9,967 (1.80)	6,980 (1.26)	31,044 (5.60)	553,905 (100)
Rate of Change	- 3.17	3.57	- 0.94	- 0.83	0.03	1.36	-

Further, the extreme density of the land and the lack of a proper assessment of the various energy options have led to concerns concerning forest destruction with respect to the inland development of small- to medium-sized solar photovoltaic power plants.⁷⁷ A recent study has shown that 10-40% of the solar power plants approved in each county or city in South Chungcheong Province are located in forest areas, and even in areas where endangered species are observed.⁷⁸

The aforementioned examples of the current government’s energy policies show the accumulated institutional problems of the preceding administrations, which the current administration recently followed. There has been no pivotal government agency responsible for energy policy addressing climate change concerns with proper expertise and authority, and no policy tool in place requiring scientific analysis of the proposals’ costs and benefits. The current institutional design of the climate change scheme affecting the electric power sector does not enable the government, as the operator of most conventional power plants, nor does it allow the regulator of the private power plants, to properly internalize the social cost of carbon or

⁷⁶ Korea Electric Power Corporation, The Monthly Report on Major Electric Power Statistics, Issue 458, 6 (Dec. 2016); Korea Electric Power Corporation, The Monthly Report on Major Electric Power Statistics, Issue 470, 6 (Dec. 2017), at https://home.kepco.co.kr/kepco/KO/ntcob/list.do?pageIndex=3&boardSeq=0&boardCd=BRD_000097&menuCd=FN0503&pamScrpSeq=0&categoryCdGroup=®DateGroup1= (last visited Mar. 3, 2018).

⁷⁷ ChungNam Institute, Chungnam Report, Vol. 295, p. 2, 4-5 (Feb. 1, 2018). The ChungNam Institute is a public research body operated by the South Chung-cheong Province government.

⁷⁸ *Id.* at 7.

require private entities to do so. Stakeholders or the public had little chance of participating in policymaking due to the opaqueness of the process.

II. The U. S. Energy Sector with New Challenges

A. Historical Wealth of Resources

The wealth of the natural resources of the U.S. has been the basis of the vast scale of its economy. The country has 28% of the global share of recoverable coal reserves,⁷⁹ and its global share of oil reserves is reportedly the largest, surpassing Saudi Arabia and Russia.⁸⁰ The most recent shale gas development led the U.S. to be a net exporter of energy.⁸¹ The U.S. Energy Information Agency estimated that the proven natural gas reserves in the U.S. territory are 341 trillion cubic feet in 2016 increased by 5%, where the share of the shale gas compared with total natural gas increased from 54% to 62%, from the previous year.⁸² Ample land with a variety of natural conditions made renewable options practically more viable than in most other countries. For example, the potential of wind power generation in the U.S. is estimated to be able to cover 20% of the entire power demand in the U.S. by 2030.⁸³ The energy policies since the mid-2000s have expedited the spread of renewable options, and the current electricity generation mix shows a significant portion of renewable sources. The ratio of natural gas almost passed coal in 2017, and the ratio of natural gas and renewables is estimated to rise in the coming years.⁸⁴

⁷⁹ U.S. Energy Information Administration, United States leads world in coal reserves (Sep. 2, 2011), at <https://www.eia.gov/todayinenergy/detail.php?id=2930> (last visited April 10, 2018).

⁸⁰ Mazin Sidahmed, and Jana Kasperkevic, Report: US is now world's largest oil reserve but global supply still small, *The Guardian* (Jul. 6, 2016), at <https://www.theguardian.com/business/2016/jul/06/report-us-world-largest-oil-reserve-global-supply-small> (last visited April 10, 2018).

⁸¹ U.S. Energy Information Administration, EIA's AEO2017 projects the United States to be a net energy exporter in most cases (Jan. 5, 2017), at <https://www.eia.gov/todayinenergy/detail.php?id=29433> (last visited April 10, 2018).

⁸² U.S. Energy Information Administration, U.S. Crude Oil and Natural Gas Proved Reserves, Year-end 2016, 1-2 (Feb. 2018). The graph in page 2 of the document shows that the proved reserves of natural gas in the U.S. doubled in comparison with the one in late 1990's. The U.S. used approximately 27.49 trillion cubic feet in 2016. See U.S. Energy Information Administration, Natural Gas Explained: Use of Natural Gas, at https://www.eia.gov/energyexplained/index.cfm?page=natural_gas_use (last visited April 30, 2018).

⁸³ U.S. Department of Energy, *Enabling Wind Power Nationwide*, 1 (May 2015). This estimation reflects the limitation of the transmission; the natural wind power of the U.S. is estimated to exceed the entire power demand of the country.

⁸⁴ U.S. Energy Information Administration, *Annual Energy Outlook 2018*, 84 (Feb. 6, 2018).

[TABLE 3] NET ELECTRICITY GENERATION BY SOURCE (UNIT: %)⁸⁵

	NUCLEAR	COAL	NATURAL GAS	OIL	HYDRO	RENEWABLE	TOTAL
2016	20	30	34	1	6.5	8.4	100

B. The Structure of the U.S. Electric Power Market

The U.S. electricity market was primarily initiated by monopolistic private enterprises, which were protected by government regulations because it was considered a natural monopoly⁸⁶ whose business activities, including pricing, were heavily regulated to prevent abusive use of the monopolistic status.⁸⁷ The electric power supplier typically provided an integrated service covering generation, transmission and distribution to the customer.

As the economic consideration that generation and distribution cannot be considered a natural monopoly entered policy discourse, the disintegration of the utility business began, bringing competition in the wholesale and retail markets in the 1990s.⁸⁸ Significant regulatory failures have been also observed and surmounted during the process of deregulation. The rolling blackouts in California in 2000 and 2001, which were followed by abundant discussions over the regulatory design, illustrates this development.⁸⁹ Such experience made the U.S.

⁸⁵ U.S. Energy Information Administration, Electricity Generating Capacity, at https://www.eia.gov/energyexplained/index.cfm?page=electricity_in_the_united_states#tab2 (last visited April 10, 2018).

⁸⁶ A “natural monopoly” means a business which cannot be operated with efficiency and economy unless it enjoys a monopoly of its market by virtue of its inherent technical characteristics, rather than by virtue of any legal restrictions or financial power. Natural monopoly businesses operates under conditions of decreasing incremental costs, while firms in the competitive market operate under conditions of either constant or increasing costs. See James C. Bonbright, *Principles of Public Utility Rates*, 11-12 (Columbia University Press, 1961)

⁸⁷ For the initial history of electricity business and regulatory movement, see Steve Isser, *Electricity Restructuring in the United States* (Cambridge University Press, 2015), p. 20-34.

⁸⁸ See for the enhanced generation efficiency after the restructuring the wholesale market in California, Catherine Wolfram, *The Efficiency of Electricity Generation in the U.S. After Restructuring*, June 2003, 2003 Electricity Deregulation Conference at Bush Presidential Conference Center, Texas A & M, Friday, April 4, 2003, available at <http://faculty.haas.berkeley.edu/wolfram/Papers/texasamf.pdf>; See for a detailed history of restructuring energy industry in the U.S. and its implication, Severin Borenstein and James Bushnell, *The U.S. Electricity Industry after 20 Years of Restructuring*, Energy Institute at Haas, Working Paper 252R (May 2015), available at <https://ei.haas.berkeley.edu/research/papers/WP252.pdf>.

⁸⁹ Paul L. Joskow, and E. Kahn, *A Quantitative Analysis of Pricing Behavior in California’s Wholesale Electricity Market During Summer 2000*, *Energy Journal*, Vol. 23, Issue 4 (2002).

society, economy and legal system have more capacity and resilience to establish and implement policy plans responding to new developments in the climate change era.

The current status of the wholesale market in the U.S. varies depending according to the policy of each state or region.⁹⁰ In regulated traditional markets, vertically integrated utilities are still responsible for power generation, transmission and distribution. The restructured competitive markets are operated by independent system operators (ISOs) or regional transmission organizations (RTOs), in which the ownership of the generation facilities is more diverse, and the utilities are typically responsible for supply to the customers.⁹¹ The retail markets also vary depending on each state's policy, and in states with competitive markets, the customer has the "retail choice" to choose the electricity provider, although all states regulate the retail rate.⁹²

The demand for enhanced energy efficiency and energy transition has invited more diversified players in the market, creating new regulatory questions. The renewable energy business for utility-scale solar and wind, and residential rooftop solar, have grown rapidly since the mid-2000's. The demand response provider, which provides services to retail customers to save electricity use and offers the aggregated electricity as a bid in the wholesale market, is a recent example of active market participants. The Community Choice Aggregators in the California retail market is also a new type of retail service provider formed in the wake of the renewable energy deployment.⁹³

⁹⁰ U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability, United States Electricity Industry Primer, DOE/OE-0017, 28-29 (2015).

⁹¹ The ISOs and RTOs are typically non-profit organizations established by the order of the FERC. See U.S. Federal Energy Regulatory Commission, Electric Power Markets: National Overview, at <https://www.ferc.gov/market-oversight/mkt-electric/overview.asp> (last visited at April 10, 2018); U.S. Environmental Protection Agency, U.S. Electricity Grid & Markets, at <https://www.epa.gov/greenpower/us-electricity-grid-markets> (last visited at April 10, 2018).

⁹² U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability, *supra* note 90 at 28-30.

⁹³ A staff white paper recently published by the California Public Utilities Commission estimates that 915,000 customers currently use the CCAs' services, and the number of customers will grow significantly in several years, given that cities and counties with populations of more than 15,000,000 are "actively in the process of forming, expanding or considering CCAs." See California Public Utilities Commission, Consumer and Retail Choice, the Role of the Utility, and Evolving Regulatory Framework, 4-5 (May 2017). Los Angeles County has begun forming a CCA that is expected to have the largest number of customers in the U.S. by 2019, providing lower rates with a more renewable portfolio than the utility currently serving the area. See Herman K. Trabish, Choice in La La Land: LA County community aggregation has California utilities on full alert, Utility Dive (May 9, 2017) at <http://www.utilitydive.com/news/choice-in-la-la-land-la-county-community-aggregation-has-california-utility/442131/>; Los Angeles County Chief Sustainability Office, About LACCE, available at <https://www.lacounty.gov/about-lacce/>.

C. Political Controversy over Climate Change Policy

The climate policy has been a frequent topic of political debate recently in association with the new administration's general foreign relations and trade policies. The amount of CO₂ emissions from fuel combustion in the U.S. ranked the first among the OECD countries and second following China worldwide in 2015.⁹⁴ The share of the U.S. among global emissions in the same year is estimated to be 15.47%, which is significant.⁹⁵ The previous federal administration initiated the Clean Power Plan to lead the energy transition through imposing restrictions on greenhouse gas emissions from power plants and promoting renewable energy across the states,⁹⁶ determined the social cost of carbon for a consistent use in federal energy policies and joined the Paris Agreement at the global level. These efforts induced the highest-emitting countries, e.g., China and India, to participate in the global discussion over climate change and energy transition policies.⁹⁷

The current administration has tried to rescind several of the previous administration's important climate change policies since the new president took office. The new president has declared that the United States would cease the implementation of the Paris Agreement,⁹⁸ and the proposal to repeal the Clean Power Plan⁹⁹ was issued in October 2017.¹⁰⁰ The

⁹⁴ IEA, *supra* note 28.

⁹⁵ *Id.*

⁹⁶ For the details of the Clean Power Plan of the previous administration, U.S. Environmental Protection Agency, FACT SHEET: Overview of the Clean Power Plan, <https://archive.epa.gov/epa/cleanpowerplan/fact-sheet-overview-clean-power-plan.html> (last visited April 10, 2018).

⁹⁷ China accounts for 28.12% of the global CO₂ emissions, and India accounts for 6.4%. IEA, *supra* note 28.

⁹⁸ The White House, Statement by President Trump on the Paris Climate Accord (June 1, 2017), at <https://www.whitehouse.gov/briefings-statements/statement-president-trump-paris-climate-accord/> (last visited April 10, 2018). It is notable, however, that the U.S. federal government has not declared that it would permanently drop out of the Paris Agreement. News outlets reported that the President indicated the U.S. may rejoin the Paris Agreement. See Justin Worland, Trump Is Telling Foreign Leaders That the U.S. May Rejoin the Paris Climate Agreement, Ex-Aide Says, *Time* (Feb. 23, 2018), at <http://time.com/5171805/paris-agreement-united-states-david-banks/> (last visited March 30, 2018); BBC News, Climate change: Trump says US 'could conceivably' rejoin Paris deal (Jan. 11, 2018), at <http://www.bbc.com/news/world-us-canada-42642331> (last visited March 30, 2018).

⁹⁹ Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 40 C.F.R. Part 60. The plan was supposed to be effective as of December 22, 2015 but stayed by the Supreme Court of the United States on February 9, 2016. See *West Virginia v. E.P.A.*, 136 S. Ct. 1000.

¹⁰⁰ EPA, Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 40 CFR Part 60 (Oct. 16, 2017). The repeal plan is currently going through the processes for public comments as of March 2018.

recommendation from the inter-agency working group in the previous administration for use of social cost of carbon in the cost-benefit analysis in policymaking was rescinded by a recent executive order, issued by the new president in March 2017.¹⁰¹

Despite the acute conflicts at the federal level, the energy transition policies at the state level continue. The recent efforts of democratic states are illustrative. For example, California lawmakers extended and strengthened the state's cap-and-trade program in 2017.¹⁰² The RGGI proposed an additional emissions cap decline,¹⁰³ and New York State, a member of the RGGI, has considered introducing the "carbon adder," similar to a tax system, in addition to the RGGI to more effectively reduce greenhouse gases from power plants.¹⁰⁴

¹⁰¹ The White House, Presidential Executive Order on Promoting Energy Independence and Economic Growth, available at <https://www.whitehouse.gov/the-press-office/2017/03/28/presidential-executive-order-promoting-energy-independence-and-economy-1>. The Executive Order disbanded the inter-agency working group and withdrew all technical recommendations on the use of social cost of carbon issued by the IWG thus far, leaving no specific guidance on the amount of social cost of carbon to use. It specifically eliminated the recommendation to use global benefits when considering social cost of carbon, terminating the controversy over the use of global versus national benefits. Instead, the new EO declares that all cost-benefit analysis including consideration of the social cost of carbon should follow the OMB Circular A-4 issued in 2003, which states the general discount rate for policymaking to be 3% or 7%. (For the OMB Circular A-4, see <https://www.gpo.gov/fdsys/pkg/FR-2003-10-09/pdf/03-25606.pdf>).

¹⁰² California Assembly Bill No. 398 (Jul. 25, 2017).

¹⁰³ RGGI Inc., RGGI States Announce Proposed Program Changes: Additional 30% Emissions Cap Decline by 2030, Press Release dated Aug. 23, 2017.

¹⁰⁴ The policy is pending at the New York State Public Utilities Commission (NYPUC) (Matter No. 17-01821).

CHAPTER 3

CURRENT INTUITIONAL DESIGN OF THE ENERGY REGULATORY SYSTEM

This Chapter reviews the regulatory system for the energy sector, from the basics of the policymaking regime, the roles of the regulatory agencies with a focus on the energy sector, the control over the agencies within the executive branch with the regulatory oversight system and the system of checks and balances by the other government branches, the legislature and the court. The Korean case is discussed in detail to identify the general problems in the policymaking process, and the U.S. case is reviewed in comparison.

I. Korean Regulatory System for the Energy Sector

A. A Brief Overview of the Korean Policymaking Regime

Korea has a direct presidential election system, which has enabled higher concentration of presidential power over the entire administration, supported by a bureaucratic civil servants system. The administration, led by the president, normally makes and amends a significant portion of the regulations, either through a formal or informal agency rule-making process or through draft legislation proposed by executive agencies. On the other hand, lawmakers have their own authority to propose legislation to create or amend regulations for passage by Congress without any input from the administration, though the coordination between the administration and the ruling party often happens for policymaking.

In terms of energy policymaking, two periodic comprehensive plans by the government have basically set the entire policy direction so far. The National Basic Energy Plan (Basic Plan), announced by the government every fifth year for the next 20 years based on the Low Carbon and Green Growth Framework Act (LCGGFA), provides the fundamentals of the overall energy policy.¹⁰⁵ The Basic Plan contains prospects and plans for comprehensive energy policy, including, e.g., the following information for electricity generation: (i) plans for the energy mix with the information of whether and how much to increase or reduce coal or nuclear power generation, (ii) the target ratio of renewable energy in 20 years and (iii) how to change the electricity pricing scheme with what types of factors.¹⁰⁶ The government also issues the Basic Plan for Electric Power Supply and Demand (Basic Electricity Plan) biennially for the next 15

¹⁰⁵ The LCGGFA was enacted in 2010 to provide the regulatory framework of sustainable economic growth and replace the then-current basic framework law for the energy sector, the Energy Basic Framework Act. Before 2010, the National Basic Energy Plan was made based on the Energy Basic Framework Act. The title of the Energy Basic Framework Act was amended to the Energy Act when the LCGGFA was enacted.

¹⁰⁶ See, e.g., the MOTIE, the Second National Basic Energy Plan, 33-44, 48-50 (2014).

years, and it provides the prospects of demand and plans for supply, including energy mix targets more specific than those the Basic Plan offers.¹⁰⁷

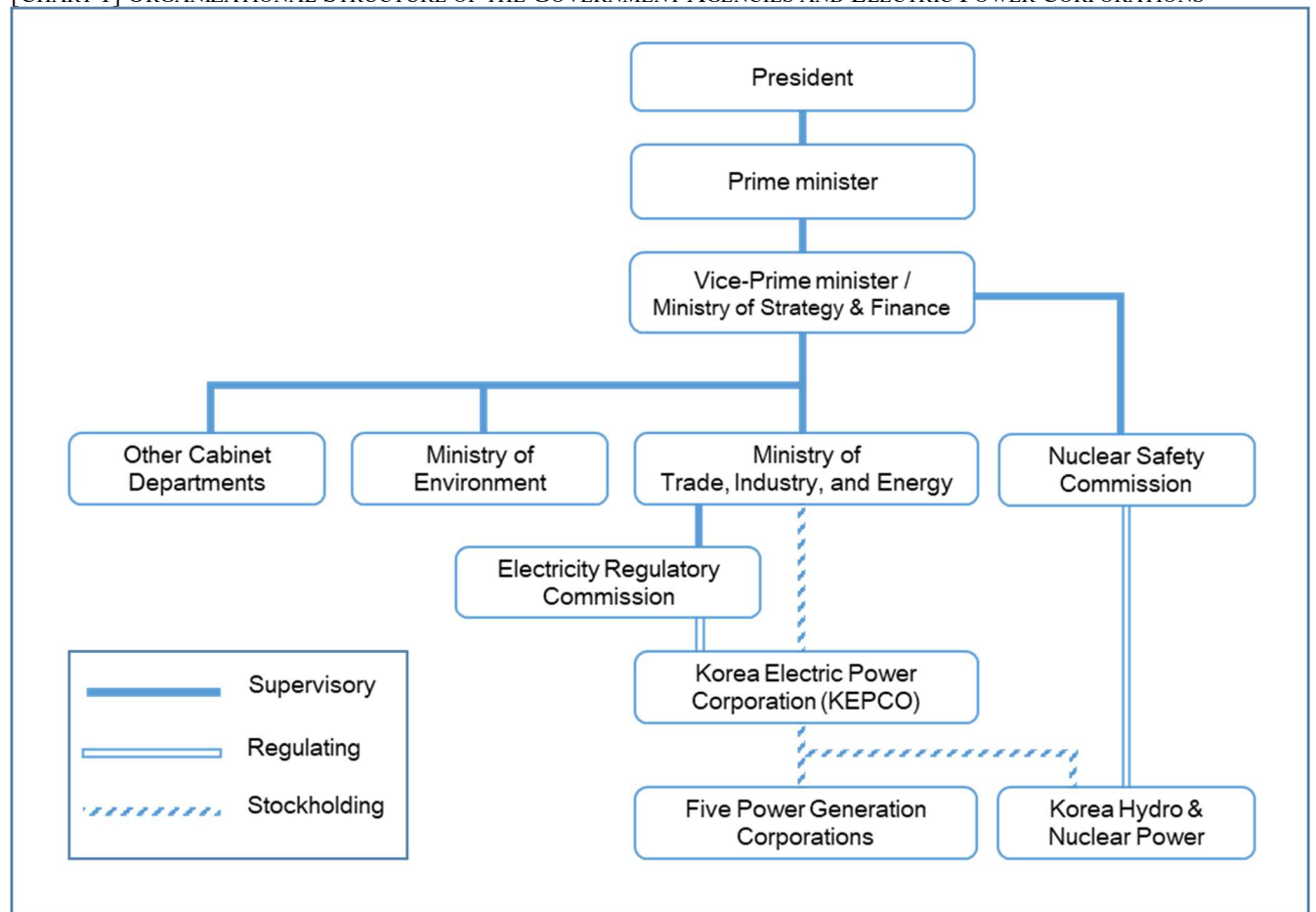
The comprehensive energy plans have not been subject to regulatory impact analysis or the cost-benefit analysis requirement but have maintained strong authority even though they are not in the form of positive laws, nor do they have an explicit, statutory ground for such authority. The current Korean long-term energy plan, the Second National Basic Energy Plan, has received harsh criticism from both international society and domestic civil society for its increasing reliance on coal power generation. The government continued to approve new coal power plants, and the volume of electricity from coal power plants grew until 2017. Thus the domestic long-term goal for greenhouse gas reduction was once set, while the implementation process to achieve such a goal has not been properly established.

B. Roles and Operations of Regulatory Agencies

The structure of the government agencies involved in the energy policy and the government-owned electric power corporations, shown in Chart 1, will benefit the discussions in this dissertation.

¹⁰⁷ Article 25, Electric Business Act (legislation no. 14672).

[CHART 1] ORGANIZATIONAL STRUCTURE OF THE GOVERNMENT AGENCIES AND ELECTRIC POWER CORPORATIONS¹⁰⁸



The Ministry of Trade, Industry, and Energy (MOTIE) is responsible for designing the aforementioned two comprehensive plans, the Basic Plan and the Basic Electricity Plan, and the licensing process of a new, utility-scale power plant, including review of the Energy Use Plan required for a power plant with a capacity of 20,000 kW or more under the Energy Use Rationalization Act.¹⁰⁹ The Electricity Regulatory Commission within the MOTIE is an advisory body for the organization with no authority to determine policy.¹¹⁰

¹⁰⁸ The agency responsible for the overall economy and national treasury, and the agency responsible for the industry and resources (including the energy) have changed name and organization. The chart reflects the current name of those agencies used throughout the dissertation for easy reference, regardless of the timing of the relevant policy under discussion.

¹⁰⁹ Article 10, Para. 1 of the Energy Use Rationalization Act (legislation no. 14996); Article 20, Annex I, of the Presidential Decree for the Energy Use Rationalization Act (presidential decree no. 28840). The capacity thresholds differ depending on the type of energy sources. The above-mentioned threshold is for conventional energy sources.

¹¹⁰ It reviews and provides advisory opinions about electricity policies and works as a mediation body for specific types of disputes between commercial parties over electricity business matters.

The MOTIE owns 51% of the shares in the KEPCO and has the right to appoint its representative director or CEO. The KEPCO has 100% of shares in the five power generation corporations and Korea Hydro & Nuclear Power Corporation (KHNP); however, the management of those six corporations is performed by the Ministry of Trade, Industry, and Energy, not by the KEPCO.¹¹¹ Nuclear power generation has a different licensing process. An independent agency, the Nuclear Safety and Security Commission, which the Prime Minister directly supervises, has the authority to review and allow plans for the construction of new nuclear plants.¹¹²

The MOTIE is legally required to discuss the Environmental Impact Assessment prepared by a company that applies for the new construction of a power plant with the Minister of Environment.¹¹³ The Energy Use Plan and the Environmental Impact Assessment are the final assessment, in which the impact of air pollutants and greenhouse gas emissions can be reviewed and analyzed with a scheme similar to cost-benefit analysis, within the boundary of the two comprehensive plans, the Basic Plan and the Basic Electricity Plan.¹¹⁴ The MOTIE, however, is practically bound by the aforementioned comprehensive plans it has issued. The Ministry of Environment, responsible for reviewing the environmental impact assessment for the power plants, is also practically bound by the comprehensive energy plans, which significantly undermines the checking functions of the environmental impact assessment system.¹¹⁵ Thus the practical effectiveness of those two schemes in reducing greenhouse gases has been nominal, and they are only part of the implementation of the two comprehensive plans.

In sum, there is practically no chance that the benefits of reducing greenhouse gases or co-benefits are scientifically assessed and compared with the estimated cost from the initial stage

¹¹¹ The government removed the management right of the KEPCO for several concerns including the possibility of an electricity price cartel among the six corporations around 2010.

¹¹² The NSSC was a subordinate agency of the Ministry of Science and Technology until 2011, when it became an independent agency. See Article 3, 11, 12 of the Act for Establishment and Operation of the Nuclear Safety and Security Commission, Legislation No. 10912 (enacted on July 25, 2011), most recently amended as Legislation No. 13546 on December 1, 2015.

¹¹³ The Environmental Impact Assessment required under the Environmental Impact Assessment Act for a power plant with the capacity of 10,000 kW or more. Article 22 of the Environmental Impact Assessment Act, Article 31, Para. 3, and Annex 3 of the Presidential Decree of the Environmental Impact Assessment Act.

¹¹⁴ A trusted news source once reported an unofficial statement from an insider of the Ministry of Environment that the MOE had approved the Environmental Impact Assessment of the new construction of a power plant with limited comments, if it had been already included in the MOTIE's higher-level electricity plans. See, Ministry of Environment Strongly Objected to the Basic Electricity Plan, Maeil Business News, Feb. 25, 2013, available at <http://news.mk.co.kr/newsRead.php?no=141546&year=2013>. The reporter of this news is not specified.

¹¹⁵ The Environmental Impact Assessment required under the Environmental Impact Assessment Act for a power plant with the capacity of 10,000kW or more. Article 22 of the Environmental Impact Assessment Act, Article 31, Para. 3, and Annex 3 of the Presidential Decree of the Environmental Impact Assessment Act.

of energy planning until the approval for the construction of a new power plant. The Ministry of Environment has the authority to implement environmental regulations, including the operation of a nationwide emissions trading scheme, with significant implementation gaps and practical limitations of discretion in setting the reduction goal, which is discussed more in detail in the following chapters. The implicit hierarchy among the central governmental agencies, where the ministries responsible for the economic growth, including the MOTIE, rank higher than the Ministry of Environment, contributes to the status.¹¹⁶

In this regard, if carbon pricing is not properly reflected at the time the comprehensive plans are made, it is difficult to carry out in the process of individual project review. This structure becomes more problematic as the wholesale electric power market opens and more private companies become interested in building new, utility-scale power plants because such structure reins the fundamental business decisions of participants in a competitive market about whether to build a certain type of power generation unit.

C. Executive Control and Coordination of Agencies

The Korean government began the regulatory oversight system by reviewing the costs and benefits of a regulatory decision in the 1990s, when they first introduced environmental impact assessment in 1993¹¹⁷ and established a general statutory ground to consider regulatory impact by enacting the Administrative Regulations Framework Act (ARA) in 1998.¹¹⁸ The Regulatory Reform Committee (RRC), an agency supervised by the President through the Prime Minister's office, has a function similar to that of the Office of Management and Budget in the U.S. concerning regulatory review.¹¹⁹ The introduction of the system was explained as part of the "deregulation,"¹²⁰ as there was not enough noticeable deregulation movement in the industrial sector at that time. It would be more reasonable to see the introduction of the system as a "modernization" process of the government-led and opaque regulatory system made in an effort to borrow the system of developed countries.

¹¹⁶ The hierarchy is presented in the order of the ministers about who would become responsible for leading the administration in the case of the President's accidental absence. See Article 71, Constitution, Article 12 and 26, The Government Organization Act (legislation no. 14804).

¹¹⁷ Environmental Impact Assessment Act, South Korean Law No. 4567, amended as Law No. 14232 as of May 29, 2016. This amendment will be effective on May 30, 2017.

¹¹⁸ South Korean Law No. 5368, last amended as Law No. 14184 as of May 29, 2016.

¹¹⁹ The RRC is formally led by two chairs, the Prime Minister and a civil chair, who is a non-governmental representative from the private sector. The commissioners also consist of government officials and experts from the private sector. The civil chair and the commissioners from the private sector are non-standing, and concerns have been raised about conflict of interest issues and expertise. See Article 25 of the ARA.

¹²⁰ No-Seong Kwak, A Proposal to Improve Regulatory Impact Analysis, Legislation and Policy Studies, Vol. 3, No. 2, National Assembly Research Service, 99-126, 103 (Dec. 2011).

Both the environmental impact assessment system and the regulatory impact assessment system, using the cost-benefit analysis, have evolved during the past 20 years but still have limited statutory grounds to expand to all important energy policies affecting greenhouse gas emissions. The overall policymaking process has gradually progressed since then, although there have been continuous critiques about its structural legitimacy, efficiency and transparency.

1. Overall Effectiveness

Since the Congress empowered the RRC to intervene in the rule-making process of the entire administration through the ARA, the constitutionality of the RRC's establishment is rarely questioned, although the constitutionality of the OIRA's operation is questioned in the U.S.^{121,122} However, the cost-benefit analysis has a much broader and stronger position as a policymaking tool in the U.S. than in Korea, and a more general scope of application and courts' established scrutiny of the administration's use or non-use of cost-benefit analysis is discussed in the following sections. A survey published by Korean National Assembly shows that the process is still at a superficial level.¹²³ Thirty-three public officials who had experience in drafting the regulatory impact assessment for the RRC's review responded to the survey, and only 3% (one person) among them prepared the regulatory impact assessment while drafting the initial proposal.¹²⁴ Meanwhile, 68.8% prepared the assessment after finalizing the draft proposal and while procedurally preparing the notice for public comments, and 9.4% responded that they prepared the assessment only for the preparation of the RRC's review.¹²⁵ These responses show that the regulatory impact assessment system or the RRC's review of the assessment have yet to gain enough authority to make a substantive oversight system and have allowed the method of carbon pricing less refined.

The environmental impact assessment system, which works as a scheme of the cost-benefit assessment system in the process of approving a certain power plant, has yet to gain the practical function to check industrial sprawl. The legislative system of the environmental impact assessment has been developed since the 1990s, while the implementation gap, overlooked or blessed by the court, is quite significant, as discussed in the following sections with detailed cases.

¹²¹ In this regard, the starting point of the RRC's constitutionality may be different from the discussions about the OIRA's operation, though not significantly.

¹²² However, the RRC's process for the review of draft regulations warrants further constitutional discussion. As the RRC has the authority to recommend the withdrawal of draft legislation proposed by the administrators before a draft reaches the Congress, and the administrators are legally obligated to follow such recommendations absent a special reason, numerous drafts of legislation have been discarded without being discussed in the Congress after the RRC's review. Given that the legislative power is clearly vested in the Congress under the Constitution of Korea, granting such authority to the RRC should be reexamined. This is a research question that should continue to be developed in the future.

¹²³ No-Seong Kwak, *supra* note 120 at 99-126, 105-107.

¹²⁴ *Id.*

¹²⁵ *Id.*

2. *Loopholes of the Oversight System*

As only draft regulations proposed by the executive agency require the RRC's review, there is no explicit regulatory management scheme for regulations proposed by lawmakers. Thus a draft legislation proposed by lawmakers does not need to go through this process, and the relevant committee within the Congress normally reviews it briefly, without specific procedural requirements, before it is brought before the plenary session for a vote. A statistics analysis has shown that the ratio of the statutes proposed by the lawmakers amounted to 87.8% among all draft legislations that passed the plenary session of the 18th Congress between 2008 and 2012.¹²⁶ Some have observed that the aforementioned structure of regulatory review has caused more regulations to be proposed by lawmakers than by the administration in order to avoid the review of the RRC,¹²⁷ and it is often true that the draft legislation proposed by lawmakers displays significant inefficiency and other problems, even in terms of its conformity to the general legal system.¹²⁸

Another loophole is the scope of the "regulation" subject to the RRC's oversight. Under the ARA, the scope of such "regulation" is defined as "a regulation limiting the rights of citizens or imposing obligations on them for a certain administrative purpose, and prescribed by a draft legislation, presidential decree, or executive orders of each ministry proposed by the executive agencies and ordinances or rules of local governments."¹²⁹ The other side of this scheme is that the administration is not legally required to perform a regulatory impact analysis or cost-benefit analysis if a certain policy does not squarely fall under the concept of the "regulation" defined in the ARA. This significantly limits the scope of crucial policies that require cost-benefit analysis, especially in the electric power sector because the comprehensive energy plans, the Basic Plan

¹²⁶ Ministry of Government Legislation, *The White Paper for the Supports to the Legislations Proposed by the Lawmakers during the 18th National Congress*, 11 (2012). As for the background on why the quantity of legislation proposed by the lawmakers dominate, the white paper explains several reasons, including that NGOs and the media assess the legislative activity of each congressperson by the number of draft legislations he or she propose, and that the proposal process has been simplified. See, *id.*, at 11. This blunt means of assessment has been highlighted as one of the central reasons for the proliferation of legislation proposed by congress members by many other critiques. See, Wan-Shik Hong, Panel Discussion for the Session III: Tasks to Respond to the Explosion of the Draft Legislations Proposed by the Congressperson, in the discussion material for the Conference for the Development and Tasks for the Legislation, hosted by the National Assembly Research Service and the Korean Society for Legislation Studies, 111-139, 137 (May 11, 2012).

¹²⁷ It was once called "the administration's proposal borrowing the name of a congressperson." See, Wan-Shik Hong, *id.* at 115-17; The Federations of Korean Industries, *The Problems and Proposals for Improvement of the Lawmaking Process of the Legislations Proposed by the Lawmakers*, Regulatory Reform Series 4, 4 (2010).

¹²⁸ See, e.g., Korea Economic Research Institute, *KERI Brief*, Issue 13-36, 1 (2013). This should also be a future research topic concerning another problem of the Korean regulatory process.

¹²⁹ Para. 1 and 2 of Article 10, Sub-para. 1 and 2, Para 1 of Article 2, ARA. The "citizen" includes foreigners subject to the domestic laws according to the relevant provisions.

and the Basic Electricity Plan do not fall under the category of the “regulation.” This loophole also reduces the practical effect of the cost-benefit analysis of an individual energy policy because of the pervasive authority of the comprehensive energy plan of the Ministry of Trade, Industry and Energy.

The loophole in the system allows agencies to determine energy policies without properly reviewing the relevant cost and benefits. Policy decisions in long-term energy plans and grants for permits to build new power plants are clear illustrations of actions taken without considering carbon effects either for the climate disorder or co-benefits, which is quite different from the Regulatory Impact Analysis in the U.S. for the Clean Power Plan.¹³⁰

3. Transparency

The limited transparency of the regulatory review process and the environmental impact assessment (EIA) also require continuous discussion and improvement. Both systems post the finalized documents online, while neither the docket nor the documents in progress or comments filed by the interested parties or agencies are available. The result of the regulatory impact assessment is typically attached to brief meeting minutes of the RRC and posted on their official website. The RRC’s resolution approving the draft update of the Renewable Portfolio Standards (RPS) in 2012 illustrates the level of transparency. The agenda for the resolution included a brief cost-benefit analysis document with no indication of the amount of the social cost of CO₂ used in the document, which was €10 per ton/CO₂.¹³¹

Since the RPS is one of the rare examples where one can see the social cost of carbon used by the government or the costs or benefits of reducing greenhouse gases, I filed an Information Disclosure Request with the Prime minister’s office, which operates the RRC, for a more detailed regulatory impact assessment document for the 2012 RPS or the details of the social cost of carbon amount.¹³² The recipient agency verbally recommended that I withdraw the original request and redirect the request to the Ministry of Trade, Industry, and Energy, explaining that the RRC or the Prime minister’s office had never received any more detailed material on the cost-benefit analysis for that regulation, which means that the regulatory review process was quite superficial and did not even verify the summarized numbers for cost or benefit factors. Accordingly, I filed the same request with the Ministry of Trade, Industry, and Energy

¹³⁰ See U.S. EPA, Regulatory Impact Assessment for the Clean Power Plan Final Rule, 4-1-4-56 (Aug. 2015), at https://www3.epa.gov/ttnecas1/docs/ria/utilities_ria_final-clean-power-plan-existing-units_2015-08.pdf (last visited March 1, 2018). The environmental impact assessment of the construction of coal power plants in Korea, as seen in this chapter later, mentions greenhouse gas emissions with no obligation to reduce or practical reduction methods. The assessment briefly mentions carbon-capture storage technology, indicating that it will be introduced if and when the government decides to do so.

¹³¹ RRC Agenda No. 2012-544: Draft Amendment of the Act on Development, Use, and Diffusion of the New and Renewable Energy, Resolved on Nov. 22, 2012, 7-12. The detailed problems of using the number in this regulatory impact assessment are discussed in Chapter 4.

¹³² Information Disclosure Request No. 4555943; an electronic copy is on file with the Author.

and received a response indicating that no document on the regulatory impact assessment created for the 2012 RPS was publicly available other than the RRC's meeting minutes, posted on the website.¹³³ This implies that only the summarized cost and benefit factors and the result of the cost-benefit analysis are available to the public, which discourages a meaningful discussion over the process or the way in which the analysis is performed. The specific problems with carbon pricing in the updated RPS proposal shown in the available document are further discussed in Chapter 4.

The level of transparency for the process reflecting the EIA, as well as the comments from the Ministry of Environment and residents to the MOTIE's final decision for a new power plant, also leave much to be desired, though this process has more transparency than the regulatory impact assessment or any other energy policy documents. The EIA Info-system website, operated by the Ministry of Environment, only discloses the first draft of the EIA and the final one updated with comments from the neighboring residents and the MOE, and only after each document is finalized.¹³⁴ Thus one cannot access interim drafts, comments from the residents or MOE or even the reaction or response to such comments from the developer or the MOITE during the process. The EIA Info-system even posts a disclaimer that documents in the process are not available.¹³⁵ The limited docket function of the EIA Info-system, together with the almost complete opaqueness of communication between the MOTIE and the developer about the overall power plant construction project, including the Energy Use Plan, as discussed below, make it difficult for the experts outside of the government to participate the process and even the direct stakeholders, e.g., neighboring residents, to keep up with the progress of the project.

D. Legislative Oversight and Judicial Review

The legislative body, the National Assembly, normally has the authority to oversee the administrative branch through budget control,¹³⁶ enactment of new legislation to affect the administrative actions,¹³⁷ investigation or audit into the performance of the administration¹³⁸

¹³³ The Ministry of Trade, Industry, and Energy, *Response to the Information Disclosure Request No. 4560581*, Mar. 21, 2018; an electronic copy is on file with the Author. The ministry did not answer the request for a regulatory impact assessment with more details of the cost-benefit analysis and instead provided brief information on the basis of the calculation for benefits from reducing the CO₂ emissions. The details of the regulatory impact assessment in this case are reviewed and discussed in Chapter 4.

¹³⁴ See <https://www.eiass.go.kr>. (The URL for each project or EIA document is not available on the website of the EIA Info-system.)

¹³⁵ *Id.*

¹³⁶ Articles 54-58, Constitution (Constitution No. 10).

¹³⁷ The principle of statutory reservation is provided throughout the entire Constitution and the decisions from the Constitutional Court. The scope of the citizen's rights and obligations that should be prescribed by the statutes has been fiercely debated. See, e.g., Constitutional Court Decision 2008Heonba48, Dec. 29, 2009.

and impeachment.¹³⁹ The legislative oversight of the administration's energy policy was limited in Korea until recently because the level of participation from the public had been low due to the centralized energy governance, which made the lawmakers less interested in dealing with relevant topics. The comprehensive energy plans of the administration, with the supra-legal authority supported by the tradition of centralized planning, also explain this status. The nationwide emissions trading scheme was also an achievement primarily led by the republican administration, rather than a discussion led by the environmentalists through the National Assembly.

Two recent activities of the National Assembly, however, signal that the legislative oversight has begun to work. The amendment of the law put a procedural checking system on the administration's authority for energy planning, requiring the Ministry of Trade, Industry, and Energy to report the draft plan to the Congress before finalization.¹⁴⁰ Given the traditionally excessive authority of the administration in energy planning, this was an important systematic change. The amendment of the law requiring environmental consideration in deciding the dispatch order of electricity in 2017 is another recent result of this oversight.¹⁴¹ These amendments have not brought immediately noticeable changes in electricity policies, but they are expected to be the statutory grounds for future policies in the sector. The detailed background and dynamics surrounding the amendments are discussed in Chapter 4.

The investigation activities of the National Assembly,¹⁴² which started for addressing the individual residential customer's interests, i.e., the possibility of increasing or decreasing the retail electricity rate, is getting more active, though a more organized way of audit or investigation is warranted to find the accurate problems and tracking down the administration's solving the problems. The audit and investigation authority of the National Assembly has strong systematic support from the law, which requires any person or institute to submit information or materials if requested by the National Assembly for audit or investigation.¹⁴³ The system has allowed some information concerning the energy policies, which was originally kept within the agencies, to be disclosed to the public through media reports of the audit or investigation, although the submitted information or material is not publicly available in its

¹³⁸ Article 61, Constitution (Constitution No. 10).

¹³⁹ Article 65, Constitution (Constitution No. 10).

¹⁴⁰ Electric Power Business Act, Legislation No. 11968.

¹⁴¹ Para. 2 and 3, Article 3, and Para. 5, Article 25, Electricity Business Act, South Korea Legislation No. 953, most recently amended as Legislation no. 14672 on Mar. 21, 2017.

¹⁴² The audit typically takes place once a year and covers all areas of the administration. A standing or special committee responsible for a certain policy area within the National Assembly may investigate a specific topic about the performance of the administration if requested by a quarter or more of all lawmakers. Article 61, Constitution (Constitution No. 10), Articles 2, and 3, Act on the Inspection and Investigation of State Administration (legislation no. 14374).

¹⁴³ Article 2, Act on Testimony, Appraisal, Etc. Before the National Assembly (legislation no. 14757). Failure to meet the obligation may be subject to criminal imprisonment up to 3 years or criminal fine up to 30 million Korean won. See Article 12 of the Act.

entirety. The audit and investigation system, however, has yet to be systemized and made available for political debate, which differs from the role of the U.S. Government Accountability Office.¹⁴⁴

For example, the status of the extremely low industrial electricity rate, which creates inefficiency and fairness issues for cross-subsidies from the residential group to the industrial group, was requested by lawmakers of the opposition party to the KEPCO and made publicly available.¹⁴⁵ The National Assembly Budget Office once analyzed in detail the structural inefficiency and fairness problems in the rate design based on information that had been publicly unavailable.¹⁴⁶ The follow-up measures taken by the administration, the Ministry of Trade, Industry, and Energy or KEPCO, however, were insufficient to address the issues raised by the lawmakers, which might have been a result of the extremely political nature and less systematic audit or investigation process. The KEPCO has slightly raised the industrial rate in response to repeated comments from the opposition party, without providing a reasoned response or addressing the problems highlighted by lawmakers at the time of the investigation. The details of the industrial rate design are further discussed in Chapter 5.

On the other hand, the role of the court has been extremely limited in the energy sector. The limited judiciability and standing in administrative litigations do not allow citizen suits or private enforcement of the provisions that specify the government's obligation to consider the impact of greenhouse gases under the relevant statutes, more specifically, the Low Carbon and Green Growth Act. Standing in the lawsuit filed against the agency is allowed only when the plaintiff has a legal interest that is direct and concrete under the relevant statutes.¹⁴⁷ Seeking a government agency's specific performance through a petition for a writ of mandamus, e.g.,

¹⁴⁴ The overall effectiveness of the audit and investigation system is not yet sufficient. A renowned policy expert once estimated that the effectiveness of the Korean congress in overseeing the administration ranks 23rd among 25 member states of the OECD considered in the research. See Tobin Im, 2015 Report on the Government's Competitiveness, Seoul National University, Korea Administration Research Institute Publication Series (2015).

¹⁴⁵ See Office of Joo-min Park, the lawmaker-elect, Press Release, May 18, 2016; Ji-young Ahn, The Lawmaker Nak-yeon Lee Talked about the KEPCO's Loss for Benefits to Big Companies, Chosun-Ilbo, Aug. 21, 2013.

¹⁴⁶ National Assembly Budget Office, Electricity Pricing Scheme and Improvement Plan, 10 (June 2013).

¹⁴⁷ The standing has been determined by the court's interpretation of the Administrative Litigation Act. See, Article 12, Administrative Litigation Act (legislation no. 14839), Supreme Court Decision no. 97Nu19571 (Sep. 22, 1998), and Supreme Court Decision no. 97Nu19588 (Sep. 4, 1998). Some commentators argue that the court has tried to expand the standing in environmental cases based on rulings that recognized standing for the residents within the area subject to the environmental impact assessment. Those comments are questionable, however, in that the court only relies on the specific "statutory system," the environmental impact assessment, as the standard of deciding the boundary of the standing requirement. As it is clear that the environmental impact assessment sets the policy goal of protecting the environment and the health of the residents living within the area subject to the assessment, the current court's position simply reiterates the traditional standing requirement, "legal interest." The reason why the court in mid-1990s began to mention the environmental impact assessment when reviewing the standing is because the system was introduced shortly before.

German *Verpflichtungsklage*, is not allowed either,¹⁴⁸ which significantly limited the scope of judicial review in litigations concerning agency policymaking.

Further, the court's standards of review with respect to agency discretion, including the method of the cost and benefit analysis or environmental impact assessment, are not yet well established enough to function as a checks and balances system. There have been cases in which the court overlooked the possible negative effect of the agency omitting cost-benefit analysis or the environmental impact assessment required by law and instead approved a less transparent or less efficient policymaking process.¹⁴⁹

The case of the *Four Major Rivers Project* illustrates this loose accountability system. The Supreme Court of Korea opined in a decision on the validity of the so-called *Four Major Rivers Project*, which was the largest dam construction in Korean history led by the government, spending 22 trillion Korean won in tax (approximately USD \$20 billion) between 2008 and 2012, that the government's omission of the preliminary assessment, including the cost-benefit analysis of the project legally required for budget spending, is not a factor that renders the administrative process of the project illegal.¹⁵⁰ The Supreme Court approved each point of the benefits of the government's assessment by reiterating the contents of the government's cost-benefit analysis document, which was drafted later than the timing required by law, while dismissing the matching arguments from the plaintiffs, which pointed out the expected significant environmental cost and the vague estimate of the economic benefits of construction.¹⁵¹ The preliminary injunction filed at the beginning of the project, based on similar issues, was dismissed by an *en banc* decision of the Supreme Court, where four Justices out of 13 strongly dissented.¹⁵²

In an interview with *Science* magazine, Professor G. Mathias Kondolf of the Department of Landscape Architecture & Environmental Planning at U.C. Berkeley said that the project is "out of step with the way river management is evolving in the developed world."¹⁵³ Furthermore, it was recently selected as one of the nine world's most high-profile waste of capital projects.¹⁵⁴ A series of reports that the water quality of the relevant rivers, which are the

¹⁴⁸ Professor Tom Ginsburg explains that limited standing rules prevent non-governmental organizations and citizen groups from intervening, foreclosing a channel of advocacy for social change, and the net result is limited public ability to participate in administrative processes, which leaves the agencies considerable flexibility. See Tom Ginsburg, Dismantling the "Developmental State"? Administrative Procedure Reform in Japan and Korea, the *American Journal of Comparative Law*, Vol. 49, No. 4, 585-625, 596 (Autumn 2001).

¹⁴⁹ See, e.g., Korean Supreme Court Decision 2006Du330 (en banc, Mar. 16, 2006), 2011Du32515 (Dec. 10, 2015), 2012Du6322 (Dec. 10, 2015), and 2010Mu111 (Apr. 21, 2011).

¹⁵⁰ See Supreme Court decision 2012Du6322 (Dec. 10, 2015).

¹⁵¹ *Id.*

¹⁵² See Korean Supreme Court decision 2010Mu111 (Apr. 21, 2011).

¹⁵³ Dennis Normile, Restoration or Devastation?, *News This Week, Science*, Vol. 327, Issue 5973, 1562 (Mar. 26, 2010), available at <http://science.sciencemag.org/content/327/5973/news-summaries>.

¹⁵⁴ Colin Horgan, The \$3.35bn subway station – and other urban white elephants, *Guardian*, Nov. 24,

most important drinking water source in Korea, and their ecology system have seriously suffered since the dam construction was completed.¹⁵⁵ No agency has been held liable either legally or politically for the project yet, and only temporary measures to revive the quality of rivers have been taken recently.¹⁵⁶ This case is an example of how a flawed cost-benefit analysis caused tremendous economic and environmental loss, and how the absence of a proper scheme for securing the accountability of the administration's analysis prevented correcting the problems.

The Korean court was not susceptible to the plaintiff's arguments about the appropriateness of the social discount rate used by the agency, even in the case where the discount rate used in the relevant cost-benefit analysis was higher than the rate set by the inter-agency guidelines. In the *Sae-man-geum* case, where sea reclamation and water resources management were the key issues, the appellate court ruled that the cost-benefit analysis performed in 1999-2000 by a special research vehicle for the development project at issue using a discount rate of 8%, without reporting the rationale behind the number, was not inadequate, which was again upheld by the Supreme Court.¹⁵⁷ At the time the analysis was drafted, however, the government was already using the unified discount rate of 7.5% across all policies, which puts the reasonableness of the court decisions in question.¹⁵⁸ The Supreme Court in that case further opined that the projects could not be held inadequate even if the consideration of certain benefits or cost factors were wrong, or if the valuation methodology was wrong, unless the entire scenario for a cost-benefit analysis lacks reasonableness.¹⁵⁹ The Korean court thus did not perform a check-and-balance role vis-à-vis the administration about the cost-benefit

2017, available at <https://www.theguardian.com/cities/2017/nov/24/3bn-subway-station-toronto-alaska-bridge-pyongyang-hotel-valencia-city-arts-sciences>.

¹⁵⁵ See, e.g., Do-kyun Kim, Green-alga Latte - Four Major Rivers, Who Will Answer For the Pollution that the Government Also Acknowledged, Seoul Broad Casting, April 17, 2017, available at http://news.sbs.co.kr/news/endPage.do?news_id=N1004111409 (last visited March 6, 2018).

¹⁵⁶ Ministry of Land and Transportation, Ministry of Environment, and Ministry of Agriculture and Foods, The Plan for Connecting Dams, Dammed Pools for Irrigation, and Reservoirs (Mar. 2017), at http://www.prism.go.kr/homepage/entire/retrieveEntireDetail.do;jsessionid=5EB003699CE7771944741F2BD2354996.node02?cond_research_name=&cond_research_start_date=&cond_research_end_date=&research_id=1480000-201500034&pageIndex=459&leftMenuLevel=160 (last visited March 5, 2018).

¹⁵⁷ Seoul High Court, 2005Nu4412, Dec. 21, 2005; Korean Supreme Court, 2006Du330, Mar. 16, 2006.

¹⁵⁸ It is not clear from the court decisions whether the plaintiffs asserted the problems in the discount rate, while lots of other problems in the cost-benefit analysis methodology were raised, including but not limited to having neglected the ecological costs, and redundantly counted certain benefit factors. See, for discussions over the problems of the court decisions in *Sae-man-geum* case, Seong Wook Heo, Establishing Climate Change Regulatory System and Social Discount Rate Debate, *Environmental Law Review*, Vol. 32, No. 1, 509-542 (2010); Joon Seok Lee, The Limits of Cost Benefit Analysis and the Judicial Review, *Environmental Law Review*, Vol. 35, No. 1, 383-410 (2013). Further, given that the government started to use a time-declining discount rate for water resources projects since 2004, it adds more questions that the court made such decisions for the development project of water resource in 2005 and 2006 when opining on the adequacy about the discount rate.

¹⁵⁹ Korean Supreme Court, 2006Du330, Mar. 16, 2006.

analysis, which has supported the opaqueness of the administration's policymaking process. The vagueness of the court's distinction, between a case in which the "entire scenario for cost-benefit analysis lacks reasonableness" and a case in which a "certain benefit or cost factor is wrong or the valuation methodology is wrong," creates problems. The court currently views the cost-benefit analysis as a formality in the realm of the administration's discretion, rather than a check-and-balance mechanism in which the court as well as the public should intervene.¹⁶⁰

The Korean court has generally considered procedural defects of the administrative actions rather generously, which has been the subject of scholarly debates. Three factors have significantly contributed and maintained these dynamics. First, the overall low level of transparency of the administrative process and the administration's strong preference for procedural efficiency to substantial accuracy has contributed to this tendency. The OECD recently published a survey indicating that the level of transparency of government policymaking in Korea is much lower than the average of the G7 or OECD countries, ahead only of Italy among the G7.¹⁶¹ Second, the tradition of German administrative law, which influenced the initial formation of Korean administrative law, has also affected to make this dynamic possible. A renowned German administrative law researcher once presented in a conference in Seoul that, under German law, "a legally legitimate decision is drawn out from the legal principle, for which reason it does not need procedural legitimacy or justice" and that the "German constitutional state aims to realize the optimal order of the freedom as the reason leads, without the democratic will of freedom or communication with the citizenry through the procedural law."¹⁶² The Korean court has set the principle of considering an administrative action illegal without a reason after the Administrative Procedures Act was enacted. This act require the administration's obligation to add legislative ground and reasons for an action.¹⁶³ The scope of judicial review, however, still remains at the level of a formality, as seen above in the cases for the cost-benefit analysis.¹⁶⁴ Third, the loose application of the separation of powers principle between the administration and the court, primarily due to the career judge system, also significantly contributes to the court's treatment of the administration.¹⁶⁵ The court operates through a

¹⁶⁰ The transparency of energy sector policymaking would be the lowest, as we saw from the cases in Chapters 3 and 4.

¹⁶¹ See OECD, *Government at a Glance: How Korea Compares*, 91 (2016).

¹⁶² See Thomas Wurtenberger (translated into Korean by Jeong Hoon Park), *The Relationship between the Administrative Litigation Act and the Administrative Procedure Act*, *Seoul Law Journal*, Vol. 45, No. 1, 176-194, 182 (2009). In this article, Professor Wurtenberger further discusses recent criticism on those aspects of German administrative law and the comparative flexibility of EU administrative law, together with the issues arising from the intersection of those two jurisdictions.

¹⁶³ See, e.g., Korean Supreme Court, 2016*Du44186*, Aug. 29, 2017.

¹⁶⁴ The court still sometimes approves administrative actions not fulfilling the requirement under the Administrative Procedures Act, explaining that the plaintiff might have been able to know the legislative ground and reasons for the action, which undermines the legal authority of the Administrative Procedures Act. See, e.g., Korean Supreme Court, 2000*Du8912*, May 17, 2002; Korean Supreme Court, 2007*Du20362*, Dec. 10, 2009.

¹⁶⁵ The current Korean Constitution does not have an explicit separation of powers provision. Article

promotion system for judges, which has made the court similar to a bureaucratic organization.¹⁶⁶ A former senior judge or even a former Justice is commonly recruited to be a political nominee for the administration. The structure of the court's operation system has thus significantly contributed to the status in which the individual judges recognize the administration as a subject to cooperate with and follow, rather than the subject of a close review.¹⁶⁷

In sum, the standards of judicial review have not properly functioned as a system to check the administration's inaction or excessive or ill-designed regulations.

II. The U.S. Regulatory System for the Energy Sector

A. A Brief Overview of the U.S. Policymaking Regime

The current federal energy policymaking is led by the Department of Energy (DOE) and the Federal Energy Regulatory Commission, an agency within the DOE with structural independence. As the electric power sector originated from private business, the relative impact of the administration's authority in this sector may be less pervasive than in the Korean case. The level of intervention from the government in the sector, however, is higher than any other sector because of its inherent characteristic affecting national security and the public economy. It is the one of the few sectors for which the government directly regulates the pricing scheme. The authority to regulate trade in the wholesale market is vested in the federal

103, which sets the independence of judges, is typically referred to as the constitutional ground of the separation of powers principle, but it does not explicitly mention independence from political influence or the administration.

¹⁶⁶ All the judges are on a rotation system and should move the court and region once every 2 to 4 years, and the location of the next workplace is unilaterally determined by an internal administrative office operated by a Justice and supervised by the Chief Justice. A small number of judges in the district court have been promoted to the appellate level court, among which a handful are recommended to be Justices, all supervised by the aforementioned internal administrative office. The incumbent Chief Justice leads an internal restructuring plan to remove the promotion system, though there remain concerns that this movement is also affected by the current administration.

¹⁶⁷ An OECD survey showed that 54% of citizens have confidence in their country's judicial system and courts on average in OECD countries, while 27% of Korean citizens do. Korea ranked among the lowest. See OECD, Public Governance: A matter of trust, at <http://www.oecd.org/governance/public-governance-a-matter-of-trust.htm>. Among the many structural improvement tasks the Korean court has, it appears to have focused more on an efficient case management system than the substantive structural problems needed in order to improve the legal infrastructure. The case management system of the Korean court often receives positive feedback, however. See, e.g., Heike Gramckow and Omniah Ebeid, Leveraging Technology to Improve Service Delivery in the Justice Sector in South Korea, The World Bank (Mar. 2016).

government, and the authority to regulate the retail market lies in each state, typically the state agency responsible for the overall public utility.¹⁶⁸

B. Role and Operation of Regulatory Agencies

The DOE is responsible for overall national energy policies including planning, regulating, research and information gathering in the energy sector, and developing and commercializing nuclear power generation.¹⁶⁹ The FERC is an organization within the DOE responsible for licensing and regulating the energy business with multi-state interests.¹⁷⁰

The structural independence of the FERC is notable. The Federal Power Commission, established by the Federal Power Act of 1920, was replaced with the FERC in 1977, when the DOE combined several administrative agencies and relevant energy policies through the Department of Energy Organization Act of 1977.¹⁷¹ The structural independence of the FERC can be observed through two recent cases in which the FERC did not accept the recommendation from the administration. The first happened during the previous administration and concerned the use of the social cost of carbon recommended by the inter-agency working group. The FERC did not use the social cost of carbon in the course of approving the construction of exporting facilities of the liquefied natural gas, citing and explaining the controversies over the calculation methods.¹⁷² The second case happened during the current administration, which favors the traditional energy sector. The DOE recommended the agency adopt a plan for subsidizing coal and nuclear power plants, but the FERC decided not to accept the recommendation after assessing the economic impact of the plan.¹⁷³

¹⁶⁸ The boundary of these authorities is not clear, especially in cases where a newer type of market participants or products are relevant, which are often subject to the jurisdictional claims. One recent example is the Supreme Court decision in 2016, *FERC v. Electric Power Supply Association*, which decided that the FERC has the authority to intervene in the price that demand response providers should be paid in the wholesale market, and to order wholesale market operators to receive demand response bids from aggregators of electricity consumers. These issues are in the mixed realm of the wholesale and retail markets. See *FERC v. Electric Power Supply Association*, 136 S.Ct. 760 (2016).

¹⁶⁹ See Department of Energy Organization Act of 1977, Public Law 95-91 (Aug. 4, 1977); DOE, Brief History of the Department of Energy, at <https://www.energy.gov/management/office-management/operational-management/history/brief-history-department-energy>.

¹⁷⁰ 42 U.S. Code § 7172.

¹⁷¹ See Marshall J. Breger and Gary J. Edles, *Independent Agencies in the United States: Law, Structure, and Politics*, 41-43 (2015).

¹⁷² *Dominion Cove Point LNG, LP*, 148 F.E.R.C. ¶ 61,244 (2014); 151 FERC ¶ 61,095 (2015). The FERC's decision was later reviewed and affirmed by the federal circuit court. See, 828 F.3d 949 (D.C. Cir., 2016).

¹⁷³ 162 FERC ¶ 61,012, Docket No. RM18-1-000 (Jan. 8, 2018).

The social regulations in this sector have been led by the Environmental Protection Agency (EPA) based on the legislative mandate at the federal level. The sector had various experiences with command-and-control type regulations, as well as market-based ones, in terms of the environmental regulations. Environmental regulations on emissions from power plants were noticeably reinforced since the enactment of the National Environmental Policy Act (NEPA) in 1969, the amendment of the Clean Air Act and the foundation of the EPA in 1970. The Acid Rain Program, based on the Title IV of the Clean Air Act of 1990 amendments, started in 1995 to reduce SO₂ emissions from power plants.¹⁷⁴ This cap-and-trade program was successful, and the EPA assessed that the SO₂ emissions from power plants decreased 36% between 1990 and 2004.¹⁷⁵ At the regional or state level, more market-based mechanisms have been begun operating, including the Regional Clean Air Incentives Market (RECLAIM) in southern California for reduction of NO_x emissions from power plants, the Regional Greenhouse Gas Initiative (RGGI) among the nine states in the east coast for reducing CO₂ emissions from power plants and the California cap-and-trade program.¹⁷⁶

C. Executive Control and Coordination of Agencies

The regulatory oversight system was launched during the Reagan Administration by founding the Office of Information and Regulatory Affairs (OIRA) within the Office of Management and Budget (OMB) and introducing the cost-benefit analysis system for reviewing draft policies in 1981.¹⁷⁷ This was a result of continued antiregulatory requests raised in response to the strengthened regulations of the 1970s.¹⁷⁸ Though the cost-benefit analysis of the OIRA did not have a statutory ground, the administrative policies adopted based on the result of cost-benefit analysis have been affirmed by judicial review, and Congress has enacted numerous statutes requiring agencies to perform such analysis.¹⁷⁹ In this way, the system has gained practical authority and settled into functioning as a strong internal oversight system within the administration. Professor Richard Revesz observes that the “theoretical and empirical work” on the cost-benefit analysis system continued after the initial launch, which

¹⁷⁴ Richard Schmalensee and Robert N. Stavins, Lessons Learned from Three Decades of Experience with Cap and Trade, NBER Working Paper Series No. 21742, 61-63 (Nov. 2015).

¹⁷⁵ *Id.*

¹⁷⁶ Daniel A. Farber, and Cinnamon P. Carlane, Climate Change Law, 102-104 (2018).

¹⁷⁷ Cass R. Sunstein, The Cost-Benefit Analysis: The Future of Regulatory Protection, 10-11 (2002); Richard Revesz, and Michael A. Livermore, Retaking Rationality, 23-24 (2008).

¹⁷⁸ Richard Revesz, et. al., *id* at 21-24.

¹⁷⁹ Matthew D. Adler and Eric A. Posner, Rethinking Cost-Benefit Analysis, The Yale Law Journal, Vol. 109, No. 2, 165-247, 167 (1999).

enabled the system to survive the Democratic presidency in the 1990s and achieve a more stable status in the 2000s under the Republican presidency.¹⁸⁰

In addition to the regulatory review function, the OIRA is also known to perform extensive coordination work among various agencies in the process of policymaking to achieve a “reasonable consensus” in order to enhance the level of compliance with the relevant laws and to ensure that public comments on draft policies are properly reflected in the final rule.¹⁸¹ The overall function of the OIRA as a regulatory oversight vehicle is substantive, and the discussion over draft policy proposals can be assessed as productive in that the process adds value to the proposals through the active participation of the involved agencies and public comments.¹⁸²

D. Legislative Oversight and Judicial Review

The established separation of powers principle in the U.S. government has made the check and balance activities by each government branch effective in comparison with the case of Korea.¹⁸³ Congress led the important turning points in energy sector regulations. As discussed above, the current agencies responsible for the sector were founded with the delegation from Congress. The Public Utility Regulatory Policies Act of 1978 (PURPA) was enacted to diversify the market in response to the oil crisis started. Its aim was to open the electric power market to small-scale renewable and co-generation business, which brought changes to the markets formerly made up of only the integrated utilities.¹⁸⁴ The Energy Policy Act of 2005 introduced various energy policies reforming the PURPA, including higher tax credit supports for renewable energy sources and energy efficiency programs, which provided the decisive opportunity for the renewable energy sector.¹⁸⁵ The American Recovery and Reinvestment Act of 2009 significantly enhanced the level of subsidies provided to the renewable energy industry.¹⁸⁶

¹⁸⁰ Richard Revesz, et. al., *supra* note 177 at 31.

¹⁸¹ Cass R. Sunstein, OIRA: Myths and Realities, *Harvard Law Review*, Vol. 126, 1838-1878, 1840-44 (2013).

¹⁸² *Id.* at 1854-63.

¹⁸³ Saikrishna B. Prakash, and John C. Yoo, Questions for the Critics of Judicial Review, *George Washington Law Review*, Vol. 72, 354-380, 358-360 (2003).

¹⁸⁴ PURPA became effective on November 9, 1978, and it stipulates the obligation of the electric utilities to purchase electricity from other, more efficient generators (Qualifying Facilities, QF), such as cogeneration facilities producing electricity and steam simultaneously and small power production facilities including renewable energy generators, if that cost is less than the utility’s own avoided cost rate to consumers. See, 16 U.S.C. § 796(17)(E) and 18 C.F.R. § 292.207. For detailed background of the PURPA and its implications, see Jim Rossi, and Thomas Hutton, *Federal Preemption and Clean Energy Floors*, *North Carolina Law Review*, Vol. 91, 1283-1356, 1304-1314 (2013).

¹⁸⁵ Pub.L. 109–58 (2005); CRS Report to Congress, *Energy Policy Act of 2005: Summary and Analysis of Enacted Provisions* (Mar. 8, 2006), 89-93.

¹⁸⁶ Pub.L. 111–5 (2009); Executive Office of President of the United States, *Retroactive Assessment of*

Further, judicial review has played a significant role in shaping energy policies to address environmental concerns within the limitation of the separation of powers principle. The most salient differences from the Korean system are that the U.S. legal system allows citizen suits and lawsuits seeking the agency's active regulatory action, and it recognizes the standing for the administrative lawsuits more widely.¹⁸⁷ The Supreme Court ruled in *Massachusetts v. EPA* that the EPA has the legal obligation to regulate greenhouse gas emissions from motor vehicles, which provided normative support for climate policies.¹⁸⁸ The court also has substantial experience in reviewing the legitimacy and justification of policies' cost-benefit analysis. A study has shown that federal courts have often questioned the reasonableness of the methodology and assumptions used for cost-benefit analysis as part of their review of the policy at issue.¹⁸⁹

The Supreme Court has yet to have the chance to rule on whether a climate standing is generally allowed.¹⁹⁰ The role of suits seeking climate damages is partly performed by citizen suits. The administration's efforts to determine the social cost of carbon were also triggered by the federal court decision in *Center for Biological Diversity v. National Highway Traffic Safety Administration*, in which the court rejected the agency's Environmental Assessment for having omitted the monetary value of greenhouse gas emissions reductions based on the NEPA.¹⁹¹

Clean Energy Investments in the Recovery Act (Feb. 2016), 21-24.

¹⁸⁷ Farber et. al., *supra* note 176 at 174-181. The U.S. legal system recognizes "injury in fact" as one of the conditions of standing, while the Korean system requires "legal interest which is concrete and direct" for an administrative lawsuit.

¹⁸⁸ 549 U.S. 497 (2007). The final opinion was split, 5:4.

¹⁸⁹ Caroline Cecot, and W. Kip Viscusi, Judicial Review of Agency Benefit-Cost Analysis, *George Mason Law Review*, Vol. 22, No. 3 575-617, 614-615 (2015).

¹⁹⁰ The issue was reviewed in *American Electric Power v. Connecticut* (564 U.S. 410 (2011)), however, the court was split evenly and did not render an opinion on this issue. See Daniel A. Farber, *supra* note 187.

¹⁹¹ 538 F.3d 1172 (9th Cir. 2008).

CHAPTER 4

THE CASE OF THE SOCIAL COST OF GREENHOUSE GASES

This chapter discusses the significance of the social cost of greenhouse gases in energy policymaking and seeks a desirable approach for Korea to develop this cost. The U.S. approach to the social cost of greenhouse gases is reviewed as an exemplary case for reference. Section I reviews the role and significance of the social cost of greenhouse gases in the current energy policies. Section II explains the utility of the cost-benefit analysis as a tool for climate policies concerning social cost of greenhouse gases. Section III reviews the current approach to the social cost of greenhouse gases of the Korean government through various policy documents that utilize the cost-benefit analysis tool in the energy sector. Section IV then reviews the case of the U.S., the development process of the social cost of greenhouse gases, the central issues discussed during development and use, and the dynamic interaction among the various government agencies and courts surrounding this issue as a policy model. Section V suggests considerations for an ideal approach when adopting the social cost of greenhouse gases and considers important, substantive issues in determining the social cost of greenhouse gases, the social discount rate and the scope of benefits to consider.

I. Significance of the Social Cost of Greenhouse Gases

Scientists and governments have tried to measure the environmental externalities of carbon dioxide emissions in order to set reduction goals and the proper level of reduction methods in climate change policies. The term “social cost of carbon,” which came into use as part of these efforts, represents the “present value of the marginal social damages from carbon dioxide emissions” which equals the “marginal social benefit from emissions abatement.”¹⁹² It typically stands for the social cost of one metric ton of carbon dioxide. The concept is thus a way to express the environmental externalities of carbon dioxide emitted from fuel combustion, although it started to be commonly used rather recently. It is indispensable for economic assessment of policy options with climate damage concerns. The inter-government agency within the U.S. administration that determined the social cost of carbon initially limited its scope to the social cost of carbon dioxide, but it later expanded its work to include estimating the social costs of methane and nitrous oxide in 2016.¹⁹³ As carbon dioxide, methane, and nitrous oxide

¹⁹² Nathaniel O. Keohane, and Sheila M. Olmstead, *Markets and the Environment* (2nd ed.), 40-41 (2016). It is different from the concept of the marginal abatement cost, which is typically regarded as equating the price of the emissions correctly in a cap-and-trade program. The inter-agency working group once explained that the social cost of carbon “establishes an economically optimal price of carbon at which the associated marginal costs of mitigation would equal the marginal benefits of mitigation.”

¹⁹³ Interagency Working Group On Social Cost Of Greenhouse Gases, United States Government, Addendum to Technical Support Document on Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866: Application of the Methodology to Estimate the Social Cost of Methane and the Social Cost of Nitrous Oxide (August 2016), at <https://www.epa.gov/sites/production/files/2016->

are the most significant greenhouse gases emitted from the combustion of fuels, climate change policies that reflect the social cost of those gases would be more efficient.

Estimating the social cost of carbon dioxide or greenhouse gases is an extremely complicated process, involving scientific and economic modeling, as we see from the process of estimating the social cost of carbon dioxide that the U.S. federal government experienced later in this Chapter. It is thus better to determine a range of numbers for the convenience of ordinary use in the policymaking process. The social cost of greenhouse gases would also help the private sector with business decisions. Several energy companies reportedly have their own internal estimation of the carbon price.¹⁹⁴ If the social cost of carbon is set and consistently used, the business sector may be able to make more stable business decisions.¹⁹⁵

II. Utility of the Cost-Benefit Analysis for the Korean Case

A. Controversies over the Cost-Benefit Analysis and Its Practical Utility

The debates surrounding cost-benefit analysis have been multi-faceted. If the focus is narrowed to the topics concerning environmental harms or benefits, we can describe such debates as two-tier issues: normative legitimacy questions and valuation methodology questions. These two groups of questions are closely related to each other, while, more recently, they have converged to be the latter.

Advocates of cost-benefit analysis maintain that it strengthens the scientific basis for regulation, ensures consistency in risk regulation, facilitates risk comparisons and leads to better agency decision-making through best estimates.¹⁹⁶ They also point out that using cost-benefit analysis for policymaking is justified, even if they sometimes produce undesirable outcomes, as long as the total costs associated with the analysis (the costs of undesirable outcomes plus procedural costs) are lower than the total costs associated with an alternative decision

[12/documents/addendum_to_sc-ghg_tsd_august_2016.pdf](#) (last visited April 13, 2018).

¹⁹⁴ Climate Home News, Exxon, Shell and BP operating “internal carbon prices,” (June 12, 2013), at <http://www.climatechangenews.com/2013/12/06/exxon-shell-and-bp-operating-internal-carbon-prices/> (last visited April 10, 2018);

¹⁹⁵ The energy companies once publicly stated that they supported the energy tax of \$40 per ton of CO₂. Oliver Milman, *Exxon, BP and Shell back carbon tax proposal to curb emissions*, The Guardian (June 20, 2017), at <https://www.theguardian.com/environment/2017/jun/20/exxon-bp-shell-oil-climate-change> (last visited April 10, 2018).

¹⁹⁶ Thomas O. McGarity, A Cost-Benefit State, *Administrative Law Review*, Vol. 50, No. 1, 7-79, 16-23 (1998). See also Cass R. Sunstein, Endogenous Preferences, *Environmental Law*, Coase-Sandor Institute for Law & Economics Working Paper No. 14, 24 (1993); Cass R. Sunstein, Legislative Foreword: Congress, Constitutional Moments, and the Cost-Benefit State, *Stanford Law Review*, Vol. 48, No. 2, 247-309, 257-60 (1996); and Stephen Breyer, *Breaking the Vicious Circle: Toward Effective Risk Regulation*, Harvard University Press, 3-10 (1995).

procedure.¹⁹⁷ Skeptics of cost-benefit analysis for normative reasons argue for the incommensurability of various values, including human health and life.¹⁹⁸¹⁹⁹ They further point out that an ambitious cost-benefit analysis may excessively slow the rulemaking process and result in a lack of precision in the estimation of cost or benefit. Some have also noted that the cost-benefit criterion tends to substitute the views of experts, as an elite group, for public perceptions of risk.²⁰⁰ Opponents further contend that there are fairly reasonable alternatives to a cost-benefit analysis, suggesting e.g., technology-based regulation, the essence of which is to require the best available methods for controlling pollution, incentive-based programs, such as a trading system for emissions, and informational regulations, which require disclosure to the public or to consumers about risks they face from exposure to hazardous factors.²⁰¹

In an effort to reflect the concerns raised by the critiques of cost-benefit analysis and seek the appropriate role and operational methods, some proponents more focused on environmental values suggest alternative methodologies for these analyses, for example, two-step assessment, in which the first stage is a normal cost-benefit analysis, and the second stage reflects other values that have not been addressed in the first stage;²⁰² another option is to set the environmental baseline by applying feasibility analysis to determine “whether a regulation is a feasible response to a significant risk” while using the cost-benefit analysis as “a benchmark for what is feasible.”²⁰³ Some proponents of a modified cost-benefit analysis who have a more economic rationale suggest that such analysis is properly conceptualized as a “welfarist decision procedure,” and that it is the decision procedure that is “the most justified in light of overall well-being in a significant fraction of agency choice situations.”²⁰⁴ In this regard, they recommend that

¹⁹⁷ Adler and Posner, *supra* note 179 at 168.

¹⁹⁸ See e.g., Frank Ackerman and Lisa Heinzerling, Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection, *University of Pennsylvania Law Review*, Vol. 150, 1553-1584 (2002); McGarity, *supra* note 196; David Copp, The Justice and Rationale of Cost-Benefit Analysis, *Theory and Decision*, Vol. 23, No. 1., 65-87 (1987).

¹⁹⁹ Moderate advocates of cost-benefit analysis do recognize that many regulations have goals other than economic efficiency, which is entirely legitimate. However, they also argue that we should try to promote social commitments in the most cost-effective manner with respect to statutes not based on economic grounds, which is the reason cost-benefit analysis is required. See e.g., Cass R. Sunstein, *Free Markets and Social Justice*, Oxford University Press, 8-9 (1997).

²⁰⁰ McGarity, *supra* note 196 at 50-62.

²⁰¹ Ackerman and Heinzerling, *supra* note 198, at 1581-1583. These alternatives suggested by opponents, however, are not necessarily insulated from the comparison of the associated costs and benefits. For example, the emissions trading scheme calls for the cost-benefit analysis to determine the level of emissions cap. Informational regulations are often compromise between a more stringent type regulation and non-regulation, where the balance between the costs and benefits are considered.

²⁰² Sunstein, *supra* note 199 at 139-40.

²⁰³ Daniel A. Farber, *Eco-Pragmatism*, 93-94, 114-116 (1999).

²⁰⁴ Adler and Posner, *supra* note 179, at 194-197, 238; Peter A. Schuck, *Why Government Fails So Often and How It Can Do Better*, 45 (2014).

agencies should use a cost-benefit analysis to evaluate the welfare effect of large projects, except where there are sufficiently substantial wealth differences between those who gain from the project and those who lose from it.²⁰⁵

One interesting aspect of the discussions is that the opponents or skeptics of cost-benefit analysis also clearly recognize the necessity of a policy instrument to set certain policy goals or methodologies. Their alternatives to cost-benefit analysis – e.g., a trading system for emissions and informational regulations – are the newest type of social regulations with market mechanisms, and they also directly involve numerical and scientific assessment and representative examples of the policies from the comparative assessment of costs and benefits. An emissions trading system needs a concrete, numerical cap of total emissions amount, typically set for each period of the scheme,²⁰⁶ and the free or auctioned initial allowances to emit greenhouse gases for each participant. The goal as well as the initial allowances, together with other basic frames of the system, should be determined by balancing the social cost of carbon, other social benefits and the cost of the participants. Further, Professor Lisa Heinzerling, a vigorous opponent of cost-benefit analysis, once wrote that “cost-benefit analysis frequently turns out to be complete cost-incomplete benefit analysis,”²⁰⁷ which illustrates the necessity of further efforts to create a more accurate and efficient cost-benefit analysis, rather than a compelling reason to completely deny cost-benefit analysis.

So, the practical debates surrounding the cost-benefit analysis seem to have shifted focus from its moral foundation or legitimacy to a more efficient and legitimate methodology, though the controversy over the economic versus environmental values continues. As for climate change policies, some skeptics from both the environmentalist and political scientist groups point out that cost-benefit analysis has raised issues in setting climate goals due to the uncertainties of damages and the generational gap between the cost-bearer and the beneficiary groups, among others.²⁰⁸ These comments might be used to frame a more cautious approach in making climate policies, and it is generally agreed among economists that the cost-benefit analysis should be used for setting goals and shaping individual policies.²⁰⁹

²⁰⁵ Schuck, *id.*

²⁰⁶ In the case where a carbon tax system is adopted, the cost-benefit analysis is also necessary to determine the appropriate level of tax.

²⁰⁷ Frank Ackerman and Lisa Heinzerling, *Priceless: On Knowing the Price of Everything and the Value of Nothing*, 207 (2004).

²⁰⁸ Jonathan S. Masur and Eric A. Posner, *Climate Regulation and the Limits of Cost-Benefit Analysis*, *California Law Review*, Vol. 99, 1557-1599, 1596-99 (2011).

²⁰⁹ William Nordhaus, *The Climate Casino: Risk, Uncertainty, and Economics for a Warming World*, 217-219 (2013).

B. Extrinsic Values of Cost-Benefit Analysis for the Case of Korea

In addition to the aforementioned normative legitimacy and effectiveness discussions on the intrinsic value of cost-benefit analysis, its extrinsic political function enhances the transparency of the policymaking process and helps provide it legitimacy; it may also provide more practical guidance on the overall direction of improving. This political function of cost-benefit analysis could have more weight in the countries where it was adopted as a policy instrument comparatively recently, as in the case of Korea.²¹⁰ This works in two, interacting ways.

First, if properly performed and disclosed in the process of policymaking, a cost-benefit analysis provides detailed information on economic and scientific justifications for adopting a policy, which enables stakeholders and even the public to know the background and have the opportunity to submit their own views. It enhances the level of public participation in policymaking and mitigates concerns that the cost-benefit analysis is an elitist tool with a low chance for deliberative democracy to affect the policymaking process.^{211,212} It may also help a policy become more persuasive and promote agreement among various interested groups. Professor Sunstein once wrote that cost-benefit analysis “might attract support from people” with diverse interests if “conceived in a particular way.”²¹³

Second, if a duly organized process for performing, publishing and reflecting comments is in place for the cost-benefit analysis, it would provide the court more opportunities to review

²¹⁰ The cost-benefit analysis might have a different institutional design and function, depending on the political and economic state of a country where it is adopted and used. See, for a similar view and analysis, Jiunn-Rong Yeh, *Changing Faces of Cost-Benefit Analysis: Alternative Institutional Settings and Varied Social and Political Contexts*, in Michael A. Livermore and Richard L. Revesz (eds.), *The Globalization of Cost-Benefit Analysis in Environmental Policy* (Kindle ed. 2013).

²¹¹ For the view that cost-benefit analysis is an elitist tool excluding democratic policymaking chances, see, e.g., McGarity, *supra* note 200.

²¹² The environmental impact assessment process of the California Energy Commission (CEC) for deciding whether to allow a new construction of a power plant provides an example where we can see that public participation can affect the policymaking process if a proper regulatory impact assessment scheme with cost-benefit frame and due process for participation are in place. During the proceeding, the CEC staff normally issues a Preliminary Staff Assessment, including environmental impact review, and after receiving comments from stakeholders and other interveners, it issues a Final Staff Assessment reflecting such comments. For example, see Final Staff Assessment Part I, Docket No. DOCKET NUMBER 15-AFC-01, Document No. 214712, p. 4.1-74-89 for the case of Puente Power Plant in Oxnard, CA which is still under the CEC’s review. The CEC staff responded to the filed comments in detail and made revisions to the Preliminary Staff Assessment where the comments are deemed to have solid grounds.

²¹³ Cass R. Sunstein, *Cognition and Cost-Benefit Analysis*, John M. Olin Program in Law and Economics Working Paper No. 85, 2 (1999). This might operate as a facilitator to form an “incompletely theorized agreement” on controversial policies, a concept developed in Professor Sunstein’s book, *Legal Reasoning and Political Conflict* (1996).

the reasonableness of a policy based on the result of the analysis, and, in turn, work as a check-and-balance system. As seen in Chapter 3 from the court decision on the *Four Major Rivers Project*, judicial review of the administration's cost-benefit analysis in Korea is superficial, and the court has approved the administration's analytical methods or sometimes even the omission of the analysis required by the law, opining that the omission of cost-benefit analysis is not a decisive factor in making an administrative action null and void. The level of the court's review of the administration's cost-benefit analysis should be enhanced from the current status, regardless of whether the administration's methods change or not. Further, it is clear that the court would have more chances to review the policymaking process if transparency were heightened, which would then lead to the court's recognition of the importance of procedural democracy and ultimately make the court perform the proper checking function vis-à-vis the administration, creating a virtuous circle.

This is not to say that the cost-benefit analysis is indispensable in making every type of policy, or that it is the only way to make the process transparent and democratic. Rather, this assessment describes the practical and political role and importance of science and economics for energy policymaking, illustrated by the cost-benefit analysis. Given that Korea is not yet a fully developed country with extreme scarcity of natural resources, the practical needs for a well-designed instrument for economic assessment to produce the optimal result with a tighter limitation of budget and resources might be even higher than in the U.S.²¹⁴ The current upheaval in the Korean energy sector stresses that solid economic and scientific grounds must be considered and disclosed during the policymaking process in order to set the right goal with a proper tool.

III. The Korean Approach to Carbon Pricing

The Korean government has yet to develop a way to estimate the social cost of carbon or measure the benefits of reducing greenhouse gas emissions. There have been several cases in which an agency used a certain amount of social cost of carbon or tried to quantify the benefit of reducing greenhouse gas emissions for a proposed policy. So far, agencies have normally borrowed the number for carbon pricing from a foreign research or policy with certain arbitrary adjustments, whose methodology is not disclosed. Different agencies have used different numbers, and an agency used different numbers for each different policies.

This section reviews the primary policy documents created from the very initial stage of the government's energy planning until the approval of a certain power plant to determine the price of carbon that was used, the way it was calculated, the procedural issues of reflecting the

²¹⁴ Euston Quah, *Cost-Benefit Analysis in Developing Countries: WHAT'S DIFFERENT?*, 19, in Michael A. Livermore and Richard L. Revesz (eds.), *The Globalization of Cost-Benefit Analysis in Environmental Policy* (2013). The author presents three reasons for the need of cost-benefit analysis for efficient policymaking in developing countries: first, need to catch up to developed countries with more speed; second, developing countries have most of the natural resources worldwide, now with the pressure from developed countries to preserve them rather than exploiting them; and third, the budgetary limitations are more significant in developing countries.

carbon price in the cost-benefit analysis and whether the pricing affects the result of such assessment. These cases of carbon pricing are expected to be illuminating for the future development and use of the social cost of carbon.

A. Cases of Carbon Pricing in the Electricity Sector

1. Basic Plan for Electric Power Supply (Basic Electricity Plan)

The MOTIE ostensibly tried to consider carbon pricing in its 6th and 7th Basic Electricity Plans, which were effective from 2013 until 2017. The 6th Basic Electricity Plan, published in 2013, explains that the MOITE decided the energy mix for 2013 to 2015 based on “economic and social cost” of each type of power generation using the Wien Automatic System Planning (WASP) model.²¹⁵ The agency further added that the environmental cost²¹⁶ includes “environmental cost of air pollutants, SO_x, NO_x, dust particles, calculated reflecting the externality cost used by the EC” and “greenhouse gas emissions cost, i.e., the purchase price of the emissions right, 21,000 Korean Won/tCO_{2e},²¹⁷ which is the average purchase price of emissions right in the EU Emissions Trading Scheme in 2010.”²¹⁸ The 7th Basic Electricity Plan published in 2015 also uses the WASP model and provides a similar explanation on the “environmental cost,” except for the concrete amount of “greenhouse gas emissions cost,” which the agency says is “25,000 Korean Won/tCO_{2e},²¹⁹ calculated based on the forecast of the IEA.” No further information on carbon pricing methods or how such pricing affected the energy mix were disclosed during the planning process. The Basic Electricity Plan presents both substantive and procedural problems concerning carbon pricing.²²⁰

First, the reference to the carbon pricing made by the EU Emissions Trading Scheme (EU ETS) or IEA does not seem to reasonably reflect the social cost of carbon, though the 6th and 7th

²¹⁵ The MOTIE, 6th Basic Electricity Plan, 28 (Feb. 2013). The WASP model is a computer code developed and distributed by the IAEA for developing countries to find an optimal power generation expansion.

²¹⁶ The Basic Electricity Plan uses the expression “social cost” and “environmental cost” alternately.

²¹⁷ Approximately USD \$18.77 as of October 2017.

²¹⁸ The MOTIE, *supra* note 215.

²¹⁹ Approximately USD \$22.35 as of October 2017. MOTIE, 7th Basic Electricity Plan (July 2015).

²²⁰ The new government published the 8th Basic Electricity Plan in December 2017 with an increased target of renewable energy ratio, up to 20% by 2030. See MOTIE, 8th Basic Electricity Plan (Dec. 29, 2017). While it is encouraging to have the enhanced renewable energy target, the volume of electricity from coal power plants is still expected to increase under the Plan. Further, the Plan does not mention the amount of the social cost or environmental cost of fossil fuel combustion and just states that the government plans to regularly work out the levelized cost of electricity reflecting the social cost without more details. The Plan was made also in the same way with the 7th Plan based on a closed discussion process, allowing only 15 days for public comments.

Plans state that the “social cost” has been reflected. The EU ETS price used in the 6th Basic Electricity Plan does not seem to reflect even the mitigation cost within the EU region, given the excessively generous allowances and lower price of the emissions rights in the EU around 2010.²²¹ Such referencing is not entirely reasonable in the case of Korea, also in that the price of emissions rights traded in the EU ETS represents the compliance cost in the specific market of the EU with the history of policies, regulatory environment, technologies and structure of stationary emission sources that differ from the Korean context. The forecast of the IEA used in the 7th Basic Electricity Plan does not even specify which forecast for what factor made by the IEA it meant to refer to. Even if the MOITE tried to mention the forecast of the IEA for the newly launched Korean Emissions Trading Scheme, such number did not properly reflect the social cost given the excessive allowances of the initial period of the Korean scheme, which will be further discussed in the final chapter of this dissertation.

Given the pervasive authority of the Basic Electricity Plan having practically normative impact on the permit process of individual power plants, the MOTIE should have tried to estimate the social cost of carbon, or at least used the number for the social cost of carbon developed by economic and scientific models, as the Ministry of Environment did in the following cases. The MOTIE should have, otherwise, revealed that it wanted to consider only the private compliance cost, not the social cost of carbon with a reasoned explanation. This less sophisticated way of carbon pricing weakens its persuasiveness, both from the perspectives of advocates of renewable energy or the conventional ones. Further, the tension between the MOTIE and the Ministry of Environment over the Basic Electricity Plan as discussed below clearly shows that the MOITE’s carbon pricing and/or its utilization for the Basic Electricity Plan left much to be desired.²²²

Second, the Basic Electricity Plans have been made with limited participation of stakeholders and the public. The 6th Plan and its predecessors were made without any public participation and did not reflect comments from other government agencies, even the Ministry of Environment for its environmental implication. After the draft 6th Plan was announced in early February 2013 with more emphasis on expanding coal power generation, the Ministry of Environment reportedly made a public statement that the draft Plan did not properly reflect the national goal for greenhouse reduction, which was then at 30% below business-as-usual (BAU)

²²¹ In principle, the marginal abatement cost equals the marginal social benefit in equilibrium, which means that the market price of the emissions rights in an ideally designed cap-and-trade system will exactly reflect the social benefit. See Martin Weitzman, *Prices vs. Quantities*, *Review of Economic Studies*, Vol. 41, Issue 4, 477-491 (1974). The central problem would be that the agency borrowed the price in the EU system formed during the trial phase as-is without properly reviewing such background in the EU market or the social cost of carbon in the case of Korea.

²²² Conflicts between agencies may be common, while the unilateral dominance of the agencies responsible for the economic and industrial development is more salient in Korea. There has been research to enhance the construction of a more coordinated policymaking process. The most recent energy policies in the new democratic administration reflect the comments from the Ministry of Environment and is expected to signal progress from the previous, customary dominance of the Ministry of Trade, Industry and Energy, and at the same time, call for a systematic and legislative scheme to make it more neutral to future political changes.

by 2020;²²³ however, the MOE's concern was not reflected in the finalized 6th Plan at all.²²⁴ According to an internal document of the Ministry of Environment, the "Analysis on the Conformity of the 6th Basic Electricity Plan to the National Goal for Reduction of Greenhouse Gas," which I obtained through the Information Disclosure Request, the draft 6th Plan used an estimate of economic growth and a ratio of manufacturing business higher than the then-most recent estimates published by other government agencies in charge of those estimations.²²⁵ This led to a 19.3% higher estimate of electricity demand that was shared among relevant agencies when discussing the national goal for the reduction of greenhouse gas emissions a year before, resulting in a higher emissions amount of CO₂. Several media outlets reported that the MOTIE did not seek comments from the MOE before the Plan was finalized.²²⁶ One news media reported that the MOTIE finalized the 6th Plan a day after it received the unsolicited comments from the MOE.²²⁷ This type of disclosed tension is not common in Korea, where technocrats operate the country in a strict order under the supervision of the President and the Prime Minister.

²²³ Article 42(1)(i) of the Low Carbon and Green Growth Act (LCGGA) and Article 25, Paragraph 1 of the Presidential Decree of the LCGGA (Presidential Decree No. 24270). The goal was amended to be by 37% below the BAU by 2030 in 2016 (Presidential Decree No. 27838). This is an enforcement legislation of the commitment made under the Copenhagen Accord in 2010. See Ministry of Foreign Affairs and Trade of Republic of Korea, Letter to the Secretariat of the United Nations Framework Convention on Climate Change with an enclosure A nationally appropriate mitigation action of the Republic of Korea in the format given in Appendix II of the Copenhagen Accord, OEE 10-485 (Jan. 25, 2010), available at http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/koreacphaccord_app2.pdf. The commitment made by Korea for the Paris Agreement was a ratification of the goal submitted for the Copenhagen Accord.

²²⁴ Seung-Im Jeong, Building More Coal Power Plants Makes the Goal of Greenhouse Gas Reduction an Empty Phrase, *Hankook-Ilbo*, Feb. 13, 2013, available at <http://hankookilbo.com/v/861dbbedf35544ed9c9c89cb5a123dfa>. This new report mentions that the MOE issued a statement on the 6th Basic Electricity Plan on February 12, 2013, which is not publicly available as of October 2017. I filed an Information Disclosure Request for this document with the MOE and received a response together with the document on November, 10, 2017. According to the official response from the MOE, the document was an internal one and not officially published. See the MOE, *Response to the Information Disclosure Request No. 4328072*, Nov. 10, 2017; an electronic copy is on file with the Author.

²²⁵ The MOE, *id.* According to the document, the MOTIE used a higher estimation of GDP growth than that published by the Bank of Korea, and the ratio of manufacturing business than the one published by the Korea Institute for Industrial Economics & Trade.

²²⁶ See, e.g., Seung-Im Jeong, *Id.*; Seong-Won Kim, and Chang-Ki, Hong, The Extension of 10,740,000kW Coal Power Generation, a Head-on Collision between the MOTIE and the MOE, *Financial News*, Feb. 12, 2013.

²²⁷ See, Ministry of Environment Strongly Objects to the Basic Electricity Plan, *Maeil Business News*, Feb. 25, 2013, available at <http://news.mk.co.kr/newsRead.php?no=141546&year=2013>. The reporter of this news is not specified.

The reason why the MOTIE desperately pursued the expansion of coal power generation facilities may be explained in several ways. First, the MOTIE wanted to keep the price of the electricity as low as possible because it is one of the most important cost factors for Korean manufacturers. As the agency responsible for industrial growth, it appears to have recognized energy as the cost of industry, and it was naturally less interested in the social cost of energy generation. The levelized cost of electricity of coal in Korea is recognized as the lowest – lower than the nuclear – if we do not consider the social cost of carbon or the co-benefits of reducing greenhouse gas emissions. For these reasons, the MOTIE continued to pursue coal power generation. Second, the MOTIE wanted to drastically increase the power capacity because it was blamed for the nationwide blackout in September 2011,²²⁸ as the single responsible agency for the energy supply, the owner of the KEPCO and the monopolistic supplier of retail electricity. The origin of the blackout turned out to be bureaucratic inefficiency in the coordination structure of the MOTIE, KEPCO and the Korea Power Exchange, and the mismanagement of the demand and supply of electric power, rather than actual deficiency of the power generation capacity.²²⁹ The MOTIE, however, tried to expand the generation capacity as a solution to prevent similar accidents, rather than trying to improve the structural inefficiency.

After the conflict between the agencies was publicly reported, three new bills amending the Electric Power Business Act, in which the Basic Electricity Plan is based, were proposed by several democratic lawmakers in February and March of 2013. These bills require the MOITE to have more open procedures and consider greenhouse gas effects for the Basic Electricity Plan.²³⁰ An alternative bill combining the proposed bills passed the National Assembly²³¹ and was enacted as of July 30, 2013; that bill requires the MOTIE to discuss the draft plan with relevant government agencies, have a public hearing on the draft, report the draft plan to the Congress and make efforts to adapt the Plan to comply with the goal for greenhouse gas reduction established according to the Low Carbon and Green Growth Framework Act.²³²

The 7th Basic Electricity Plan issued in 2015, however, did not make much progress from the 6th, despite the legislative efforts and changes. A public hearing was convened and other procedural requirements under the amended the Electric Power Business Act were met, but the

²²⁸ The black-out happened due to the failure of demand prediction leading to the shortage of 4.96 million kW and affected the entire nation for 4 hours and 46 minutes. See Geun-Joon Lee, Considerations for Electric Power Industry development regarding Blackout Case Analysis, 2011 Fall Conference of the Korean Institute of Electrical Engineers, Vol. 2011, No. 1, 26-27 (2011).

²²⁹ Geun-Joon Lee, Operation Errors of Circulatory Blackout on September 15, 2011, 2012 Fall Conference of the Korean Institute of Electrical Engineers, 323-25 (2012).

²³⁰ Bill No. 1903645, 1903827, and 1903960, Bill Information system of the Congress, available at http://likms.assembly.go.kr/bill/billDetail.do?billId=PRC_R1Q3T0I4S2E2E1N0M2M4D1Y9O0X4L8.

²³¹ Bill No. 1905571, Bill Information system of the Congress, available at http://likms.assembly.go.kr/bill/billDetail.do?billId=PRC_R1Q3T0I4S2E2E1N0M2M4D1Y9O0X4L8

²³² Electric Power Business Act, Legislation No. 11968. This amendment survived possible political conflicts in the Congress thanks to a few other bills proposed by the republican lawmakers dealing with other aspects of the Electric Power Business Act. The alternative bill combined the bills proposed by the republicans, as well.

effect was still limited. The energy mix presented in the draft of the 7th Plan published for the public hearing on June 4, 2015²³³ was not updated and simply kept in the finalized 7th Plan, which has a higher coal power generation and lower natural gas use and passive renewable energy promotion in 15 years.²³⁴ Further, as seen above, the 7th Plan used the forecast of the IEA for carbon pricing without explaining how the mentioned number was related to the social cost.

Further, the 7th Plan again resulted in some tension between the MOTIE and the Ministry of Environment. The full text of the Ministry of Environment's comments on the MOTIE's draft 7th Plan was not publicly available. However, a democratic lawmaker disclosed that the MOITE ignored all the comments provided by the Ministry of Environment, one of which was that the ratio of coal power generation should be reduced and the ratio of natural gas and renewable sources should be increased.²³⁵ A day after the lawmaker's remarks were reported, the MOTIE issued a brief official press release explaining that the MOTIE did not need to reflect the MOE's comments because all of them were unreasonable or already reflected in the draft plan,²³⁶ which seemed offensive and lacked a reasoned explanation. The MOITE specifically remarked on the MOE's comments about the energy mix that the ratio of natural gas had been already "significant," and increasing the ratio was not necessary.²³⁷ The agency added that the energy mix should reflect both economic efficiency and environmental concerns, while it did not make any response to the controversy on the increasing ratio of coal power generation.²³⁸ It thus seems that the agencies simply exchanged their opinions without a productive "discussion" to determine how to address environmental concerns, even after the statutory ground for a mutual discussion has been provided.

Last, and perhaps more fundamentally, the MOTIE's ultimate goal has been solely to minimize the overall cost of power generation, seeking an economical way of procuring electricity.²³⁹ The newly enacted climate change law currently functioning as the basic framework legislation for the entire energy policy, the Low Carbon and Green Growth Act

²³³ The MOTIE, the Draft 7th Basic Electricity Plan, 13 (June 4, 2015), available at http://www.motie.go.kr/motie/ne/announce2/bbs/bbsView.do?bbs_seq_n=63147&bbs_cd_n=6.

²³⁴ MOTIE, *supra* note 219.

²³⁵ Hyo-Sang Lee, The 7th Basic Electricity Plan Estimates the Electricity Price Too Low and Demand Too High, *Kyunghyung Shinmun*, July 14, 2015, available at http://biz.khan.co.kr/khan_art_view.html?artid=201507142138445&code=920501.

²³⁶ MOTIE, Press Release for Clarification (July 15, 2015), at http://www.motie.go.kr/motiee/presse/press2/bbs/bbsView.do?bbs_seq_n=157394&bbs_cd_n=81 (last visited May 5, 2018).

²³⁷ *Id.*

²³⁸ *Id.*

²³⁹ The MOTIE tried to explain that saving the production cost of electricity was the single mandate from the Electric Power Business Act, which was controversial. (See Article 3 of the EPBA, Legislation No. 14672.) This provision was amended in March 2017 to clarify the controversy and explicitly require the MOTIE to reflect the environmental and safety concerns when establishing electricity supply plans.

(“LCGGA”), mandates that the MOTIE consider climate impact when planning energy policy.²⁴⁰ These provisions, however, have yet to gain the practical legal authority to affect the energy mix plan. The MOTIE considered renewable energy sources expensive and less economical than the conventional ones because the agency had never tried to estimate the social cost of carbon or reflect such costs in the power generation cost.

As a technical but the most practical aspect of the planning, the WASP model used by the MOTIE had the problems in reflecting potential supply and demand of renewable energy, as several scholars have indicated.²⁴¹ The WASP model is a computer program developed by the IAEA for member states to minimize the cost of the whole power generation system of a country or region.^{242,243} Unless the cost of renewable energy sources achieves the grid parity level or the social cost factor is properly reflected, it is not possible for the MOTIE to figure out an energy supply plan promoting renewable energy only with the operation of the WASP model.²⁴⁴ The recent version of the model was explained to have reflected environmental concerns.²⁴⁵ However, the model has been criticized as being unable to reflect the Renewable Portfolio Standards (RPS), which have been effective in Korea since 2012.²⁴⁶ This makes it difficult to properly reflect the solar and wind power generation sources in the supply plan.^{247,248} Given that

²⁴⁰ Article 38, Legislation No. 15101.

²⁴¹ See, e.g., Jeong-In Lee, Il-Woo Lee, and Bal-Ho Kim, Generation Expansion Planning Model Supporting Diverse Environmental Policies for Reduction of Greenhouse Gases, *ETRI Journal*, Vol. 37, Issue 2, 295-305, 296 (2015); Yoo-soo Lee, Analysis on Electricity Generation Mix Utilizing Portfolio Theory, Regular Research Reports 12-07 (No. 1105005721), Korea Energy Economics Institute, 6 (2012).

²⁴² According to the user manual published by the IAEA, the “WASP was originally developed in 1972 by the Tennessee Valley Authority and the Oak Ridge National Laboratory in the USA to meet the IAEA’s needs to analyze the economic competitiveness of nuclear power in comparison to other generation expansion alternatives for supplying the future electricity requirements of a country or region.” See Wien Automatic System Planning (WASP) Package: A Computer Code for Power Generating System Expansion Planning, Version WASP-IV, User Manual, International Atomic Energy Agency, 2 (2001). So, it is clear from the statement of the IAEA that the model was developed with focus on expanding the nuclear power generation.

²⁴³ The model has been utilized to provide grounds of expanding nuclear power plants in Korea, pointing out the relatively higher cost of generation for renewable energy sources. See Young Eal Lee, Young Beom Jung, Challenges of nuclear power for sustainable role in Korean energy policy, *Energy Conversion and Management*, Vol. 49, Issue 7, 1951-59, 1958-59 (July 2008).

²⁴⁴ It assumes the case where the MOTIE does not reflect the proper social cost of carbon in the electricity pricing or electricity supply plan.

²⁴⁵ IAEA, *supra* note 242 at 1-3.

²⁴⁶ Jeong-In Lee, et. al., *supra* note 241 at 296-97.

²⁴⁷ See for a similar view, e.g., Filipa Amorim et.al., Electricity decarbonization pathways for 2050 in Portugal: A TIMES (The Integrated MARKAL-EFOM System) based approach in closed versus open systems modeling, *Energy*, Vol. 69, 104-112, 105 (May 2015).

²⁴⁸ WASP-IV is also known to be “unable to geographically distribute and allocate the capacities among

the RPS are rather a modest and politically compromised approach, rather than directly adopting an environmental dispatch expected to significantly contribute to the expansion of renewable energy sources in Korea, where development is still in the initial stage,²⁴⁹ the problem that the WASP-IV model does not reflect the RPS in the energy mix might result in a misleading planning of energy mix that does not reflect even the currently effective regulations. If the MOTIE continues to use the WASP-IV without significant consideration of renewable energy policy and/or reflecting the social cost of carbon when assessing the cost of energy sources, this problem will continue indefinitely.²⁵⁰ There have been several efforts to propose an alternative for the current WASP-IV. Research has proposed using the National Energy Modeling System developed by the U.S. Energy Information Administration, which reflects both the energy policy and market, including environmental and security concerns, and is currently used for its Annual Energy Outlook.²⁵¹ Further, one of the recent studies of the Ministry of Environment suggested a model called MESSAGE-II, which can reflect renewable energy targets.²⁵²

The most recent amendment of the Electric Power Business Act in 2017 requires the MOTIE to reflect the environmental concerns together with economic considerations when establishing electricity supply plans,²⁵³ whose practical impact remains to be seen.²⁵⁴

the areas.” See Ahmad Rouhani, Gohar Varamini, and Mehdi Nikkhah, *Generation Expansion Planning Considering Renewable Energies*, *American Journal of Engineering Research*, Vol. 2, Issue 11, 276-86, 276-77 (2013). In Korea, discussions over distributed generation and transmission system have just begun. So, if Korean government continues to use the WASP-IV model, there might be problems in dealing with the distributed generation and transmission system currently being discussed.

²⁴⁹ William H. Rogan, *Electricity Markets and the Clean Power Plan*, HKS Working Paper No. 59, 3, 23 (Sep. 2015); Jonas Meckling, Nina Kelsey, Eric Biber, and John Zysman, *Winning coalitions for climate policy*, *Science*, Vol. 349, Issue 6256, 1170-1171 (2015).

²⁵⁰ The model that is used by each developed country to forecast of the energy mix or required power capacity is not readily available. The WASP model is well known and its use is widespread, but it seems that there are currently not many countries relying solely on the model for the national modeling of the electricity sector. An interesting research on the list of models that appear in U.K. academic literature for U.K. planning between 2008 and 2015 showed that WASP was the 10th frequently mentioned model. The research explains that new energy technologies, renewable sources, and the need to address climate change have diversified the models subject to research, discussion and use. See Lisa M.H. Hall, and Alastair R. Buckley, *A review of energy systems models in the UK: Prevalent usage and categorization*, *Applied Energy*, Vol. 169, 607-628 (2016).

²⁵¹ See Suil Lee, *Consistency in the Basic Plan on Electricity Demand and Supply and Social Costs*, *KDI Journal of Economic Policy*, Vol. 34, No. 2, 58-93, 83 (2012).

²⁵² Seung-rae Kim, Ho-jin Sung, Sang-yeol Shim, et.al., *Final Report on Research on Alternative Energy Policy Measures for Consideration of Environment and Climate Change* submitted to the Ministry of Environment, *SyncNow*, Vol. I, II, and III, April 2015. This final report was obtained through the formal Information Disclosure Request filed with the Korean government. See the Climate Change Policy Division of the MOE, *Response to the Information Disclosure Request No. 4309171*, November 8, 2017; an electronic copy is on file with the Author.

²⁵³ Article 3 of the EPBA, Legislation No. 14672.

2. *The Energy Use Plan*

A developer of a new power plant with a capacity of 20,000 kW or more is required to analyze “the impact on the greenhouse gas (only CO₂) emissions from the operation of the power plant” when drafting the Energy Use Plan that should be submitted to the Minister of Trade, Industry and Energy (“MOTIE”) for approval of the development plan.²⁵⁵ This approval system was introduced in 2004, earlier than more recent regulations addressing climate change concerns.²⁵⁶ The Energy Use Plan, together with the Environmental Impact Assessment, is the last step in which the impact of greenhouse gas emissions can be reviewed before the MOTIE decides whether to build a new, conventional power plant. The overall structure and procedure of the regulation again presents questions about the practical effect of reducing greenhouse gas emissions.

First, as discussed for the Basic Electricity Plan, the Energy Use Plan is not a decisive factor in determining whether to allow the development of a new power plant. If the Basic Electricity Plan approves construction as part of its generation expansion plan, such a project would be approved. Further, the language of the relevant legislation does not assume that the MOTIE would reject a development plan for a reason relevant to greenhouse gas emissions, and it only stipulates that the MOTIE may recommend that the developer adjust or supplement the Energy Use Plan if it deems necessary.²⁵⁷ Further, the law does not say that the impact of greenhouse gas emissions should be considered; rather, it says the impact of operating such power plant on the greenhouse gas emissions should be subject to consideration.²⁵⁸ It may thus be more reasonable to interpret the law that the mandate is limited to reviewing the prospect of greenhouse gas emissions from the power plant, not the damages or impact of such emissions. This would cast doubt on the efficacy of this regulation, especially given the MOTIE’s position toward the social cost of greenhouse gas emissions.

Second, neither the MOTIE nor the developer is required to discuss the Energy Use Plan with any other agency, stakeholders or residents to be affected by the new power plant. There is no disclosure requirement or a public docket of the approval process; instead, the Energy Use

²⁵⁴ The most recent Basic Electricity Plan issued by the new administration in 2018 did not mention the model it relied upon for forecast of electricity, unlike the previous ones. I filed an Information Disclosure Request on whether the WASP model was again used, and if not, what model it relied on. The MOTIE responded that the agency “did not use any model” for the 8th Plan. (See MOTIE, Response to the Information Disclosure Request No. 4600035, April 5, 2018; an electronic copy is on file with the Author.) This answer is understood to be a rejection of the Information Disclosure Request, as it is not easily imaginable that a nation’s electricity forecast was made without any modeling. The government is in a transition period for energy planning and seems to be cautiously reviewing various models.

²⁵⁵ Article 10 of the Energy Use Rationalization Act, Legislation No. 13805.

²⁵⁶ The provision was introduced by amendment through the Legislation No. 7018 on December 30, 2003 and came into effect as of July 1, 2004.

²⁵⁷ Article 11 of the Energy Use Rationalization Act, Legislation No. 13805.

²⁵⁸ Article 10 of the Energy Use Rationalization Act, Legislation No. 13805.

Plan is shared only between the developer and the MOTIE. Further, Korea does not have any command-and-control type regulation on CO₂, which is different from the U.S. federal regulation standards for CO₂ emissions for newly constructed power plants and requires a certain level of technical specification for reducing emissions.²⁵⁹ The Energy Use Plan thus does not have any legal standard to comply with in relation to greenhouse gas emissions, while other stakeholders do not have any procedural chance to review the plan and present comments. Given the structure of the Basic Electricity Plan and individual projects to build a new power plant, the Energy Use Plan of a new coal power plant could be a mere formality, without any system to secure accountability of either the MOTIE or the developer for greenhouse gas emissions. The nationwide Emissions Trading System for CO₂ was launched in 2015²⁶⁰ but soon went through significant changes, accommodating voices of the industry to alleviate the participants' mitigation burden before the system is settled, as discussed in Chapter 6 in detail. The current emissions trading scheme may not be sufficient to deter entrepreneurs' business decision to build a new coal power plant.

I filed a request for Information Disclosure Request with the MOTIE for the Energy Use Plan prepared for the construction of a new coal power plant by a developer called POS-POWER in Sam-Cheok city, Gangwon Province²⁶¹ and received a rejection notice.²⁶² The agency briefly explained that the interested party requested that the agency reject the request, arguing that the Energy Use Plan contained the developer's confidential business information.²⁶³ Much heated discussions has taken place over this coal power plant as of 2017. A group of residents vehemently object to its construction for environmental and climate change concerns with support from environmental groups,²⁶⁴ while other residents and the developer argue in favor of

²⁵⁹ The U.S. EPA's "Standards of Performance for Greenhouse Gas Emissions from New, Modified and Reconstructed Stationary Sources: Electric Utility Generating Units" imposed certain technical conditions and standards for CO₂ emissions. *See* for statutory authority of this regulation, 111, 301, 302, and 307(d)(1)(C) of the Clean Air Act (CAA) as amended (42 U.S.C. 7411, 7601, 7602, 7607(d)(1)(C)); section 307(d) of the CAA (42 U.S.C. 7607(d)); 80 Fed. Reg. 64509 (Oct. 23, 2015). 40 CFR part 60, Subpart TTTT, Section 60.5520 (a). The administrator of the EPA under the new administration, however, signed a notice to review the final rule again on March 28, 2017, which made the future of this regulation unpredictable.

²⁶⁰ Korea is known to have the second nationwide emissions trading program in operation in Asia after Kazakhstan. Currently, 525 entities from 23 industrial sectors participate in the Korean emissions trading scheme, and the cap of 573 MtCO₂-eq in 2015 is the second-largest worldwide, after the European Union's Emissions Trading Scheme. *See* Cho and Choi, *supra* note 47 at 1-2.

²⁶¹ The developer is POS-POWER, a subsidiary of the POSCO, whose aggregate market value of total shares ranked number one among steel manufacturing companies in the world in 2016.

²⁶² The Electric Power Business Division of the MOTIE, *Response to the Information Disclosure Request No. 4305450*, Oct. 25, 2017; an electronic copy is on file with the Author.

²⁶³ *Id.*

²⁶⁴ Soo-Hyuk Park, Residents of Sam-cheok City Marching in Seoul Claiming to Nullify the POS-POWER Coal Power Plant Project, Hankyoreh News, June 19, 2017, available at <http://www.hani.co.kr/arti/society/area/799387.html>; Greenpeace Seoul Office, Press Release (June 30, 2017), at <http://www.greenpeace.org/korea/news/press-release/climate-energy/2017/NO-POSPower->

the project, noting that the new construction and operation of the plant would revive the economy of the region.²⁶⁵ The new administration led by the democratic party publicly indicated that it would instruct the developer to build a natural gas power plant instead of a coal power plant without presenting a sophisticated rationale or detailed plan for such comments.²⁶⁶ In this variety of controversies, the core information on the prospect of the plant's use of coal and any previous discussion between the MOTIE and the developer have not been disclosed. The aforementioned debates happen primarily through demonstrations, that is, without a chance to have a formal procedural argument. The Environmental Impact Assessment has also been submitted for approval of a power plant development plan. However, for several institutional problems, including the aforementioned structure of the Basic Electricity Plan and Environmental Impact Assessment, the EIA's practical efficacy for greenhouse gas mitigation has been in question, which is further discussed in the following section.

3. Environmental Impact Assessment

The Environmental Impact Assessment system, which is the only procedural requirement to consider environmental impact when a developer wishes to build a new coal power plant, does not estimate the social cost of carbon or function as an effective instrument that properly reflects the social cost of greenhouse gas emissions in the government's decision to permit another new coal power plant. It may have happened due to the institutional limits of the role of the Environmental Impact Assessment as an instrument for mitigating greenhouse gases in the Korean electricity generation sector.

A developer of a new conventional power plant with a capacity of 10,000 kW or more is required to prepare an Environmental Impact Assessment, discuss it with the residents neighboring the power plant site and reflect comments from the residents to the EIA in order to obtain approval for the project from the MOTIE,²⁶⁷ who must have a discussion with the Minister of the Environment over the project before deciding whether to approve it.²⁶⁸ The developer is required to take appropriate measures to reflect the result of discussion between the MOTIE and the MOE.²⁶⁹ In terms of greenhouse gas emissions, the developer is required to estimate the amount of CO₂, CH₄ and N₂O to be emitted during the course of construction and

[Coal-20170630/](#) (last visited May 5, 2018).

²⁶⁵ Joon-Beom Kwon, Sam-cheok POS-POWER Getting into Trouble, Energy News, June, 16, 2017, available at <http://www.energy-news.co.kr/news/articleView.html?idxno=48318>.

²⁶⁶ Seong-Goo Cho, Minister Woon-Kyu Baek Reaffirms that Four Coal Power Plants are Going to be Converted into LNG, Korea Energy News, Oct. 12, 2017, available at <http://www.koenergy.co.kr/news/articleView.html?idxno=92579>.

²⁶⁷ Article 22, Para. 1, Subpara. 3, Environmental Impact Assessment Act ("EIA Act," Legislation No. 14232), Article 31, Para. 2, The Presidential Decree of the EIA Act. The threshold of scale varies depending on the energy sources: conventional energy, solar, wind and water.

²⁶⁸ Article 27, Environmental Impact Assessment Act (Legislation No. 14232).

²⁶⁹ Article 30, Environmental Impact Assessment Act (Legislation No. 14232).

operation of the power plant, and to address the mitigation plan in the EIA.²⁷⁰ The EIA also deals with the mitigation plan for air pollutants, which are controlled through a command-and-control type regulation under the Air Environment Preservation Act, e.g., SO₂.

The EIA system has been developed and refined ever since it was first introduced in the early 1990s, and the Ministry of Environment provides many detailed guidelines and formatting for it. The transparency of the process is relatively progressive compared to almost any other policymaking processes, certainly more so than the aforementioned energy planning cases. The draft EIA, the comments collected during discussions with the neighboring residents and the Ministry of the Environment, and the final version of the EIA reflecting the comments are publicly available at a government-run website called Environmental Impact Assessment Information Support System (EIA Info-system).²⁷¹ The EIA system, however, also has inherent institutional limitations as an effective policy instrument for mitigating greenhouse gas emissions. Two recent EIA documents found in the EIA Info-system, one for the new coal power plant in Sam-cheok city discussed for the Energy Use Plan,²⁷² and the other for a new one in Dang-jin city proposed by an SK group company,²⁷³ illustrate such limitations.

First, the law does not provide a ground to reject an application for approval of a new power plant only based on the EIA, which is the inherent limited scope of authority of the system. The EIA Act mandates that the Minister of Environment provide comments for a certain project, and does not require the agency with the authority to approve the project to reject it for environmental concerns. Judicial review of an EIA has been superficial, and the court has made it clear that it would not intervene in the government's approval or plan of a project for environmental concerns if an EIA document existed, regardless of the contents, timing, scope or any other issues surrounding the EIA.²⁷⁴ In this regard, the most decisive factor for the direction of a new power plant construction is the MOTIE's internal plan and policy for electricity supply. The plan for a new electric power plant has already been decided within the MOTIE and even publicly announced through the Basic Electricity Plan by the time an EIA is drafted by an applicant, who is supposed to have had a fair amount of prior discussion with the MOTIE about the new project.²⁷⁵ The aforementioned unofficially reported comments from an

²⁷⁰ The MOE requires the assessment of greenhouse gas emissions and mitigation plan by the Guidelines for Greenhouse Gas Assessment for Environmental Impact Assessment.

²⁷¹ See <https://www.eiass.go.kr/>.

²⁷² Project No. ME2015C002, available at <https://www.eiass.go.kr> (last visited Dec. 5, 2017).

²⁷³ Project No. ME2013C003, available at <https://www.eiass.go.kr> ((last visited Dec. 5, 2017). SK group is the third-largest conglomerate in Korea and is actively engaged in energy development in and out of the Korean peninsula, including shale gas development and LNG exports in the U.S. The Dang-jin city project started in 2013 by another company called Dong-bu Power Generation, which SK group acquired in 2014.

²⁷⁴ For discussion on the state of judicial review on the EIA or cost-benefit analysis, *see* Chapter 3. The court affirmed a government's huge construction project, which lacked an impact assessment required by the law, upholding the argument made by the government that the construction already started and would incur huge sunk costs if the construction were cancelled.

²⁷⁵ The internal agency discussion is likely to be already set to proceed with the project at issue, as the

insider of the MOE also support the point that even the MOE is not willing to challenge the new coal power plant construction for environmental concerns.²⁷⁶

The documents available in the EIA Info-system concerning the new coal power plant in Dang-jin city show that the comments from the MOE for greenhouse gas mitigation are only temporary, i.e., to plant more air-purifying trees at the site, to install a carbon capture and storage (CCS) facility if and when such facility is required by the law in the future and to install a small-scale hydropower generator within the coal power plant site.²⁷⁷ All of the recommendations from the MOE are either temporary measures or a request for an empty promise for a future policy that has not yet been introduced. There is no legal requirement for an operator of a coal power plant in Korea to install a CCS facility yet, and it has not been scientifically or economically reviewed at the government level if the CCS would be a viable solution for Korean greenhouse gas problems. One of the most recent scientific studies co-authored by a team of researchers at university institutes and a private enterprise revealed that Korea might not have enough storage capacity to adopt CCS technology, given the lower estimate of storage supply,²⁷⁸ which Korea should also carefully examine before starting any tangible efforts to create CCS regulations.

Second, the aforementioned limited transparency of the process significantly undermines the effectiveness of the EIA system. For example, the EIA history for the new coal power plant in Sam-cheok city available on the EIA Info-system website indicates that the first draft EIA has been revised two times, in 2015 and 2016, but neither of the revised EIAs nor the comments from residents or the MOE is available as of November 2017.²⁷⁹ The EIA Info-system thus did not function as a docket in reality, given that the construction plan was most contested during that period.

Third, the link between the EIA and the existing command-and-control or market-based regulations for greenhouse-gases is not currently effective. Korea does not have any command-and-control type regulation for CO₂, and the emissions trading system for CO₂ has recently gone through changes that raise questions about its efficacy, as discussed in Chapter 6. The EIA documents for two new coal power plants do estimate the amount of CO₂ emission per year during the operation; however, they do not evaluate the impact of such emissions, nor do they

timing of the assessment is delayed. See Daniel A. Farber, and Ann E. Carlson, *Cases and Materials on Environmental Law* (9th Ed.), 369-70 (2014).

²⁷⁶ See *supra* note 114.

²⁷⁷ See *supra* note 272. The comments from the MOE on the EIA for the project in Sam-cheok city is not available yet as of Dec. 2017.

²⁷⁸ The research was performed by the MIT Energy Initiative (MITEI), MIT Joint Program on the Science and Policy of Global Change, and ExxonMobil. The research concludes that only Korea and Japan would have the problem with the lower estimate of storage supply among all the inhabited continents and regions worldwide. See Jordan Kearns et. al., *Developing a Consistent Database for Regional Geologic CO₂ Storage Capacity Worldwide*, *Energy Procedia*, Vol. 114, 4697-4709, 4706-07 (2017).

²⁷⁹ See Project No. ME2015C002, available at <https://www.eiass.go.kr> (last visited Nov. 30, 2017).

mention how much CO₂ would be reduced through the proposed mitigation technologies and facilities. SO₂, NO_x and a major greenhouse gas, CH₄, are subject to the command-and-control regulation under the Air Environment Preservation Act (AEPA),²⁸⁰ but only by density of the emission at the end of the pipe in regions except for the capital area, Seoul city and Gyeonggi Province, where the total emissions amount is capped only for NO_x and SO₂.²⁸¹ There is no separate regulation applied nationwide for the cumulative effect of greenhouse gas emissions from a certain stationary source or a project. Given that the most recent conventional power plants are planned in the regions outside the capital area, the only relevant regulation for SO₂, CH₄ and NO_x is the command-and-control type one by density at the end of the pipe under the AEPA.²⁸² Further, the AEPA imposes an administrative charge on the operator of a power plant when the density of the SO₂ emission is higher than the legal standards, while it does not do so for NO_x or CH₄.²⁸³

The new democratic government published the Comprehensive Plan for Particulate Matter Management in September 2017, and it addresses some of the aforementioned issues, including an expansion of the administrative charge for NO_x emission and an upgrade of the density regulation for the regions outside the capital area to total emissions amount management system.²⁸⁴ Twelve agencies participated in this plan, including the Ministry of Environment, the MOTIE and the Office of Government Policy Coordination within the Prime Minister's Office, which operates the RRC in charge of the cost-benefit analysis.²⁸⁵ The 40-page plan, however, does not have any cost-benefit analysis, mention of the costs, social benefits from reducing particulate matter or any associated reduction of greenhouse gas emissions, although it would incur a significant cost for the regulated firms and industries. On the other hand, the

²⁸⁰ The AEPA sets the regulation on the combined group of nitrogen oxide which covers nitrous oxide, nitrogen dioxide, and nitrogen monoxide. It is notable, however, that the nitrogen oxide has been regulated as a group of criteria pollutants and the risk of climate change in association with the nitrous oxide, N₂O, has yet to be separately reviewed and discussed in Korea.

²⁸¹ The Regulation of the Total Amount of Air Pollutants in the Capital Area sets limits on the amount of NO_x, SO_x, and PM 10. CO₂ and CH₄ are not covered by this regulation. See Article 14, Para. 1 of the Special Act for Improving the Air Quality in the Capital Area, and Article 17 and Annex 2 of the Presidential Decree of the Act.

²⁸² The coal power plants are severely concentrated in South Chung-cheong province, adjacent to the capital area, which raises serious environmental justice issues. The ChungNam Institute, a public research body operated by the province government, published an informational graphic showing that 26 out of 53 coal power plants in Korea are located in the province, seven are under construction and two are being planned as of July 2016. See ChungNam Institute, Current State of Thermal Power Generation in South Chungcheong Province, CNI Infographic No. 20 (July 21, 2016).

²⁸³ Article 35, Para. 2 of the Air Environment Preservation Act, and Article 23 of the Presidential Decree of the Act. NH₃, CS₂, H₂S, HF, dust, fluoro compounds, HCl, Cl, HCN are also subject to the same regulation.

²⁸⁴ The Office for Government Policy Coordination (Prime Minister's Secretariat) and 11 Agencies, Comprehensive Plan for Particulate Matter Management (Sep. 26, 2017).

²⁸⁵ For the RRC and the regulatory impact assessment including the cost-benefit analysis, see Chapter 3.

Vice-Minister of Environment reportedly made a statement during the press conference of the Plan that the cost to be incurred to the whole industry would be more than 1,000 billion Korean won (approximately \$0.9 billion USD), which has caused vehement opposition from the industry.²⁸⁶ It is expected that individual proposals for amending the relevant laws and regulations would contain a certain type of cost-benefit analysis going forward; however, as seen in the case for the quasi-normative influence of the Basic Electricity Plan over each project of new power generation, the government's position toward the Comprehensive Plan for Particulate Matter Management was presented in quite a decisive way. The more environmentally friendly policies also use the opaque process, even under the democratic government, which would weaken the substantial and procedural justifications for such policies and thus make the path for mitigating greenhouse gases more difficult.

4. The Case of the Renewable Portfolio Standard

The numerical benefits of reducing greenhouse gases were mentioned in the regulatory impact assessments by the MOTIE for introducing the Renewable Portfolio Standard (RPS) and slightly strengthening it between 2010 and 2013.²⁸⁷ The agency used €20 per ton/CO₂ for the “environmental benefits” in the regulatory impact assessment published in 2010 for introducing the RPS and thus reducing the emissions from the conventional power plants.²⁸⁸ The agency later used €10 per ton/CO₂ for the “CO₂ reduction effect,” described one of the “measurable benefits” in the regulatory impact assessment prepared for a regulation slightly tightening the RPS in 2012.²⁸⁹ The agency did not provide grounds for the numbers in either regulatory impact assessment. The agency's way of using the benefits of CO₂ reduction in the cost-benefit analysis of the proposed RPS policy presents several issues.

First, and most importantly, the agency did not specify the grounds of the numbers. As discussed before *infra* Section A, since only the result of the regulatory impact assessment for launched policies is publicly available and there is no docket for the regulatory review process,

²⁸⁶ Rae-gun Park, The Expansion of Regulation of Total Amount of Pollutants and Particulate Matter, Causes the Industry to Bear More than 1,000 billion Won Cost, *Chosun Ilbo*, Sep. 27, 2017, available at http://biz.chosun.com/site/data/html_dir/2017/09/27/2017092700028.html (last visited March 20, 2018). This news was reported by a renowned conservative media outlet. It appears that the statement of the Vice-Minister of Environment was made in response to a question from a reporter during the press conference. It was not reported whether the Vice-Minister also mentioned the estimated benefits of the new policy.

²⁸⁷ Korea had the Feed-in-tariff (FIT) system until 2012, when the country introduced the RPS and started to phase out the FIT.

²⁸⁸ The Regulatory Impact Assessment in the Agenda for Review of New or Strengthened Regulations, Ministry of Knowledge and Economy, Agenda for Review of Regulatory Reform Committee No. 2010-21, May 12, 2010, 33, 46. The name of the MOTIE has been changed a few times during the past several years.

²⁸⁹ The Regulatory Impact Assessment in the Agenda for Review of New or Strengthened Regulations, Ministry of Knowledge and Economy, Agenda for Review of Regulatory Reform Committee No. 2012-544, November 12, 2012, 9-10.

one cannot have access to the internal discussions on what made the agency decide to use a number. The opaqueness of the process enables the government to make the regulatory impact assessment simple without reasoning.

In this regard, the best guess possible is that the agency may have tried to utilize the average price of the emissions rights traded in the EU ETS in a certain year because the agency used the same amount for the Basic Electricity Plan with the explanation that it comes from the market price of the EU ETS emissions rights as seen *infra* Section A, and that the agency used the Euro currency in this document. We are still not able to guess whether the agency wanted to present the savings of compliance cost or intended to use the social cost of carbon by such numbers because the agency's use of those concepts was confused in the Basic Electricity Plan. Even if the agency wished to use the compliance cost, it should have provided certain grounds why and how the average amount of the EU ETS price could be adopted as the Korean benefits of CO₂ reduction without any reasonable adjustment. It raises the question of why the agency did not reflect compliance cost for greenhouse gases other than CO₂ and air pollutants regulated by command-and-control regulations if it intended to reflect compliance cost. It is needless to say that the agency also should have considered a more expanded cost and also co-benefits than mere savings of compliance cost.

If the agency tried to reflect the social cost of greenhouse gas, there is a critical problem in the methodology. The numbers used for the same policy, and the way the agency views the environmental benefits of the RPS, are not consistent, and the number used two years later is simply half of the number used for the initial launching of the RPS.²⁹⁰ This appears to contradict the fact that the estimate of the social cost of carbon generally increases as scientific and economic research develops. Finally, it is also problematic that no co-benefits have been considered or reflected in the cost-benefit analysis for the RPS.

There are exemplary cost-benefit assessments for the state-wide RPS systems in the U.S.²⁹¹ New York state, for example, assessed the costs and benefits of the RPS, in which the reduction amount of CO₂, mercury, NO_x and SO₂ emissions and the value of the reduced CO₂ emissions, as well as the health benefits from avoiding mercury, NO_x, and SO₂ are all considered and reflected.²⁹² The methodology that each state adopted to assess the costs and benefits varies, but it is common that states have tried to quantify the amount of the reduced emissions,

²⁹⁰ The average price of emissions rights in the EU ETS severely fluctuated between €5 and €35 between 2006 and 2012 in Phases I and II. See Christian de Perthuis, and Raphael Trotignon, Governance of CO₂ markets: Lessons from the EU ETS, Energy Policy, Vol. 75, 100-106, 102 (2014).

²⁹¹ The RPS in the U.S. is designed and implemented by state regulations.

²⁹² New York State Energy Research and Development Authority, Renewable Portfolio Standard Main Tier 2013 Program Review Volume 2 – Main Tier Current Portfolio Analysis 20-21, 25 (Sep. 5, 2013). The NYSERD performed the research at the request of the Public Service Commission, which is the agency responsible for economic regulation of the utilities. For the costs and benefits assessment of each state-wide RPS system, see J. Heeter, G. Barbose, L. Bird, S. Weaver, F. Flores-Espino, K. Kuskova-Burns, and R. Wiser, A Survey of State-Level Cost and Benefit Estimates of Renewable Portfolio Standards, National Renewable Energy Laboratory (May 2014).

health benefits and the economic benefits when preparing the impact assessment of the RPS system.²⁹³

B. Other Energy Policy Developments with the Social Cost of Carbon

1. The Case of Vehicles' Fuel Economy Standards

The MOE used a certain social cost of carbon in its regulatory impact assessment when it tried to expand the scope of vehicles subject to the Vehicles Fuel Efficiency Standards (Korean CAFE) to include, e.g., light trucks with a capacity of less than 3.5 tons, which is worth mentioning here even though it is not directly relevant to electric power generation.²⁹⁴ The agency presented \$104 USD per ton/CO₂ as the “social benefits” of the enhanced Korean CAFE and indicated that the number came from “Tol, 2008.”²⁹⁵ It is encouraging that the agency tried to use one of the renowned integrated assessment models in its policymaking. There seems to be serious misunderstanding, however, about the amount of the social cost of carbon determined by the model. Professor Tol, the original developer of the Climate Framework for Uncertainty, Negotiation and Distribution (FUND) model, argued in the 2008 article that there is only “one percent probability that the social cost of carbon is greater than USD 78/tC” and emphasized the median number \$20/tC USD (\$23/tC USD with risk premium), which was calculated from other researchers’ peer-reviewed estimates of the social cost of carbon that he selected.²⁹⁶ In this regard, the MOE should have specified under which percentile, discount rate or other condition it assumed that the social cost of carbon was \$104 USD with Professor Tol’s model. Even if the assessment had provided more details its process in determining the number, some questions remain as to why the agency selected that model and whether it is a reasonable application to Korean policymaking. The opaqueness of the policymaking process exists here, as well.

²⁹³ J. Heeter et. al., *id.* at vi-vii.

²⁹⁴ The Korean government has tried to match the level of this regulation with those of the U.S. and the E.U. in order to facilitate the cross-border trades of vehicles. The current scope of vehicles subject to the regulation is the same as that of the U.S. Corporate Average Fuel Standards (CAFE). See the Regulatory Impact Assessment in the Agenda for Review of New or Strengthened Regulations, Ministry of Environment, Agenda for Review of Regulatory Reform Committee No. 2014-502, 8-20, 11-14 (Dec. 12, 2014). The legal ground of this regulation is the LGCCA that was enacted to be the framework act for sustainable energy regulation. The LGCCA provides a clear ground for regulating greenhouse gases, including CO₂ for vehicles, while it is silent on how to regulate greenhouse gas emissions from stationary sources.

²⁹⁵ Regulatory Impact Assessment in the Agenda for Review of New or Strengthened Regulations, Ministry of Environment, Agenda for Review of Regulatory Reform Committee No. 2014-502, 16-17. The regulatory impact assessment does not offer any more details about the reference to Professor Tol’s research, but it is understood to mean the following study: Richard S.J. Tol, The Social Cost of Carbon: Trends, Outliers and Catastrophes, *Economics: The Open-Access, Open-Assessment E-Journal*, Vol. 2, No. 2008-25 (2008).

²⁹⁶ Tol, *id.*

The regulatory impact assessment indicates that there is no additional cost to be incurred as a result of the enhanced Korean CAFE because the Korean vehicles industry already exported 70% of domestic production to the U.S. or the EU, and the manufacturers do not need to develop new technology to meet the new regulation.²⁹⁷ Thus, regardless of the social cost of carbon amount used in the assessment, the policy would have been approved by the Regulatory Reform Committee and then implemented. The way the MOE borrowed the social cost of carbon from one of the IAMs left much to be desired; however, it may be a starting point to develop a more reasonable process for determining the carbon price and considering carbon pricing in energy policymaking.²⁹⁸

2. *The 2015 Research on Alternative Energy Policy Measures for Consideration of Environment and Climate Change*

The Ministry of Environment led a research project with energy and environmental experts between 2014 and 2015,²⁹⁹ when the MOITE was preparing the 7th Basic Electricity Plan.³⁰⁰ The background of this research was not disclosed; however, one can reasonably guess that the MOE tried to prepare its comments on the draft 7th Basic Electricity Plan based on experts' opinions in mid-2015, after having gone through the difficulties surrounding the 6th Plan. The research team consisted of 38 economists, energy and environmental engineering experts, environment policy specialists and policy experts, including former and then-current public officials of the MOE and its affiliated entities.³⁰¹ The research covers a broad range of energy policies, including management of demand and supply of electricity with environmental considerations. The researchers tried to determine a more sustainable energy mix based on the available data of the prospect of electricity demand, stranded cost and variable cost of each energy source, the social cost of carbon, etc., that differs from what the MOTIE used for the

²⁹⁷ This point might be also quite controversial, although it has not been challenged by lawsuits of the industry.

²⁹⁸ There is no reported litigation challenging the validity of this regulation so far. It is not easy to imagine a court decision addressing such omissions and errors in the cost-benefit analysis in a regulatory impact assessment, given the current standards of judicial review the court adopts for cost-benefit analyses in general.

²⁹⁹ Ministry of Environment, Public Notice No. 2014-397, Invitation to Bidding for a Research on Alternative Energy Policy Measures for Consideration of Environment and Climate Change, July 2014, available at <http://www.me.go.kr/home/web/board/read.do?pagerOffset=0&maxPageItems=10&maxIndexPages=10&searchKey=&searchValue=&menuId=290&orgCd=&boardMasterId=39&boardCategoryId=52&boardId=352006>; Seung-rae Kim, Ho-jin Sung, Sang-yeol Shim, et.al., the Final Report on Research on Alternative Energy Policy Measures for Consideration of Environment and Climate Change submitted to the Ministry of Environment, SyncNow Co., Ltd., Vol. I, II, and III (April 2015).

³⁰⁰ This final report was obtained through the formal Information Disclosure Request filed with the Korean government. See the Climate Change Policy Division of the MOE, *Response to the Information Disclosure Request No. 4309171*, November 8, 2017; an electronic copy is on file with the Author.

³⁰¹ One of the researchers became the Vice-Minister of Environment in mid-2017.

Basic Electricity Plan.³⁰² As for the social cost of carbon, the paper did not calculate a new number through its own modeling but rather borrowed from a study from MIT³⁰³ with adjustment through the Benefit Transfer Methods.³⁰⁴ The research paper established the levelized cost of electricity (LCOE) from coal, LNG and nuclear power generators reflecting the social cost of each energy source, which have not been reflected in electricity pricing so far.³⁰⁵ The research presents the current LCOE, as well as the social cost of carbon and air pollution of coal and LNG as shown in Table 4:³⁰⁶

[TABLE 4] LEVELIZED COST AND SOCIAL COST OF COAL AND LNG POWER GENERATION

	Coal	LNG
Current LCOE ³⁰⁷	58	140
Social Cost	86.39	16.3
Combined LCOE	144.39	156.3

Unit: Korean won/kWh; 1,000 Korean won is approximately \$0.9 USD.

³⁰² For example, the research paper points out that the MOITE set the electric power reserve rate excessively higher than a reasonable estimation reflecting the prospect of demand increase based on estimated economic and population growth. See, Kim, et. al., *supra* note 299 at 265-68.

³⁰³ The research paper, however, does not specify the exact source of MIT research, and instead says “MIT (2012)” adding that the data was recited from internal data of an affiliated institute of the MOE for research and administration, the Korea Environment Corporation. See, Kim, et. al., *supra* note 299 at 307.

³⁰⁴ Kim, et. al., *supra* note 299 at 307-308. The Benefit Transfer Methods is the “use of research results from pre-existing primary studies at one or more sites or policy contexts (often called study sites) to predict welfare estimates” of another site, which is called the policy site. The methods are known to be frequently used when “time, funding, data availability or other constraints preclude original research, so that preexisting estimates must be used instead.” See Robert J. Johnston, et.al., Introduction to Benefit Transfer Methods, in R.J. Johnston et al. (eds.), *Benefit Transfer of Environmental and Resource Values*, 19-59, 20 (2015).

³⁰⁵ Kim, et. al., *supra* note 299 at 307-308. The Levelized Cost of Electricity represents “the per-kilowatthour cost (in discounted real dollars) of building and operating a generating plant over an assumed financial life and duty cycle,” where key input factors include “capital costs, fuel costs, fixed and variable operations and maintenance costs, financing costs and an assumed utilization rate for each plant type.” See U.S. Energy Information Administration, *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2017* (Apr. 2017), at https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf (last visited March 5, 2018).

³⁰⁶ Kim, et. al., *supra* note 299 at 307-308. The report explains that the “social cost” covers the social cost of carbon dioxide and the damages from air pollutants.

³⁰⁷ The source is not specified in the research paper. However, when the paper explains the LCOE of renewables, it indicates that the current LCOE numbers are the ones used by the Korea Power Exchange (KPX), which is administered ultimately by the MOTIE.

The research concludes in this regard that both the combined LCOE of Coal and LNG surpass that of the solar and wind, which are estimated to be 107 and 144 Korean won/kWh each, and come closer to the LCOE of offshore wind, 173 Korean won/kWh.³⁰⁸ The research then determines a more “environment-friendly” energy mix using a model called MESSAGE-II,³⁰⁹ which differs from the WASP model used by the MOTIE, explaining that the model allows restrictions for various environmental, technical and policy factors, including the limitation of the total CO₂ emissions amount to produce an energy supply system.³¹⁰

The result of the research is encouraging in a few respects. It recognizes the social cost of greenhouse gases and other air pollutants emissions as the social cost of electricity generation and actually determines the number and the LCOE reflecting such social cost based on an economic model; it then uses the LCOE to arrive at a more sustainable energy mix. The research also shows that the LCOE of renewables might be lower than that of coal and the LCOE of LNG might not be much higher than coal’s.³¹¹

³⁰⁸ Kim, et. al., *supra* note 299 at 307-308. The combined LCOE of nuclear power generation with more risk premium reflected is estimated as 74.94 Korean won/kWh, which is still well below of that of coal or LNG. As for the LCOE of solar and wind, the paper explains that the amount of LCOE used here reflects 20 years of life span and thus is lower than the LCOE used at the KPX; this is because the numbers used at the KPX assume that the life span of renewables is only 12 years, which is the contract period for the standard purchase agreement used to meet the RPS. The KPX’s use of a shorter life span for renewables leads to a significant increase in its LCOE also undermines the chances of renewables being expanded.

³⁰⁹ Kim, et. al., *supra* note 299 at 299-339. The research explains that this model is also developed by the IAEA.

³¹⁰ Kim, et. al., *supra* note 299 at 299.

³¹¹ The unique taxation and import pricing system for LNG in Korea has been mentioned as a hurdle for expanding the use of LNG as a power generation source, though the level of impact might be subject to further discussion. The individual consumption tax, which has been levied mostly on luxury goods, was introduced also for oil, LNG and coal in the 1980s and 1990s. Though certain taxes have the function of deterring consumption, which is good for the fossil fuel energy sources now, the problem is that the tax amount for LNG is double the amount for coal. Nuclear power sources are not taxed at all. The current amount for LNG for power generation is 60 Korean won/kg, while for coal the power generation is 30 Korean won/kg. The tax for LNG for individual use is 45 Korean won/kg. (See Article 1, Para 2, Sub-para 4, Individual Consumption Tax Act, Legislation No. 15036.) Further, the import price of LNG either for power generation or individual use has been set as the same, on average, despite the major transmission cost and seasonal fluctuation of demand for individual use. Thus, the structure of the current individual consumption taxation of LNG raises cross-subsidy issues in two ways. First, between the LNG power generation and coal/nuclear power generation, and second, between the LNG use for power generation and the individual use of LNG for heating residential or business buildings. This uncommon structure of taxation and pricing has faced growing criticism for decades but has not yet been fully resolved. The most recent minor effort to mitigate the problem is the coal tax increase by 6 Korean won effective in April 2018. (See Individual Consumption Tax Act, Legislation No. 15217, to be effective on April 1, 2018.) For a study which maintains that the cross-subsidy effect between the LNG use for power generation and the individual use of LNG for heating residential or business buildings is not significant, see Lee, *supra* note 251. For a study that suggests the cross-subsidy issue between the

This is an advance given the ambiguous way of dealing with the “social cost” or “environmental cost” of greenhouse gas emissions in the aforementioned cases. Further, it is the first experiment at the government level where economists, engineering experts and policymakers worked together on the topic. This would be a good starting point to determine a carbon-pricing model for Korean policymaking. The research, however, takes a shape that might be a better fit for the MOE’s internal use and should have been equipped with several more points if it were to be used to provide logistic grounds for debates over the carbon-pricing methodology or to persuade other agencies or voices with various stances and ideas about carbon pricing. Most of all, it adopts standards that are most controversial when deciding a social cost of carbon amount without providing justifications. The methodology used to calculate the amount of the social cost of carbon is simply borrowed from an unspecified study with a certain Benefit Transfer Method, the details of which are not provided. It should be further subject to a discussion as to whether it is appropriate to use the Benefit Transfer Methods for setting the social cost of carbon, or how to use it, which would affect the direction of the entire energy policies broadly. If the Benefit Transfer Method were used, more than a plain comparison between the income level or value of the statistical life should be considered and reflected, given that such a simplistic approach may omit the noneconomic costs of growth, equity concerns or the tendency towards the management of health-related risks in the transferee nation.³¹² The best way to determine the benefits from reducing greenhouse gases is, however, to calculate the social cost through appropriate modeling and the co-benefits reflecting the natural, social and cultural environment in Korea, which is further discussed later in this chapter. A study proved through a model that a primary research rather than a benefit transfer method results in “better decisions” for the projects with larger interests.³¹³

Further, when the paper determines the proposals of an environmental friendly energy mix, it uses the discount rate of 5.5% without any explanation for adopting it.³¹⁴ This would warrant many opposing voices either from the advocates of a higher discount rate or lower ones. The then-current discount rate recommended by the Ministry of Strategy and Finance for the policies of most agencies was 5.5%, which is discussed in Chapter 4; however, adopting that discount rate for the social cost of greenhouse gases without discussing any alternative left much

LNG use for power generation and the individual use of LNG for individual use is a serious problem undermining competition between the power generators/sources and the climate policy, see Sang-cheol Shin et. al., An Assessment of the Feasibility of the Emissions Trading System for the Electric Power Sector in Korea, Korea Environment Institute 27-28 (2010), at <http://webbook.me.go.kr/DLi-File/091/018/011/5503284.pdf> (last visited March 5, 2018).

³¹² Quah, *supra* note 214 at 19-20; Lisa A. Robinson and James K. Hammitt, The Benefit-Transfer Approach Valuing Health Risks in Sub-Saharan Africa, 37-40, in Michael A. Livermore and Richard L. Revesz (eds.), *The Globalization of Cost-Benefit Analysis in Environmental Policy* (2013). As for the benefit transfer method, significant literature has been accumulated to develop more sophisticated models. See for primary literature, John Rolfe et. al., *Meta-analysis: Rationale, Issues and Applications*, in R.J. Johnston et al. (eds.), *Benefit Transfer of Environmental and Resource Values*, 358-369 (2015)

³¹³ B. P. Allen, and J. B. Loomis, The decision to use benefit transfer or conduct original valuation research for benefit-cost and policy analysis, *Contemporary Economic Policy*, Vol. 26, 1–12, 9 (2008).

³¹⁴ Kim, et. al., *supra* note 299 at 305.

to be desired, especially given that the rate recommended by the Ministry of Strategy and Finance was already decreased to 4.5% in 2017, and even the public research institutes have considered around 3% of social discount rate for several years.³¹⁵ Finally, the research would also have added more value to the discussion surrounding carbon pricing in the electric power generation sector if it more clearly compared the advantages of the MESSAGE-II model with the functions of the WASP-IV model that has been used by the MOTIE for the past decade, in terms of reflecting the social cost of greenhouse gases emissions.

C. Observations from the Review of Relevant Policies

The case studies of the policymaking process for the electric power generation sector revealed procedural and substantial problems and institutional dysfunctions in the climate change regime in Korea, as summarized below.

First, the cost-benefit scheme is not properly utilized in the relevant policymaking, which led to undermining the efficacy of the new climate change schemes, including the Low Carbon and Green Growth Act and the emissions trading scheme. Some of the policies were not included in the cost-benefit analysis, and others have been implemented with a less sophisticated way of cost-benefit analysis. The scope of the regulations requiring cost-benefit analysis is quite narrowly set, and the cost-benefit analysis has been performed as a formality. Further, the Korean electric power sector has been almost monopolized by the government for decades, and the MOITE has tried to keep the process opaque as before, without inviting comments from other central or local agencies, outside experts or the public for its energy policies. The process should change to be more transparent, especially given recent structural changes in the relevant markets, where more private parties participate in conventional power generation and newer sources of electricity, including renewables, are being established. The imminent need to introduce effective social regulations to mitigate climate change also calls for broader participation in the policymaking process because it indispensably accompanies more political conflicts and requires more open discussions.

Second, the social cost of greenhouse gases is not properly considered. There have been at least superficial efforts by the agencies to reflect the social cost of carbon. The status of development, however, is still incipient. The concept has not yet been agreed upon among agencies, and the standards to determine the social cost of carbon have not been developed. Even a single agency used a different amount of social cost of carbon for different policies without explanation. This was also the case for the more environmentally friendly policies advanced by the Ministry of Environment or the new democratic administration, which started in May 2017. The social cost of greenhouse gases is the rational ground for various climate

³¹⁵ One of the recent studies by the Korea Energy Economics Institute (KEEI), one of the most authoritative in the energy economics sector in Korea, concluded that the appropriate social discount rate for Korea lies between 2.5% and 3%. See, Ji-Woong Lee et. al., Estimation of Appropriate Social Discount Rate and Social Cost of Carbon in Korea, Basic Research Paper 15-30, Korea Energy Economics Institute, 133-186 (2015). See also Section VI of Chapter 4 for further discussion on the discount rate of carbon pricing.

change regimes and provides a solid tool for a more active discussion of the climate response either domestically or globally. In this regard, the social cost of carbon should be incorporated into the coordination among various agencies and systematic supports to properly update and use it for policymaking and electricity pricing.

Third, the nationwide emissions trading scheme for CO₂ does not yet effectively work in the energy sector, either for the agencies' policy decisions or the private companies' business decisions, because no attempt to reflect the price of carbon utilizing the price of the emissions correctly in the Korean market has been observed, and the private companies are still interested in adding a new coal power plant.³¹⁶ Chapter 6 discusses detailed institutional problems of the emissions trading scheme and proposals to address them, with the methodologies to mitigate the concerns of an electricity price increase, which is often mentioned as the political hurdle of reflecting the carbon effect in the electricity price.

Fourth, the conflicts between the agency responsible for economic growth and the Ministry of Environment over electric power policies show the necessity of effecting changes in the institutional structure of the policymaking authority for the electric power sector. The current structure centralizes authority in the MOITE with an opaque policymaking process that is vulnerable to political dynamics and likely to delay the implementation of effective climate change policies, given that pursuing sustainability has not been the agency's role or responsibility.

IV. The U.S. Approach to Carbon Pricing: the Case of the Federal Government

The way the federal government of the U.S. determined the social cost of carbon, various issues discussed during the process, the subtle differences in various agencies' approach to carbon pricing and the judicial review's substantial effect on carbon pricing are reviewed and discussed in this section, which considers the development of the social cost of carbon in Korea. The U.S. federal government has estimated the social cost of carbon in policymaking since 2008, when the federal circuit court decision reviewing the agency's use of the social cost of carbon was rendered³¹⁷ after the U.S. Supreme Court made it clear that greenhouse gases are included in the air pollutants regulated under the Clean Air Act, thus approving the EPA's authority to

³¹⁶ Some of the primary reasons for the current ineffectiveness of the emissions trading scheme can be briefly summarized as follows: (i) the scheme went through some political turmoil at the beginning and allowed too generous emissions rights following the EU case; (ii) the compliance cost to secure the emissions rights of the electric power generation companies are fully paid by the KEPCO, the monopolistic retailer, to the wholesale generators, which undermines the generators' incentive to abate CO₂ or reduce the abatement cost; and (iii) there is practically no accompanying command-and-control type regulation on CO₂ or other types of greenhouse gases, which might supplement the dysfunction of the emissions trading scheme during the initial grace period.

³¹⁷ U.S. GAO, Regulatory Impact Analysis, Development of Social Cost of Carbon Estimates, GAO 14-663, 22 (July 2014), at <http://www.gao.gov/products/GAO-14-663> (last visited May 5, 2018); *Center for Biological Diversity v. National Highway Traffic Safety Administration*, 538 F.3d 1172 (9th Cir. 2008).

regulate their emissions.³¹⁸ The process of setting the social cost of carbon does not appear simple, given the technical difficulties as well as the political conflicts. The inter-agency working group (IWG) led by the Office of Management and Budget (OMB) determined a recommended amount of social cost of carbon based on prominent integrated models combining scientific and economic considerations.³¹⁹ The agencies considered the social cost of carbon in 67 regulatory actions from 2008 to June 2014, and the rules of the energy conservation program and fuel efficiency of vehicles are the most frequent applications of the social cost of carbon.³²⁰ Given the extreme uncertainty of the boundary of the social cost of carbon and its calculation methods, it was not unexpected that the agency's decision on whether and how to consider the social cost of carbon would face legal challenges. The federal courts have rendered several opinions on the legitimacy, statutory grounds and discretion of the agency's consideration of the social cost of carbon since *Center for Biological Diversity* in 2008.³²¹

A. Coordinated Discussion Process for Calculating the Social Cost of Carbon

The government-wide effort to establish a more consistent social cost of carbon was triggered by the 9th Circuit opinion in *Center for Biological Diversity v. National Highway Traffic Safety Administration* in 2008.³²² The OMB and the Council of Economic Advisers, based on Executive Order 12866, convened and led an informal IWG in which four other offices from the Executive Office of the President (EOP) and six federal agencies including the DOE, DOT and EPA participated.³²³ Professor Michael Greenstone, a prominent economist who was actively involved in the IWG, explains that the purpose of the IWG formation is to achieve more transparency and consistency of the range of the social cost of carbon estimates despite the uncertainties and significant differences in various relevant models.³²⁴

³¹⁸ *Massachusetts v. EPA*, 549 U.S. 497 (2007).

³¹⁹ IWG, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866 (Feb. 2010), at https://www.epa.gov/sites/production/files/2016-12/documents/scc_tsd_2010.pdf.

³²⁰ GAO, *supra* note 317 at 22-29. The agencies that considered the social cost of carbon in policymaking are the DOE, Department of Transportation (DOT), EPA and National Highway Traffic Safety Administration (NHTSA).

³²¹ 538 F.3d 1172 (9th Cir. 2008).

³²² 538 F.3d 1172 (9th Cir., 2008).

³²³ GAO, *supra* note 317 at 1.

³²⁴ Michael Greenstone, Elizabeth Kopits, and Ann Wolverton, Estimating the social cost of carbon for use in U.S. federal rulemakings: A summary and interpretation, National Bureau of Economic Research, No. w16913, MIT CEEPR WP 2011-006 (2011). In this article, the authors explained it as follows:

“Specifically, the goal was to develop a range of SCC values in a way that used a defensible set of input assumptions, was grounded in the existing literature, and allowed key uncertainties and

Professor Cass Sunstein, who initially helped to convene the IWG as the then-Administrator of the Office of Information and Regulatory Affairs (OIRA), explains that the working group meetings purely focused on substantive deliberation without “political interference.”³²⁵ This does not mean that the discussion within the IWG was without fierce debates on the appropriate level of the social cost of carbon or discount rate. On the contrary, Professor Sunstein once indicated there was a sharp controversy within the group over the discount rate of the social cost of carbon between the agencies responsible for environmental policies and the agencies more focused on pure economic assessment of a certain policy tool, e.g., the Council of Economic Advisers and the National Economic Council, when explaining the practical difficulties of re-assessing the social cost of carbon in response to the critiques.³²⁶ There was, however, a clear political economic value of forming such an inter-agency group to discuss the controversial matter.³²⁷ Some agencies started using the social cost of carbon after the 2008 federal court decision in policymaking, before the IWG issued the recommendation in 2010, but the amount of the social cost of carbon used by each agency significantly varied then.³²⁸ So, the IWG functioned as an efficient forum to produce a consensus among agencies with various diverging interests about the highly controversial matter. The contribution of experts in science and economics, e.g., the NAS and the Council of Economic Advisers, is also notable.

The IWG on the Social Cost of Carbon issued an initial formal recommendation in 2010,³²⁹ which was updated in 2013, 2015, and 2016,³³⁰ taking into account the recommendations of the National Academies of Sciences, Engineering, and Medicine (NAS). The NAS also issued a recommendation to consider making it higher in early 2017, explaining that it should be updated to incorporate damages currently omitted from the SCC, including

model differences to transparently and consistently inform the range of SCC estimates used in the rulemaking process.”

³²⁵ Cass R. Sunstein, *Changing Climate Change, 2009-2016*, Harvard Environmental Law Review, Vol. 42, 231-285, 250 (2017).

³²⁶ Cass R. Sunstein, *On not revisiting official discount rates: Institutional inertia and the social cost of carbon*, *The American Economic Review*, Vol. 104, No. 5, 547-551, 549 (2014) (arguing that re-assessment of the social cost of carbon and discount rate would not be cost-effective given the institutional restraints of changing policy.)

³²⁷ R. W. Hahn, and R. A. Ritz, *Does the Social Cost of Carbon Matter? Evidence from US Policy*, *The Journal of Legal Studies*, Vol. 44, No. 1 (2015), 229-248, Economic Studies at Brookings Working Paper Series 16-20 (July 2014).

³²⁸ GAO, *supra* note 323.

³²⁹ IWG, *supra* note 319.

³³⁰ IWG, *Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* (Aug. 2016), available at https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf.

ocean acidification, sea level rise and regional spillover effects, such as climate-induced human migration, among many others.³³¹

B. Selecting Models

The IWG adopted three prominent integrated assessment models (IAMs)³³² to estimate the social cost of carbon: the Dynamic Integrated Climate and Economy (DICE) model developed by William Nordhaus of Yale University, the Policy Analysis of the Greenhouse Effect (PAGE) model by Chris Hope of Cambridge University and the Climate Framework for Uncertainty, Negotiation and Distribution (FUND) model by Richard Tol and David Anthoff et al. of Germany and the Netherlands.³³³ Professor Greenstone explains that the IWG selected those three models among other prominent models to estimate climate change impact because they best synthesize the physical impacts and economic damages, while other models focus more on either scientific or economic impacts.³³⁴ They decided to work with three existing models rather than selecting only one of them or building a new one because it would reduce the “risk of selectivity” and help to secure “neutrality” of the recommendation of the IWG.³³⁵ It is not difficult to imagine that vigorous discussions preceded the decision to adopt those three models within the IWG, or even within the NAS.

Each of the three IAMs calculates emissions projections based on specific socio-economic pathways reflecting GDP and population, which are then translated into atmospheric greenhouse gas concentrations, and then again into an increase of temperatures based on each model’s climate sensitivity. Finally, these are transformed into economic damages, which are discounted over time to arrive at the present value.³³⁶ Thus, it was unavoidable that the outcomes of each IAM significantly varied depending on assumptions about key inputs, including socio-economic pathways, climate sensitivity and the discount rate.³³⁷ In this regard,

³³¹ National Academies of Sciences, Engineering and Medicine, *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*, 13-14, 18-26 (2017), available at <http://www.nap.edu/24651> (last visit May 10, 2017)

³³² The “integrated assessment model” means the model integrates both scientific and economic knowledge. See Greenstone et al., *supra* note 324 at 3.

³³³ David Anthoff is now a professor in the Energy and Resources Group at the University of California, Berkeley.

³³⁴ Greenstone et al., *supra* note 324 at 3-4.

³³⁵ See, on the subject of the IWG’s adoption of the FUND, DICE and PAGE models, Sunstein, *Changing* *supra* note at 325 at 250-251; Daniel A. Farber, *Coping With Uncertainty: Cost-Benefit Analysis, the Precautionary Principle, and Climate Change*, *Washington Law Review*, Vol 96, 1659-1726, 1720-21 (2015).

³³⁶ Greenstone et al., *supra* note 324, at 3-6.

³³⁷ Greenstone et al., *supra* note 324, at 6-16.

the IWG made efforts to make the outcomes to be more consistent with each other and the findings of the IPCC, e.g., adjusting the probability distributions for the equilibrium climate sensitivity to be consistent with the one used in the IPCC's Fourth Assessment Report, which was then its most recent finding.³³⁸

C. *Setting the Social Discount Rate*

The social discount rate is one of the most critical issues when designing climate change policy because the present value of the future benefit of reducing greenhouse gases is highly sensitive to the discount rate.³³⁹ The economic methodology used to determine the proper discount rate vastly varies depending upon which factor is reflected with more weight, among, e.g., the social rate of time preference, rates in the financial markets and economic growth rates.³⁴⁰ The significant input from the controversy over how to reflect distributive justice

³³⁸ IWG, *supra* note 319, at 12-13; IPCC, Fourth Assessment Report (Climate Change 2007: Synthesis Report), 38 (2007); Farber, *supra* note 335 at 1710 (explaining in detail the additional value that the IWG made based on the existing models). The IPCC considers the climate sensitivity as the most critical factor when determining the social cost of carbon. See IPCC, Working Group II: Impacts Adaptation, and Vulnerability, IPCC Fourth Assessment Report, 823 (2007).

³³⁹ The IPCC considers the discount rate as the second most critical factor for working out the social cost of carbon after climate sensitivity. See IPCC, Working Group II: Impacts Adaptation and Vulnerability, IPCC Fourth Assessment Report, 823 (2007).

³⁴⁰ More recently, the economists' views have changed to weigh the growth rate to decide the social discount rate for a policy affecting a long time span, rather than relying on the rate of return in the markets. See Daniel A. Farber, Gambling over Growth: Economic Uncertainty, Discounting and Regulatory Policy, *The Journal of Legal Studies*, Vol. 44, No. 52, S509-S528 (June 2015). Nicolas Stern points out that determining the social discount rate based on the private market rates of return is not proper because it does not reflect, among others, the risk structure of the problem. See Nicolas Stern, The Economics of Climate Change, *American Economic Review*, Vol. 98, Issue 2, 1-37, 13 (2008). William Nordhaus, who originally used the "discount rate on goods" for the social discount rate for the DICE model, added an update to the discount rate used in the most recent version of the model to reflect the growth rate, which he calls the "growth-corrected discount rate." See William D. Nordhaus, Revisiting the Social Cost of Carbon, *PNAS*, Vol. 114, No. 7, 1518 - 23, 1520-21 (2017).

between generations to the discount rate further complicates the relevant discussions.³⁴¹ The time horizon to consider is also an issue.³⁴²

The IWG explains that it appreciated the deep normative controversies over the discount rate while setting the social cost of carbon.³⁴³ Professor Sunstein also indicates in his article that there were significant discussion over the discount rate within the group.³⁴⁴ The IWG finally chose 3% as the central value, explaining that it is consistent with estimates for the consumption rate of interest provided in the Circular A-4 Regulatory Analysis issued by the OMB in 2003³⁴⁵ and approximately corresponds to the after-tax riskless interest rate,³⁴⁶ which is the social marginal rate of time preference. The OMB previously adopted both 3% and 7% in the Circular A-4 Regulatory Analysis and explained that the 3% rate was set to reflect the social rate of time preference.³⁴⁷ The IWG also chose to use 2.5% and 5% as well to accommodate various economic and normative views.³⁴⁸ The IWG set forth the discount rate for the 95th

³⁴¹ David Weisbach and Eric A. Posner describe the division in opinions as “ethicists” and “positivists.” “The ethicists” refers to the group who regard the future generation’s benefits equally to the contemporary generation. “Positivists” refers to the group acknowledging the use of the discount rate when determining the present value of future benefits from a certain policy. See David Weisbach and Eric A. Posner, *Climate Change Justice*, 149-58 (2010). The authors argue that it is more important to seek an appropriate discount rate rather than debating the morality of discounting itself because, even under the ethicists’ theory, discounting is imperative. For an ethicist’s view arguing that discounting is immoral, see, e.g., Douglas Kysar, *Discounting ... on Stilts*, *University of Chicago Law Review*, Vol. 74, Issue 1, 119-138 (2007).

³⁴² According to Kenneth Arrow, overlapping generations might be a good alternative because reflecting the benefits for infinite future generations is not realistic. See Kenneth J. Arrow, *The Rate of Discount on Public Investments with Imperfect Capital Markets*, 115-136, 116-17, in *Resources for the Future Library Collection Energy Policy Vol. 3: Discounting for Time and Risk in Energy Policy*, 1982 (reprinted in 2011). Eric Posner argues that 30 to 50 years in the future would be appropriate to consider. See Eric A. Posner, *Agencies Should Ignore Distant-Future Generations*, *University of Chicago Law Review*, Vol. 74, Issue 1, 139-43, 143 (2007).

³⁴³ IWG, *supra* note 319, at 19.

³⁴⁴ Cass R. Sunstein, *supra* note 325, at 252-254.

³⁴⁵ OMB, Circular A-4 Regulatory Analysis, 2003, available at <https://www.gpo.gov/fdsys/pkg/FR-2003-10-09/pdf/03-25606.pdf>, and <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf> (last visit Jan. 20, 2017); Section 6(a)(3)(c) of the Executive Order 12866, *Regulatory Planning and Review*.

³⁴⁶ IWG, *supra* note 319, at 23.

³⁴⁷ OMB, *supra* note 345 at 33-34 (2003).

³⁴⁸ The IWG explains that “the upper value of 5% represents the possibility that climate changes are positively correlated with market returns” and it “may be justified by the high interest rates that many consumers use to smooth consumption across periods.” The IWG also explains that the lower value of 2.5% responds to “ethical objections that have been raised about rates of 3% or higher” addressing a more normative approach and the possibility that “climate investments are negatively correlated with the overall market rate of return.” See IWG, *supra* note 319, at 23. For the literature proposing this lower

percentile at a 3% discount rate to consider “the higher-than-expected economic impacts from climate change further out in the tails of the social cost of carbon distribution.”³⁴⁹

Different discount rates result in significant differences in the amount of social cost of carbon values, which would create a decisive impact on policy direction. According to the IWG’s updated Technical Support Document published in 2016, the amount of the social cost of carbon as of 2015 is \$36 with a 3% of discount rate, \$56 with a 2.5% discount rate, \$11 with a 5% discount rate and \$101 with the 95th percentile at a 3% discount rate.³⁵⁰ The discount rate was once litigated but the Seventh Circuit, who affirmed that the DOE’s use of the discount rate recommended by the IWG was not arbitrary or capricious.³⁵¹ There has been no known divided federal court opinion thus far that viewed the agencies’ use of the discount rate recommended by the IWG as inappropriate.³⁵²

D. Global Benefits vs. Domestic Benefits

One of the most controversial issues concerning the social cost of carbon is whether the U.S. government should consider the global benefits rather than a domestic benefit from reducing greenhouse gas emissions. The IWG recommends considering global benefits, explaining that climate change is a “global externality” and thus needs transnational coordination.³⁵³ The OMB Circular A-4 requires policy analysis from the domestic perspective and describes the analysis from the international perspective as optional.³⁵⁴ This would naturally raise questions about what other countries would do for such global externalities and what makes the social cost of carbon special enough to reflect an international perspective. Thus, the IWG further elaborates that “the United States has been actively involved in seeking international agreements to reduce emissions and in encouraging other nations, including

discount rate for climate change impact, *See Stern, supra* note 340; Nicholas Stern, *The Economics of Climate Change: The Stern Review* (2007); T. Sterner, and U. Persson, *An Even Sterner Review: Introducing Relative Prices into the Discounting Debate*, *Review of Environmental Economics and Policy*, Vol. 2, Issue 1, 61-76 (2008); and G. Heal, *Climate Economics: A Meta-Review and Some Suggestions for Future Research*, *Review of Environmental Economics and Policy*, Vol. 3, Issue 1, 4-21 (2009).

³⁴⁹ IWG, *supra* note 319, at 25.

³⁵⁰ IWG, *supra* note 330.

³⁵¹ *Zero Zone, Inc. v. United States Department of Energy*, 832 F.3d 654 (7th Cir. 2016). For the details of this case, *see* Section IV in the Chapter.

³⁵² The more important point here is what the federal court’s view would be on the new administration’s use of a far lower amount for the social cost of carbon with a lower discount rate if the current proposal, based on Executive Order No. 13783, which repealed the recommendation of the IWG, goes into effect. *See* for details, *infra* Section II of Chapter 2.

³⁵³ IWG, *supra* note 319, at 10-11.

³⁵⁴ <https://www.gpo.gov/fdsys/pkg/FR-2003-10-09/pdf/03-25606.pdf>.

emerging major economies, to take significant steps to reduce emissions” given the global nature of damages from greenhouse gas emissions.³⁵⁵ This statement seems to provide assurance that the IWG understands the reciprocity requirement.

E. Application of the Social Cost of Carbon

The agencies that participated in the IWG have applied the social cost of carbon in their policymaking during the past several years. Professor Greenstone explains that the joint DOT and EPA greenhouse gas emission and fuel efficiency standards for light-duty vehicles in model years 2012-2016 made an example, proving the important role of the social cost of carbon in policymaking that involves environmental impacts.³⁵⁶ The agencies estimated the technology costs of the policy to be \$345.9 billion.³⁵⁷ The societal benefits, without considering the social cost of carbon, were estimated to be \$277.5 billion, which means the estimated costs exceed the benefits by almost \$70 billion. But the societal benefits from reducing CO₂ estimated based on the social cost of carbon with a central value (at a 3% discount rate) were \$176.7 billion.³⁵⁸ The proposed policy could thus be adopted with \$108.3 of net benefits.³⁵⁹

Two economists once argued that use of the social cost of carbon had little effect on policy direction and was notable only from the perspective of political economy, based on their empirical research on 23 policies made between 2008 and 2013.³⁶⁰ However, the effect of setting the social cost of carbon through the IWG cannot be confined to how many times the government changed the direction of policies from less regulating to more regulating, not to mention the limits of scope and methodology in the empirical research. Such new policy instruments signaled to the market that it should consider the social cost of carbon when making business decisions and provided guidance on how much should be considered. The U.S. government’s action would have informed the rest of the world of the necessity of pricing carbon and, likely, the scientific and institutional methodology to determine the appropriate level.

While several federal agencies have used the social cost of carbon in various policymaking procedures following the recommendations from the IWG, the Federal Energy Regulatory Commission (FERC) has expressed reservations about its use.³⁶¹ The reasons

³⁵⁵ IWG, *supra* note 353.

³⁵⁶ Greenstone et al., *supra* note 324 at 23-24.

³⁵⁷ *Id.*

³⁵⁸ *Id.*

³⁵⁹ *Id.*

³⁶⁰ Hahn, *supra* note 327.

³⁶¹ For example, the FERC acknowledged the availability of the social cost of carbon tool when reviewing the environmental impact of construction and operation of a new LNG facility between 2013 and 2015 but decided to not use it. *See EarthReports, Inc. v. FERC*, 828 F.3d 949, 956 (July 15, 2016).

behind such differences can be explained in a few ways. The first is that there is no statutory ground to generally mandate agencies to consider the social cost of carbon, just as cost-benefit analysis has not secured a statutory ground, though it is rather clear that the NEPA requires the agencies to consider the climate impact as part of the environmental assessment statement. This leaves discretion for each agency to determine whether to use the social cost of carbon in which policies, subject to the relevant statutory languages. Second, the FERC might have reserved its decision to use the social cost of carbon partly because the agency's primary mission has been designing and implementing the 'economic regulation' while 'social regulation' has not been the agency's main policy instrument.³⁶² Third, perhaps more practically, the agency's comparative structural independence from the general administrative body might have contributed to establish some distance from the then-current administration's core energy policy.³⁶³

F. Courts' Role in the Administration's Use of the Social Cost of Carbon

The federal court has also had an important role during the past 10 years in setting the social cost of carbon. But it is true that court's role has been more focused on checking the minimum rationality of agency policymaking rather than actively engaging in technical or even normative controversies. It is largely consistent with the U.S Supreme Court's *Chevron* doctrine, which provides significant deference to agency's discretion in the modern administrative state in which agencies face genuine uncertainties and risks.³⁶⁴ The central issues that the federal court reviewed with respect to the agencies' use of the social cost of carbon can be summarized as follows: first, the court seriously considered the statutory ground for an agency to consider the social cost of carbon and concluded that an agency's use of the measure is legal if it has a statutory ground to do so; second, the court tried to respect an agency's decision whether or not to consider the social cost of carbon if the process was transparent and the agency provided a "reasoned explanation" for its decision; third, the court also respected the methodology of the cost of carbon consideration if the agency presented

³⁶² The economic regulation in this sense means government control over the entry and exit of firms, prices, and/or output to ensure competitive or efficient markets and avoid consumer or other harms that can happen when such markets are not feasible. The concept is distinguished from the social regulation, which restricts behaviors that directly threaten public health, safety, welfare, or well-being. For the distinction between the economic and social regulation, see Schuck, *supra* note 204 at 81; Lester M. Salamon, Economic Regulation, in Salamon, ed., *The Tools of Government*, 118-119; Peter J. May, Social Regulation, in Salamon, ed., *The Tools of Government*, 157-158 (2002).

³⁶³ The commission consists of up to five commissioners, each of whom is appointed by the President with confirmation by the Senate and has one equal vote in the FERC's regulatory decisions. Commissioners serve five-year (practically staggered) terms, which contributes to the relative independence of the FERC from the Presidency or the ruling party.

³⁶⁴ Adrian Vermeule, *Law's Abnegation: From Law's Empire to the Administrative State*, 125-126, 155-196 (2016).

scientifically reliable grounds. More detailed rulings on the specific issue in each case are discussed below.

1. Early Court Decisions on the CBA and Climate Change

The U.S. Court of Appeals for the 9th Circuit's 2008 decision in *Center for Biological Diversity v. National Highway Traffic Safety Administration*³⁶⁵ became a catalyst for the government's efforts in developing the social cost of carbon estimation and reflecting it in policymaking. Plaintiffs, including several states, challenged the NHTSA's rule setting the corporate average fuel economy (CAFE) standards for light trucks. The court determined that the agency rulemaking was arbitrary and capricious because it failed to monetize greenhouse gas emissions reductions while preparing the Environmental Assessment required under the NEPA. First, the court confirmed that the NEPA provides a legal ground for an agency to consider the cumulative impacts of greenhouse gas emissions on climate change and environment for a policy that should be reflected to the cost-benefit analysis.³⁶⁶ Second, the court opined that the value of carbon emissions reduction is certainly not zero based on scientific evidence submitted by the petitioners, contrary to the agency's assertion.³⁶⁷ Third, the court also pointed out that the agency provided no reason why it believed the range of values was extremely wide, while the National Academy of Science and several other commenters selected the value of \$50 per ton of carbon.³⁶⁸ In response to the court ruling, the NHTSA later published an Environmental Impact Statement with detailed analysis on the impact on the global CO₂ level and temperature that the various policy options would have.³⁶⁹

Around 2008, two circuit court decisions were rendered that deviated from the 9th Circuit's *Center for Biological Diversity v. National Highway Traffic Safety Administration*. In *North Slope Borough v. Minerals Management Service*, a federal agency, the Minerals Management Services, faced a challenge based on the NEPA about a lease sale of federal lands for oil and gas development.³⁷⁰ The 9th Circuit, affirming the Alaska District Court's decision,³⁷¹ ruled that the Minerals Management Services did not act arbitrarily or capriciously in determining that risks posed to polar bears by cumulative effects of global warming could be mitigated, even under a "hard look" standard.³⁷² In *Mayo Foundation v. Surface Transportation*

³⁶⁵ 538 F.3d 1172 (9th Cir. 2008).

³⁶⁶ 538 F.3d at 1215-1217.

³⁶⁷ 538 F.3d at 1200-1201.

³⁶⁸ 538 F.3d at 1200-1204.

³⁶⁹ Paul Weiland, Robert Horton and Erick Beck, Environmental Impact Review, in Michael B. Gerard and Jody Freeman, *Global Climate Change and U.S. Law* (2nd ed.), 161 (2014).

³⁷⁰ 2008 WL 110889 (D. Alaska 2008).

³⁷¹ 2008 WL 110889 (D. Alaska 2008).

³⁷² 343 Fed.Appx. 272 (2009 WL 2635023).

Board,³⁷³ the 8th Circuit dismissed the challenge against the Surface Transportation Board's (STB) environmental impact assessments on the construction of a new rail line and upgrade of existing rail line, which would increase coal consumption, resulting in an environmental impact. The 8th Circuit approved a revised environmental impact assessment suggesting that the national and regional impact of the construction and upgrade of rail lines, which includes the increase of carbon dioxide and other air pollutants, would be less than 1%, and "small," as calculated by the computer program based on the National Energy Modeling System (NEMS).³⁷⁴ The 8th Circuit originally remanded the case to the STB, requiring it to reflect the "foreseeable" environmental impacts in the environmental impact assessment performed under the NEPA.³⁷⁵ The 8th Circuit made it clear that, when the nature of the effect is reasonably foreseeable but its extent is not, the agency may not simply ignore the effect, and that once the agency evaluates the effect in a reasonable way without omitting foreseeable factors, the court grants deference to the result.

2. *Recent Opinions after the IWG's Recommendation on the Social Cost of Carbon*

In *Zero Zone, Inc. v. United States Department of Energy*,³⁷⁶ the 7th Circuit upheld the agency's use of the social cost of carbon and the discount rate, which followed the IWG's recommendation. The plaintiffs challenged to the DOE's consideration of the social cost of carbon, i.e., environmental benefits, when determining whether the new energy efficiency standards for commercial refrigeration equipment were economically justified. They argued that the DOE was not legally authorized to consider the social cost of carbon in policymaking, and that the way the DOE considered the reduction of the social cost of carbon, and the costs of such standards, was arbitrary and capricious.

The court first found that the DOE has the legal authority to consider the social cost of carbon because "the EPCA (Energy Policy and Conservation Act) specifically requires DOE to consider the need for national energy ... conservation"³⁷⁷ and "to determine whether an energy conservation measure is appropriate under a cost-benefit analysis, the expected reduction in environmental costs need to be taken into account."³⁷⁸ The court further opined that the DOE did not act arbitrarily or capriciously because the DOE presented, as the basis of its consideration of the social cost of carbon, various supporting materials, including referenced letters from multiple parties that supported the social cost of carbon values, the 2010 IWG report on the

³⁷³ 472 F.3d 545 (2006).

³⁷⁴ 472 F.3d 545, 555-556. (2006).

³⁷⁵ *Mid States Coalition for Progress v. Surface Transp. Bd.* (345 F.3d 520, 549-550)

³⁷⁶ *Zero Zone, Inc. v. United States Department of Energy*, 832 F.3d 654 (7th Cir. 2016).

³⁷⁷ [42 U.S.C. § 6295\(o\)\(2\)\(B\)\(i\)\(VI\)](#).

³⁷⁸ The court explained that this argument is highlighted by an amicus brief submitted by the Institute for Policy Integrity at New York University School of Law. See note 23, 832 F.3d 654, 677, and Institute for Policy Integrity, Brief of the Institute for Policy Integrity at New York University School of Law as Amicus Curiae in Support of Respondents, p. 5-8. (July 29, 2015), available at http://policyintegrity.org/documents/Policy_Integrity_Amicus_Brief_social_cost_of_carbon_July2015.pdf

discount rates used and the OMB's Final Information Quality Bulletin for Peer Review.³⁷⁹ The court added that the petitioners may disagree with the merits of DOE's conclusion in terms of the cost consideration when doing the cost-benefit analysis, but this does not affect whether the DOE's analysis is arbitrary or capricious.³⁸⁰

This case has another notable point that is also relevant to the ongoing debates over the standards for setting the social cost of carbon. The DOE, in this case, considered global benefits to the environment, but only *national* costs when performing the cost-benefit analysis, which was challenged by the petitioners. The DOE explained that climate change involved global externality and that national energy conservation had global effects, which were an appropriate consideration when looking at national policy. The court dismissed the claim of the petitioners challenging the DOE's use of the global benefits, pointing out that the petitioners suggested no global costs that should have been considered. This issue is again disputed in the litigation over the EPA's Clean Power Plan, and the EPA has partly relied on the court opinion in *Zero Zone, Inc.*³⁸¹

On the other hand, a D.C. Circuit decision in 2016, *EarthReports, Inc. v. Federal Energy Regulatory Commission*, showed a slightly different view in upholding the FERC's rejection of using the social cost of carbon analysis or similar tools to analyze environmental impacts of greenhouse gas emissions from the construction and operation of facilities liquefying and exporting natural gas.³⁸² The FERC acknowledged the availability of the social cost of carbon tool but concluded that it would not be appropriate to use for the project in this case because of the lack of consensus on the appropriate discount rate, the failure to measure actual incremental impacts and the lack of established criteria identifying monetized values to be considered.³⁸³ The court found that the FERC had the authority to not consider the social cost of carbon because considering the indirect environmental effects of increased natural gas exports, including possible effects on climate change, was not required by the NEPA.³⁸⁴ These decisions did not deny that the greenhouse impact should be considered in the environmental impact statement

³⁷⁹ 832 F.3d 654, 677-679; [79 Fed. Reg. at 17,779](#). The DOE used the values from the 2013 interagency report adjusted to 2012 levels using the GDP price deflator for this project. For each of the four sets of the social cost of carbon values, using discount rates of 5%, 3%, 2.5% and 3% (for 95th percentile), the values for emissions in 2015 were estimated as \$11.8, \$39.7, \$61.2 and \$117 per metric ton avoided (values expressed in 2012-level currency). *See* 79 Fed. Reg. at 17,777-17,779.

³⁸⁰ 832 F.3d 654, 679.

³⁸¹ Keith Goldberg, EPA Says Recent Rulings Back Clean Power Plan's Legality, Law360 (Aug. 18, 2016.), available at <https://www.law360.com/articles/829942/epa-says-recent-rulings-back-clean-power-plan-s-legality>.

³⁸² 828 F.3d 949 (D.C. Cir. 2016).

³⁸³ 828 F.3d 949, 956 (D.C. Cir. 2016).

³⁸⁴ *Id.* The Sierra Club filed a separate but similar claim about the FERC's same project, and the D.C. Circuit dismissed the argument about the social cost of carbon again, referring to its own decision in *EarthReports, Inc. v. FERC*. *Sierra Club v. Federal Energy Regulatory Commission*, 2016 WL 6915537 (2016).

prepared based on the NEPA, but rather granted deference to the agency's discretion on whether to consider the social cost of carbon when assessing the climate change impact.

The most recent D.C. Circuit decision, rendered in August 2017 after the new administration began, *Sierra Club v. F.E.R.C.*, made clear that the NEPA requires the agency to consider the greenhouse gas impact in the environmental impact statement for approval of the new, interstate natural gas pipeline in the Southwestern region.³⁸⁵ The panel concluded that the amount of the carbon emissions from the power plant that the new pipelines at issue would make possible is an indirect environmental effect of the pipelines that the FERC should estimate in the environmental impact statement, and that, for this reason, the agency's environmental impact statement was inadequate.³⁸⁶ The case was remanded to the FERC to prepare a conforming environment impact statement.³⁸⁷

3. Roles and Limitations of the Court

One distinctive aspect of judiciary review of use of the social cost of carbon in the U.S. is that it is expected to function as a check-and-balance system vis-à-vis the administration's recent policy changes, but it is not yet clear how much the court will intervene. The federal circuit court decisions discussed so far might illustrate the scope of the court's authority to review the agency's consideration of the social cost of carbon and its discount rate. At first glance, *Center for Biological Diversity v. NHTSA* and *EarthReports, Inc. v. FERC* demonstrate conflicting ideas about the scope of the agency's discretion in deciding whether to reflect the social cost of carbon. However, the fact pattern in those two cases shows significant difference at least in one important respect: the agency in the *Center for Biological Diversity* failed to provide a plausible explanation for not using the social cost of carbon (or the environmental impact of the project apparently increasing coal consumption), while the agency in *EarthReports, Inc.* provided reasoned explanation for not reflecting it.

In this regard, the federal court opinions in fact converge into important principles: (i) the court interprets that the NEPA requires the agency to review the climate change impact from greenhouse gas emissions in the environmental impact assessment, while the cases of the court's interpretation of other legislation concerning this issue have not been accumulated; (ii) the court

³⁸⁵ *Sierra Club v. F.E.R.C.*, 867 F.3d 1357 (D.C. Cir. 2017).

³⁸⁶ 867 F.3d 1357, 1371-75. The court reaffirmed the standards of review of an agency's environmental impact statement in *Dep't of Transp. v. Pub. Citizen* (457 F.3d at 93) and *Nevada v. Department of Energy* (867 F.3d 1357, 1368), stating that if the deficiencies of the environmental impact statement are "significant enough to undermine informed public comment and informed decision-making," the environmental impact assessment would be held inadequate.

³⁸⁷ It is notable, however, that the court opined that the *Sierra Club's* argument to use the social cost of carbon for the estimation of greenhouse gas damages cannot be reviewed in this case because the FERC did not explain its position on the use of the social cost of carbon in the environmental impact assessment for this case, as the agency did in *EarthReports, Inc. v. FERC*. In this regard, the court ordered the FERC to explain in its new environmental impact assessment whether the agency still holds the position toward the social cost of carbon in *EarthReports, Inc. v. FERC*. and why. (867 F.3d 1357, 1375.)

affirmed the agencies' use of the social cost of carbon determined as the global benefits of reducing greenhouse gases, and the social discount rate recommended by the IWG or the National Academy of Science; and (iii) the court grants deference to the agency's reasoned decision to not use the social cost of carbon in its assessment methodology of the climate change impact if it is accompanied by a reasoned decision. This explains the court's opinion in *Zero Zone, Inc.* and, more recently, *Sierra Club v. FERC* in 2017 as well. Further, it is in line with the court's position toward its authority to review the government agency's cost-benefit analysis in policymaking.³⁸⁸

V. Considerations for an Ideal Approach

Three policy implications can be found from the comparative review of the approaches to the social cost of carbon in two countries.

A. *The Process of Designing the Carbon Pricing Scheme*

The current status of the Korean government's use of the social cost of carbon has some similarity with the status of the U.S. government's use before the IWG determined the social cost of carbon. They recognized the necessity of reflecting carbon pricing in energy policies; however, there were not yet established standards to adopt. Each agency's basic position toward carbon pricing shows differences, whereas the agencies responsible for environmental quality have been more active in using the price of carbon with a higher amount. Given that a consistent government policy in social regulation as carbon pricing provides a consistent signal to the market to consider the carbon price in business decisions and enables more aligned and efficient climate policy implementation, it is recommended that Korea develop and update the social cost of carbon through an ongoing working group comprised of various agencies.³⁸⁹

³⁸⁸ Given the court's overall deference toward agency discretion and the recent federal circuit court decisions discussed above, it is not highly likely that the court will actively intervene in the agency's assessment of the social cost of carbon and discount rate. This leaves questions about the direction of future court decisions on disputes surrounding the policies to be made under the new administration, for example, the criteria of the "reasoned explanation" for not using the social cost of carbon. In the case, an agency that once used the social cost of carbon based on the recommendation by the IWG denies this recommendation in newer policies based on the new Executive Order. The legal debate surrounding such policymaking will be subject to a considerable debate.

³⁸⁹ A survey of the OECD countries revealed that 12 out of 19 countries that provided a response have clear criteria for how to include greenhouse gas emission changes in the cost-benefit analysis in the transportation sector, and 6 out of 15 have clear criteria for the energy investment as of 2014. See Stephen Smith, Nils Axel Braathen, Monetary Carbon Values in Policy Appraisal, OECD Environment Working Papers, No. 92, 32-33 (2015).

B. Reasons for Developing the Carbon Pricing Scheme for Korean Case

As seen from the Korean cases, the agencies normally used the Benefit Transfer Method for pricing carbon, while the U.S. government devised a scheme on its own based on various scientific studies. The U.K. and Canada are also known to have their own schemes for consistent carbon pricing, aside from the U.S.³⁹⁰ The Benefit Transfer Method is often used for environmental evaluation, but there are a few legal, political and practical reasons to calculate the Korean scheme for the price of reducing greenhouse gases rather than borrowing the numbers used by other countries. The development of the new scheme should determine the social cost of CO₂ as well as the social cost of other types of greenhouse gases, including at least methane and NO_x.

First, determining the social cost of greenhouse gases will help firms and the government be prepared to negotiate the terms and conditions of the potential connection of the nationwide emissions trading scheme to the global market, which has recently been considered. Prominent economists have discussed a global linkage of market-based instruments in multiple jurisdictions,³⁹¹ and the Asian regional-level coordination has also been one of the frequently discussed topics recently.³⁹²

Second, the government should find a more persuasive and sophisticated scientific tool to establish the goal and methods of each energy policy with climate change implications. This would add more transparency and help make the energy policymaking process more effective

³⁹⁰ *Id.* at 25-30.

³⁹¹ *See*, for articles discussing the various types of existing linkages between market-based schemes in multiple jurisdictions, Matthew Ranson and Robert N. Stavins, Linkage of greenhouse gas emissions trading systems: learning from experience, *Climate Policy*, Vol. 16, Issue 3, 284-300 (2016); *See* for the discussions surrounding the political and practical issues to resolve to promote the expansion of the linkages, Michael A. Mehling, Gilbert E. Metcalf, and Robert N. Stavins, Linking Heterogeneous Climate Policies (Consistent with the Paris Agreement), Discussion Paper ES 17-6, Harvard Project on Climate Agreements (Oct. 2017).

³⁹² For example, Korea reportedly considers connecting its emissions trading scheme to those of Japan and China. *See* Ling Chen, China and Asia-Pacific Carbon Markets, *The Diplomat*, June 2, 2017, available at <https://thediplomat.com/2017/06/china-and-asia-pacific-carbon-markets/> (last visit Jan. 7, 2017). Japan, however, reportedly does not consider expanding the current cap-and-trade system in the Tokyo area and currently plans to introduce a carbon tax system to mitigate greenhouse gas emissions. *See* Climate Change Center, Press Release: International Conference on the Paris Agreement Article 6 and Northeast Asian Carbon Market, Dec. 8, 2017, available at <http://www.climatechangecenter.kr/2017/12/18/%EB%B3%B4%EB%8F%84%EC%9E%90%EB%A3%8C-%ED%8C%8C%EB%A6%AC%ED%98%91%EC%A0%95-%EC%A0%9C6%EC%A1%B0-%EB%B0%8F-%EB%8F%99%EB%B6%81%EC%95%84-%ED%83%84%EC%86%8C%EC%8B%9C%EC%9E%A5-%EA%B5%AD%EC%A0%9C/> (last visited Jan. 7, 2018). Professors Michael A. Mehling, Gilbert E. Metcalf and Robert N. Stavins propose that the market-based schemes to connect do not necessarily need to be the same form; in other words, an emissions trading scheme can be connected to a carbon tax system with a proper accounting scheme. *See*, for further discussion, Mehling, Metcalf, and Stavins, *id.*

and participatory, which is politically imperative, especially given the current turmoil of the energy sector in Korea. The damage from greenhouse gas emissions is a complicated concept, in that it is global but should be reflected in each nation's policymaking, and that it should differ based on various factors, e.g., the social discount rate that a country adopts in which the social consensus is reflected. Third, more practically, it is clear that the co-benefits of greenhouse gas mitigation should be better calculated by each relevant nation,³⁹³ and the calculation process of the social cost of carbon greenhouse gases will facilitate the estimation and use of the co-benefits in the case of Korea, given the current paucity of scientific research or communication with the public on the benefits of reducing the greenhouse gases, in terms of global warming, the direct damages from global warming on the Korean territory or the co-health benefits. This will help to mitigate the political conflicts of climate change policies by providing a more accurate report of the damage to the public. Scientific research has revealed that the co-benefits for human health from greenhouse gas mitigation are local and relatively short-term,³⁹⁴ which means that the co-benefits for Korean residents should be found and calculated by Korea on its own. The Ministry of Environment once recognized the necessity of the relevant research on co-benefits of climate change policy;³⁹⁵ however, the task is not simple enough to be conducted by the MOE alone, and there has not yet been notable progress in this regard.

Finally, the Korean administration has the legal mandate to reflect the social cost of carbon. The LCGGFA, the basic framework law for the energy and climate change policy, explicitly requires the government to economically analyze the costs and benefits of greenhouse gas reduction, which has yet to be fulfilled.³⁹⁶

³⁹³ The IPCC defined the co-benefits quite broadly and included “mitigation of air-pollution impacts, energy-supply security, technological innovation, reduced fuel cost, employment and reducing urban migration.” The IPCC pointed out that the co-benefits are “typically experienced on a local or regional level” and could be a critical factor for policy decisions but are often neglected by the relevant governments. See IPCC, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Section 4.5.3 (2007), available at https://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch4s4-5-3.html (last visited Jan. 3, 2018).

³⁹⁴ See, on concluding that the health benefits from the greenhouse gas mitigations should be considered when choosing the appropriate climate policies, Michelle L. Bell, Devra L Davis, Luis A. Cifuentes, Alan J. Krupnick, Richard D. Morgenstern and George D. Thurston, Ancillary human health benefits of improved air quality resulting from climate change mitigation, *Environmental Health*, Vol. 7 (2008). doi: 10.1186/1476-069X-7-41; see, on concluding that health co-benefits provide additional incentive to reduce greenhouse gases especially because those benefits are generally “local and near-term,” J. Jason West, Steven J. Smith, Raquel A. Silva, Vaishali Naik, Yuqiang Zhang, Zachariah Adelman, Meridith M. Fry, Susan Anenberg, Larry W. Horowitz, and Jean-Francois Lamarque, Co-benefits of Global Greenhouse Gas Mitigation for Future Air Quality and Human Health, *Nature Climate Change*, Vol. 3, 885–889 (2013). doi: 10.1038/NCLIMATE2009.

³⁹⁵ Ministry of Environment, Research on National Framework Plan for Climate Change Adaption (2011-2015): Final Report, 174-75 (2011), at <http://webbook.me.go.kr/DLi-File/091/018/009/5514290.pdf> (last visited Jan. 3, 2017).

³⁹⁶ Article 38, Para 2, Legislation No. 15101. It is not clear from that article, however, whether the “benefits” of greenhouse gas reduction mean the social cost of carbon. Article 3, Paragraph 7 further stipulates that the government should restructure the tax and financing system for the “economic costs” of

C. Necessity of a Clear Statutory Ground

As the scope of the judicial review is relatively narrow in Korea, and the court is less amenable to reviewing a substantial part of the policies, it would benefit Korean carbon pricing to have a clearer statutory ground for development, update and use. The 9th Circuit decision provided a turning point for carbon pricing through the interpretation of the NEPA, which might not be expected from the Korean court. Further, as the role of the court in administrative policymaking should be inherently limited, a legislative scheme will provide a more stable ground for carbon pricing that will be less influenced by political changes.³⁹⁷ The aforementioned provisions in the LCGGFA provide a starting point. The amendment should contain the establishment of an inter-agency working group,³⁹⁸ designing and updating the use of carbon pricing scheme, in a more direct way.

VI. Considerations for a Substantive Answer

It is worthwhile to note the Korean context of two commonly controversial issues for carbon pricing: how to set the social discount rate and what should be reflected in terms of global and local benefits.

environmental pollution or greenhouse gas emissions to be reflected in the market price of goods or services. The Act does not have more provisions to clarify the meaning of the “costs” in Article 38. Article 1 of the Act, however, stipulates that one of the primary goals of the Act is completing the nation’s responsibility in the global society, which indicates that the benefits of reducing greenhouse gases should be consistent with what global society understands. In this regard, the term “economic costs” in Article 3 can also be understood to be numerical costs.

³⁹⁷ In the case of Korea, legislative change is comparatively easier than in the U.S., as seen from the cases.

³⁹⁸ The process of working out the social cost of carbon which is highly technical as well as political warrants the diverse input and discussion among the various agencies. As seen from the cases concerning the conflicts between the MOTIE, responsible for the energy policy, and the MOE, responsible for environmental preservation, the political interest represented by each agency is diverse. This political issue in working out the agreed level and methodology of the social cost of carbon can also be addressed during the process for enactment of the relevant legislation in the National Assembly. However, the highly technical aspects of the modeling may not be properly managed only through the enactment process given the rather less organized lawmaking process in Korean National Assembly as discussed before.

A. Social Discount Rate

1. Possibility of Adopting a Lower Discount Rate than the Current One

The Korean government has tried to use a more unified number for the social discount rate used in policymaking. The Ministry of Strategy and Finance, the agency responsible for the national economy and finance, has set the social discount rate for the Preliminary Feasibility Study, required for large development projects in which government funds are invested, and recommended that other agencies use the discount rate in most of the cost-benefit analysis for general policymaking since 1999. The rate was initially set 7.5% in 1999 and decreased to 6.5% in 2004, 5.5% in 2007 and, most recently, 4.5% in 2017.³⁹⁹ The initial 7.5% rate was set primarily using the Marginal Social Opportunity Cost of Capital (MSOC), while the Social Rate of Time Preference (SRTP) has been used as the primary factor to determine the rate for the updates made in 2004, 2007 and 2017.⁴⁰⁰ The nominal interest rate of the national Treasury bond and the economic growth rate were also considered when updating the SDR in 2017, which appears to basically adopt the Ramsey rule.⁴⁰¹ A survey on the SDR in various jurisdictions published by the Asian Development Bank showed that developed countries tend to prefer the SRTP methodology over the MSOC, with wide variation in the actual rates.⁴⁰² The controversy over the methodology of deciding the social discount rate continues, while there is a rough consensus that the social discount rate for environmental policies should reflect intergenerational distributive justice concerns either at the initial calculation of the social discount rate or as a form

³⁹⁹ Article 52 of the General Implementation Guidelines for the Preliminary Feasibility Study issued by the Ministry of Strategy and Finance sets the social discount rate. (See, for the full text in Korean, http://mosf.go.kr/lw/denm/detailTbDenmView.do?searchBbsId1=MOSFBBS_000000000121&searchNttId1=MOSF_00000000010638&menuNo=7030000.) This Guideline is subordinate to Article 31 of the Operation Guidelines for Preliminary Feasibility Study and Article 38 of the National Finance Act (Legislation No. #). The past social discount rates and the rationale surrounding those rates can be found in the Ministry of Strategy and Finance, Press Release (Aug. 11, 2017), and Korea Development Institute, Update and Supplementary Research for Implementation of Preliminary Feasibility Study (5th ed.), 181-212 (Dec. 2008) (the research was instructed by the Ministry of Strategy and Finance.)

⁴⁰⁰ Ministry of Strategy and Finance, *id.*; Korea Development Institute, Update and Supplementary Research for Implementation of Preliminary Feasibility Study (5th ed.), Dec. 2008, p 181-212.

⁴⁰¹ Ministry of Strategy and Finance, *id.*; Frank P. Ramsey, A Mathematical Theory of Savings, *The Economic Journal*, Vol. 38, No. 152, 543-59 (1928); Christian Gollier, Pricing the Planet's Future: The Economics of Discounting in an Uncertain World, 36-39 (2013).

⁴⁰² See, Juzhong Zhuang, Zhihong Liang, Tun Lin and Franklin De Guzman, Theory and Practice in the Choice of Social Discount Rate for Cost-Benefit Analysis: A Survey, Economics and Research Department, Asian Development Bank, Working Paper No. 94, 16-20 (2007); Maria Damon, Kristina Mohlin and Thomas Sterner, Putting a Price on the Future of Our Children and Grandchildren, 57-59 in Michael A. Livermore and Richard L. Revesz (eds.), *The Globalization of Cost-Benefit Analysis in Environmental Policy* (2013).

of adjustment at a later stage.⁴⁰³ The Korean government adopted the SRTP as its basic rule to determine the SDR while maintaining the most conservative number within the range.

Aside from the general research about the methodology to calculate the social discount rate, some scholars have argued that the social discount rate in Korea should be further lowered given the recent lower economic growth rate and interest rate. The most recently updated 2017 SDR reflected this discussion; however, it is still meaningfully higher than the number suggested by academia or used by countries with a similar economic growth rate.⁴⁰⁴ The annual growth rate of Korea's GDP has been approximately 3% since 2012, when the country recovered from the 2008 global financial crisis.⁴⁰⁵ The Korea Energy Economics Institute recently published a paper concluding that an appropriate social discount rate for the social cost of carbon in Korea lies between 2.5% and 3% using prominent economic models.⁴⁰⁶ In this paper, the results of a survey of 612 energy and environmental economists in Korea about the appropriate level of the discount rate for Korea were also presented. The average of the responses was 3.26%, which does not significantly deviate from the 3% recommended by the IWG in the U.S.⁴⁰⁷ More recent research suggests similar rates. One of the papers holds that 2.9% to 4.9% is appropriate, and the other suggests 3.3% to 4.7%, both of which reflect the recent lower economic growth rate of Korea.⁴⁰⁸ Some of the countries with similar economic growth rates similar use a lower

⁴⁰³ See, e.g., Lawrence H. Goulder, and Robert N. Stavins, An Eye on the Future, *Nature*, Vol. 419, 673–674 (October 2002) (holding that the SDR should be the market rate of return, and the intergenerational distribution issues should be reflected aside from setting the SDR); Martin S. Feldstein, The Social Time Preference Discount Rate in Cost Benefit Analysis, *The Economic Journal*, Vol. 74, No. 294, 360-379 (June 1964) (holding that the SDR for public projects should be determined based on the social opportunity cost but reflect the social rate of time preference).

⁴⁰⁴ The adopted rate was a revision to a 10-year-old one, but it appears that a drastic reduction was not conceived as feasible given the possible impact on the whole economy, while the economic changes during those 10 years have been significant.

⁴⁰⁵ See Bank of Korea, National Income, available at http://www.index.go.kr/potal/stts/idxMain/selectPoSttsIdxSearch.do?idx_cd=2736. The annual GDP growth rate during the past five years between 2012 and 2016 was 2.3%, 2.9%, 3.3%, 2.8% and 2.8%. The OECD forecasts Korea's GDP growth rate for the next three years to be 3.2%, 3.0% and 3.0%. See OECD, *Economic Outlook*, Vol. 2017, Issue 2, 186-87 (Nov. 2017), at http://www.oecd-ilibrary.org/economics/oecd-economic-outlook_16097408.

⁴⁰⁶ Ji-Woong Lee et. al., *supra* note 315 at 133-186.

⁴⁰⁷ *Id.* at 185-86. They also concluded the amount of the social cost of carbon is temporarily 26,600/tCO₂ Korean won (approximately \$24 USD), considering the amount used in the U.S. and the E.U. and the difference between the economic status of the U.S. or E.U. and Korea. The Institute did not try to measure the social cost of carbon itself, as the research team was comprised of economists and legal scholars, without scientists. The paper argues that more systematic research is warranted. *Id.* at 187-94.

⁴⁰⁸ Sang Kyun Kim, The Effect of Social Discount Rate Manipulation on the Economic Feasibility Test: Focusing on the Environmental Public Investment Projects, *Journal of Environmental Policy*, Vol. 12, No. 4, 71-92 (2013); Ji Eun Choi, and Tong Kyu Park, Estimation of the Social Discount Rate for the Public Investment Projects, *Journal of Social Science*, 145-167 (2015).

rate for projects with environmental impacts. Canada currently uses 3% as the central social discount rate setting the social cost of carbon⁴⁰⁹ and has long used 0% to 3% of the discount rate for policies with higher environment and health impacts than normal, long-term development projects.⁴¹⁰ The Ministry of Finance in the Netherlands currently recommends a 3% discount rate.⁴¹¹ Professors Joseph Stiglitz and Robert Lind hold that the value of the social discount rate might vary for each project because it depends on a number of relevant factors.⁴¹² Several countries, including the U.S., Canada and Spain, have indeed used a lower discount rate for projects and policies with environmental concerns.⁴¹³ Thus, it is conceivable to adopt a lower SDR for climate policy to have a more effective climate change policy.

2. Declining Discount Rate

The Korean government uses a time-declining discount rate for projects with more than 30 years of analysis period, at 4.5% for the initial 30 years and 3.5% for the period after 30 years, though only railroads and water resources are relevant at this time.⁴¹⁴ This means the discount rate applied to other types of projects assumes an analysis period to be 30 years or less within a generation, which is at odds with the nature of climate change policies where the benefits from mitigation or damages from greenhouse gas emissions affect future generations. There have been debates over how to reflect the greater uncertainty about the distant future, while it has been proved that the greater uncertainty makes the discount rate lower than the ones currently

⁴⁰⁹ See, Environment and Climate Change Canada, Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates (March 2016), at http://publications.gc.ca/collections/collection_2016/eccc/En14-202-2016-eng.pdf (last visit Feb. 21, 2018).

⁴¹⁰ Anthony E. Boardman, David H. Greenberg and Mark A. Moore, The Social Discount Rate in Canada, in Aidan Vining, and John Richard (eds.), *Future Issues in Public Infrastructure in Canada* (2001).

⁴¹¹ C. Hepburn, and B. Groom, B, Looking back at social discount rates: effect of papers, presentations and personalities on policy, *Review of Environmental Economics and Policy*, Volume 11, Issue 2, 336–356, 349-350 (2017).

⁴¹² Joseph E. Stiglitz, The Rate of Discount for Benefit-Cost Analysis and the Theory of the Second Best, 151-202; Robert C. Lind, The Rate of Discount and the Application of Social Benefit-Cost Analysis in the Context of Energy Policy Design, 443-457 in *Resources for the Future Library Collection Energy Policy Vol. 3: Discounting for Time and Risk in Energy Policy*, 1982 (reprinted in 2011).

⁴¹³ The U.S. EPA has generally used a lower discount rate than other agencies, even before the IWG published the recommended social cost of carbon. Spain is known to have used a lower discount rate for policies on water use. See Damon et. al., *supra* note 402 at 63; Humberto Lopez, The Social Discount Rate: Estimates for Nine Latin American Countries, Policy Research Working Paper 4639, World Bank Latin America and the Caribbean Region, 3 (June 2008). For the Canadian case, see Boardman, et. al., *supra* note 410.

⁴¹⁴ Article 52 of the General Implementation Guidelines for Preliminary Feasibility Study. The government has used a time-declining discount rate for water resources since 2004.

observed effective over the long term in the instant future.⁴¹⁵ Those literature suggest that declining discount rate will better incorporate the uncertainty.⁴¹⁶ A recent research holds more specifically about the climate change policy that the time-declining discount rate more accurately reflects the rates of time preference and uncertainties in the future.⁴¹⁷ The U.K and French government have adopted a declining discount rate for projects with long term effects.⁴¹⁸ In this regard, adopting a declining discount rate might be also considered as an option when determining the social cost of carbon, especially in the case that the current social discount rate of 4.5% must be applied without further reduction.

B. Global Benefit vs. Local Benefit

A recent survey showed that the amount of carbon pricing in most other countries is not lower than the social cost of carbon amount used in the U.S. when reflecting the difference of GDP between the U.S. and the relevant countries,^{419,420} although it is questionable whether the amount of the social cost of carbon adjusted proportionately by the GDP will be effective to mitigate climate change.⁴²¹

⁴¹⁵ Martin L. Weitzman, Why the far-distant future should be discounted at its lowest possible rate, *Journal of Environmental Economics and Management*, Vol. 36, Issue 3, 201– 208 (1998); Richard G. Newell and William A. Pizer, Discounting the Distant Future: How Much do Uncertain Rates Increase Valuations?, *Journal of Environmental Economics and Management*, Vol. 46, Issue 1, 52-71 (2003); Gollier, *supra* note 401 at 111-127.

⁴¹⁶ Weitzman, *id.*; Gollier, *id.*

⁴¹⁷ Kenneth J. Arrow, Maureen L. Cropper, Christian Gollier, Ben Groom, Geoffrey M. Heal, Richard G. Newell, William D. Nordhaus, Robert S. Pindyck, William A. Pizer, Paul R. Portney, Thomas Sterner, Richard S. J. Tol, and Martin L. Weitzman, Should Governments Use a Declining Discount Rate in Project Analysis?, *Review of Environmental Economics and Policy*, Vol. 8, Issue 2, 145-163 (2014); Lawrence H. Goulder and Roberton C. Williams III, The Choice of Discount Rate for Climate Change Policy Evaluation, *Climate Change Economics*, Vol. 3, No. 4 (2012) (suggesting that the discount rate for climate change should be time-declining).

⁴¹⁸ Arrow et.al., *id.* at 146.

⁴¹⁹ P. H. Howard, and J. Schwartz, Think Global: International Reciprocity as Justification for a Global Social Cost of Carbon, *Columbia Journal of Environmental Law*, Vol. 42, 203-294, 223-231, 285-294 (2016). The article tries to show that many other countries are considering the global benefits for the social cost of carbon through comparing the amount of the social cost of carbon in each country and that used by the U.S. federal government. The reason why only GDP has been considered in this analysis was not provided in this article, while it is supposedly intended to show the proportional ratio of the responsibility for the climate change.

⁴²⁰ The U.K., the Netherlands, Finland and Italy also use the social cost of carbon. See R. W. Hahn and R. A. Ritz, *supra* note 327, at 2.

⁴²¹ This might create leakage problems from an economic perspective, at least. One of the previously discussed policy documents of the Korean government indeed used methodology that adjusted the amount

On the other hand, those supporting a focus on domestic benefits maintain that the appropriate action for the United States depends in part on what other countries do, and judgments about such matters are political rather than technical because the Constitution does not delegate the authority to make policies reflecting the benefits to other jurisdictions at the cost of the U.S. to the administration.⁴²² According to the IWG, domestic benefits, the social cost of carbon for the U.S., is only around \$7-10 and difficult to calculate because of the inherently global nature of the harms from global warming.⁴²³ Advocates of domestic benefits once suggested that it should be between 7% and 13% of global benefits, which is less than \$5.⁴²⁴ The difference between \$36/ton and \$5/ton is immense, and it will decisively affect the relevant policy direction. More practical opponents of global benefits argue that, in the case of the U.S., the country should try to determine the proper value of domestic benefits, pointing out that expecting or relying on full global reciprocity is unrealistic.⁴²⁵

This controversy has continued. The debate gained more significance due to the Executive Order issued in March 2017, reviewed below. In addition to the fundamental notion that the climate is the global commons, there are some strategic, practical and legal reasons to reflect global benefits when determining the social cost of carbon. First, if each country only reflects local benefits and damages when designing a climate policy, the remaining damages will not be addressed by any country. Given that the purpose of climate damage policy is to internalize the externalities of greenhouse gas emissions, a climate policy reflecting only local damages significantly undermines efficacy and does not have a reason to exist. This problem grows when we consider the significant portion of greenhouse gas emissions from developing countries, including China and India. If those countries only consider the domestic damages from their own emissions when deciding spending on mitigation policies, the remaining global damages or the costs to cover those damages will be borne by other countries, which is not practically feasible. Some scholars hold that game theory explains that counting global damage is a winning strategy in this context.⁴²⁶ Second, the global discussion over reduction efforts has rapidly evolved since the Paris Agreement, and the advancement of technology for renewable

of the social cost of carbon of the IWG by the difference of GDP between the U.S. and Korea, which resulted in a significantly low amount of the social cost of carbon. *See infra* Chapter 4.

⁴²² Masur and Posner, *supra* note 208 at 1596-97.

⁴²³ IWG, *supra* note 319, at 10-11.

⁴²⁴ 2015 WL 12978953 (C.A.7) (Appellate Brief), 7th Circuit, Brief of Petitioners Zero Zone, Inc. & Air-Conditioning, Heating and Refrigeration Institute, 28-29.

⁴²⁵ T. Gayer, and W. Kip Viscusi, Determining the Proper Scope of Climate Change Policy Benefits in US Regulatory Analyses: Domestic versus Global Approaches, *Review of Environmental Economics and Policy*, 257-261 (2016); Robert Stavins, Local Costs and Global Benefits, *The Environmental Forum*, Vol. 31, No. 5, 14 (2014).

⁴²⁶ Howard and Schwartz, *supra* note 419 at 221-231; Stephen J. DeCanio & Anders Fremstad, Game Theory and Climate Diplomacy, *Ecological Economics*, Vol. 85, 177-187 (2013) (describing that “the most serious difficulties in reaching a global climate protection agreement arise if one of the major countries, the ones whose emissions alone are enough to produce dangerous anthropogenic interference with the climate, ranks highest the outcome in which it pollutes while the rest of the world abates”).

energy generation has been quite fast, which mitigates the concerns of the opponents of using global benefits based on the reciprocity issue. The recent massive shale gas production, which has begun to replace coal, also contributes to this point. Third, there are legal grounds for considering the global benefit for climate policies in the U.S. and Korea. Professor Daniel Farber interpreted that the NEPA and the Clean Air Act certainly provide a legal basis.⁴²⁷ The NEPA requires the federal government to “recognize the worldwide and long-range character of environmental problems” and “where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind’s world environment.”⁴²⁸ The Clean Air Act requires the EPA to take appropriate measures when the agency “has reason to believe that any air pollutant or pollutants emitted in the United States cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare in a foreign country.”⁴²⁹ It is also notable that the 7th Circuit recently approved an agency’s use of global benefits, which might signify that the court directly justified the use of global benefits vis-à-vis domestic benefits, while it did not present detailed reasoning affirming that use and simply deferred to the agency’s discretion.⁴³⁰

In the case of Korea, the framework implementation legislation, the LCGGFA, takes a similar approach to the provision of the NEPA and stipulates that one of the primary goals of the Act should be completing the “nation’s responsibility in the global society,” and the government should “participate in the global efforts” for responding to the “climate change problems caused by the global warming.”⁴³¹ These provisions indicate that the benefits of reducing greenhouse gases should be consistent with what global society understands. Based upon the provisions, it would be sensible to interpret that the “benefits of greenhouse gas reduction” under the other provision of the Act⁴³² includes global benefits with local co-benefits for health.

⁴²⁷ Daniel Farber, *The Social Cost of Carbon – Revisited: The case for using global rather than simply U.S. impacts*, Legal Planet (Feb. 22, 2018), at <http://legal-planet.org/2018/02/22/the-social-cost-of-carbon-revisited/> (last visited April 13, 2018).

⁴²⁸ *Id.* Section 102(2)(F) of National Environmental Policy Act.

⁴²⁹ Daniel Farber, *supra* note 427. Section 115 of Clean Air Act.

⁴³⁰ *Zero Zone, Inc. v. United States Department of Energy*, 832 F.3d 654 (7th Cir. 2016).

⁴³¹ Article 1, Article 38, Para 1, Low Carbon and Green Growth Framework Act (“LCGGFA”), Legislation No. 15101.

⁴³² Article 38, Para 2, LCGGFA (legislation no. 15101).

CHAPTER 5

RECOMMENDATIONS FOR REFORM: PROCESS AND GOVERNANCE

This chapter discusses recommended improvements to properly utilize the social cost of greenhouse gases in terms of the policymaking process and the structure of the agency responsible for energy policy. Section I proposes reforms in three systems to make the energy policymaking process more transparent and effective in reflecting the social cost of greenhouse gases. Section II proposes establishing an independent agency responsible for energy policies, the Korean Energy Commission, with suggestions for structuring. The ownership change in the government corporations in the electricity sector is also proposed.

I. How to Improve the General Decision-making Process

Once the social cost of carbon determined, an adequate process to utilize in the cost-benefit analysis of climate change policies will be needed, along with a supportive legislative ground. As seen in the case studies of Korean policies, the current legislative language requiring the agency to assess and consider the climate change impact has yet to gain legal authority, and it appears that the court's proper intervention through judicial review should not necessarily be expected.

As discussed, the checking function of the court vis-à-vis the administrative process is minimal in Korea due to the German administrative law heritage, while serious discussions to change this aspect is about to begin. In the meantime, bringing changes to legislation, which the court technically relies on as the basis of judicial review, and structural changes in the administration would be effective in order to realize the climate policies in the energy sector.

In this regard, this section proposes institutional and procedural changes to realize the use of the social cost of carbon based on the policy implications from the problems in the case studies in Chapters 3 and 4. The proposed changes, together with proper carbon pricing, aim to contribute to enhancing the effectiveness of the cost-benefit analysis for energy policies and transparency with more participation from the public and the market.

A. *Climate Impact Assessment of the National Energy Plans*

The current energy supply is planned by the government in advance using large-scale energy plans involving the regulatory impact assessment or any other institutional checking system. Even if the social cost of carbon is determined by research based on proper modeling in the future, the practical authority of the energy plans could undermine its efficacy when it comes to deciding on an individual climate policy. In this regard, there are three conceivable options that would mitigate structural problems.

The first option is removing the authority of the national energy plans and making them work as a forecast as the U.S. Annual Energy Outlook issued by the Energy Information Agency. This may not require legislative changes because no legislation explicitly requires the Ministry of Trade, Industry and Energy to adhere to the energy plans. Selecting this option will, however, make the practical change more difficult and time-consuming, as this option is an effort to remove the customary practice without positive legal changes. Further, it might be difficult to achieve without an expansive privatization of the energy sector, a process that would be extremely slow if at all advanced, given that the current wholesale and retail electric power markets and the natural gas market are almost monopolized by the government-owned corporations.

Second, expanding the coverage of the current regulatory impact assessment system to include the national energy plans might be also considered as an alternative. This could be done by amending the Administrative Regulations Framework Act, which would not be extremely difficult given the relatively simple process of legislative activities in the Korean Congress. It may not be desirable in terms of the structural consistency of the law because neither the Basic Energy Plan nor the Basic Electricity Plan falls squarely under the concept of “regulation.”

Third, as the final alternative, requiring the agency to prepare a climate impact assessment by law may be considered when publishing a policy guideline or establishing a new rule or policy relevant to climate concerns that are not subject to the environmental impact assessment or regulatory impact assessment. This can be done by providing a legislative ground in the LCGGA, which is the basic framework law of the entire energy policy. As previously seen, the Act already has a provision requiring the government to consider the climate change impact when designing policies.⁴³³ So, the legislative ground of the alternative can be achieved by adding language on the way the government should prepare a climate change impact assessment with economic analysis for carbon pricing. This is the alternative that would need the most modest change but have the most direct impact. For a more accurate definition of the requirement, the policies subject to it can be listed in a positive way, while it needs to add language to cover all the temporary plans of the government to reduce greenhouse gases.⁴³⁴

B. Materializing the Function of the Regulatory Reform Committee

The current regulatory review process by the RRC does not add value to the draft regulation, at least for energy-related policies, as seen in the case of the RPS. This might be partly because the actual supervisory authority of the entire energy policy is concentrated in the Ministry of Trade, Industry and Regulation, and because the review process of the Committee

⁴³³ Article 38, Legislation No. 15101.

⁴³⁴ The Korean government issues temporary national plans for environmental concerns, e.g., the Comprehensive Plan for Management of Particulate Matter in September 2017. See, Ministry of Trade, Industry and Energy, Ministry of Environment, Ministry of Land, Infrastructure and Transport, et. al., Press Release (September 26, 2017) in *supra* note 284.

has been designed to allow the Committee to perform a rather superficial review. As seen in the case of the RPS, the Committee does not receive any backup materials for the regulatory impact assessment prepared by the agency in a summarized form during the review process. There is no process for other interested agencies to participate in the process, which discourages the Ministry of Environment from providing the energy policies of the agencies responsible for economic growth. In this regard, the following proposals to improve the process might be considered.

First, in order to make the review process more effective, more evidentiary documents need to be attached to the regulatory impact assessment submitted to the Committee and docketed for public review. The Administrative Regulation Framework Act currently requires the agency to attach a summary of the comments from other agencies or interested parties to the regulatory impact assessment when submitting it for the Committee's review.⁴³⁵ However, the 2012 RPS document showed no reference to comments from other agencies and only mentioned the number of meetings that the agency had with vaguely specified groups.⁴³⁶ This change would require amendment of the relevant provisions in the Administrative Regulation Framework Act and would help the energy regulations to be more consistent and detailed.

Second, the Committee should take over a significant portion of the coordination work rather than passively receiving the end result of the discussion.⁴³⁷ Within the review process, the Committee should be invited to or lead the discussion among the agencies, and the other interested agencies should be given the opportunity to join the regulatory review hearing. This was presented as one of the most significant and effective functions of the Office of Information and Regulatory Affairs.⁴³⁸ As climate policies, including carbon pricing, typically need inter-agency cooperation in designing and implementation, the enhanced coordination role of the RRC will especially benefit the effective establishment and implementation of those policies.

C. Introducing the Assessment Process for Legislation Proposed by Lawmakers

Materializing the regulatory impact assessment and the RRC's review process might raise the relative ratio of the regulations made by legislation proposed by lawmakers, which lie outside of the regulatory review process, as we saw from the trend in the legislative process in which agencies utilize Congress to alter the regulatory review process in Chapter 3. In this regard, the need for introducing a regulatory review process in the legislative process of regulations proposed by lawmakers is important in Korea. The Legislation & Judiciary Committee within the National Assembly, whose function at this time is limited and less organized, may be the

⁴³⁵ Article 10, Para 2, South Korean Law No. 5368, last amended as Law No. 14184 as of May 29, 2016.

⁴³⁶ RRC Agenda No. 2012-544: Draft Amendment of the Act on Development, Use and Diffusion of the New and Renewable Energy, Resolved on Nov. 22, 2012, 11-12 (2012).

⁴³⁷ One of the current focuses of the function of the RRC appears to be the ombudsman function addressing claims filed by individual citizens.

⁴³⁸ Revesz, and Livermore, *supra* note 177 at 174-179; Sunstein, *supra* note 181 at 1842-43.

starting point. Further, the well-established assistant organizations, such as the National Assembly Secretariat, may be utilized to build the system. The Secretariat is one of the assistant organizations that, at the request of each lawmaker who presents an initial idea on a new draft bill, performs research on the legislative policy, collecting comments from outside experts and drafting the legislation.⁴³⁹ Thus, if the current authority of the Legislation & Judiciary Committee and the tasks performed by the Secretariat are systemized by a legally designated process, founding the assessment system within the legislature may not be a costly task.⁴⁴⁰ On the other hand, creating a procedural burden on the legislative process might face challenges from lawmakers in general. In this regard, limiting the scope of draft bills either by the significance of the potential impact or the areas, e.g., energy, national security, etc., might be an alternative. This change would require an amendment of the National Assembly Act.

II. How to Improve Energy Governance for the Diversifying Market

A. Structural Causes of the Problems

The structural problems in the energy governance responsible for the energy policy that have been discussed may be summarized in three categories: (i) the lower expertise of the civil servants involved in energy policymaking due to the unique rotation system in Korean bureaucracy; (ii) the structure of the Ministry of Trade, Industry and Energy, which covers both the energy sector and the general industries; and (iii) the phenomenon of former civil servants of the MOTIE often recruited to be the management of government-owned corporations.

Korea has operated several levels of national exams and training systems in hiring government officials, and the central ministries are typically led by civil servants who passed the highest level of exams and commit to longer periods of work, which has been the basis of the technocrat system supporting the Korean administration.⁴⁴¹ The Korean technocrat system was known to be highly efficient, in that the highly educated elite group with expertise designs and implements government policies with decent social recognition and stable working conditions.⁴⁴² The country's bureaucratic system has been highly regarded for its efficient management of the government which resulted in the rapid economic growth after the Korean War until recently.

⁴³⁹ National Assembly Secretariat, The Roles and Functions, at http://korea.assembly.go.kr/secretary/over_01_02_01_01.jsp (last visited March 7, 2018).

⁴⁴⁰ The idea of requiring the RRC's review on draft bills proposed by lawmakers has also been proposed, but this structure will have constitutionality issues in terms of the separation of powers principle.

⁴⁴¹ For details of the hiring system, see Soo-Young Lee and Seulki Lee, Civil Service Reforms and the Development of Korea, *The Korean Journal of Policy Studies*, Vol. 29, No. 1, 47-67 (2014).

⁴⁴² Kongdan Oh, Bureaucracy-Think Tank Partnership Powered Korea, Brookings Institute (March 12, 2010), at <https://www.brookings.edu/articles/bureaucracy-think-tank-partnership-powered-korea/> (last visited April 5, 2018).

In the case of administration of energy policies, however, a structural problem has created inefficiencies. One of the general operational rule of the technocrat system, the rotation system requiring relocation of public servants to another division within an agency typically biennially, has contributed to the failure in educating specialists with the proper expertise in the energy sector due to the structure of the MOTIE.⁴⁴³ The rotation system was introduced to enhance the efficiency of work and to minimize possible corruption that might result from the negative capture of the officials by the regulated parties;⁴⁴⁴ however, it ironically deprives the public servants the opportunity to earn expertise and creates repeated time-consuming work for frequent changes in position.⁴⁴⁵

The energy policy has been led by the Office of Energy and Resources (OER) within the MOTIE since 1993.⁴⁴⁶ The OER is one of the six offices in the MOTIE, of which the other five are responsible for the general industries and international trade policies. The public officials of the MOTIE, as the officials in other central agencies, are subject to regular rotation across the six offices every two years, and senior officials with the title of director or higher rotate annually on average.⁴⁴⁷ This naturally makes the average of a civil servant's term of working in the OER relatively shorter than the term working in other offices. Thus, under the current personnel change system, it is not feasible for public officials to develop expertise in energy policy, which requires extensive understanding and knowledge about the energy industry, economics and security issues. Given that recruiting from outside experts is extremely rare, the overall level of expertise of a civil servant making energy policy leaves much to be desired in comparison with her entire term of service within the MOTIE.

The government announced in 2014 that the divisions of the OER were released from the strict rotation system, which was expected to promote the expertise of the civil servants in the office.⁴⁴⁸ However, this does not necessarily mean that the civil servants in the OER should stay in the office. One of the press releases on the promotion and rotation issued by the MOTIE in 2016 illustrates that the previous system persists. Six divisions within the OER had a new division head as part of the rotation then, of which only one was transferred within the OER, and the other five came from other bureaus or offices not directly relevant to energy policies.⁴⁴⁹

⁴⁴³ The rotation system has a legal basis in Articles 44 and 45 of the Presidential Decree, Civil Servants Recruitment Rule (Presidential Decree No. 28572).

⁴⁴⁴ *Id.* at 64-65.

⁴⁴⁵ Aside from the energy sector, the problems of the rotation system undermining the expertise of the civil servants have been seriously debated and the government is recently trying to improve the system through granting options for each civil servant to focus on a certain area of work within an agency.

⁴⁴⁶ The Ministry of Power and Resources was abolished and incorporated as one office under the MOTIE in 1993. So, before 1993, the officials working for the Ministry of Power and Resources worked in such a way that they could develop expertise.

⁴⁴⁷ Kwang-ho Kim, A Study on Job Rotation in Civil Service, Korea Development Institute, KDI Journal of Economic Policy, Vol. 30, Issue 2, 68-70 (2008).

⁴⁴⁸ Ministry of Security and Public Administration, Press Release (July 1, 2014).

⁴⁴⁹ Ministry of Trade, Industry, and Energy, Press Release (April 29, 2016). There are 20 divisions

The incumbent chief of the OER appointed in 2017 has worked for other offices in the MOTIE and had no experience in working for the OER since 2001.⁴⁵⁰ Among the immediate eight predecessors of the current chief of the OER, only two had noticeable periods of working for the OER before the appointment, and the other six spent most of their career regulating other types of industries within the MOTIE.⁴⁵¹

This problem becomes graver if we consider the dynamics between the OER and other offices in charge of industry and trade policies within the MOTIE. As the energy industry is one of many industries that the MOTIE supervises, and energy has been considered as a mere cost factor of general industry until recently, the OER's function appears to have been rather supplementary for other offices of the MOTIE. If we borrow the theory of defining regulation of Professor Stigler, the status of the MOTIE's regulatory capture by the general industry is rather simply explained. Professor Stigler described regulation as a product subject to the supply and demand rule, whereby the supplier is the regulating agency in case the Congress delegates the authority to regulate, and the demander is often the business group that expects benefits from the regulation.⁴⁵² The demand from the general, non-energy industries would have been stronger than the energy industry, given the relative economic size of each group. Further, Professor Stigler also showed that the competition between different demander groups, the producer group with concentrated interest versus consumer group with diffused interest, typically resulted in the victory of the group with concentrated interest.⁴⁵³ Thus, it would have been natural for the MOITE officials to place more weight on reducing the cost of the industry, rather than properly reducing green-house gases and promoting renewable energy generation for the general interest of the public.

The fact that most of the energy industry still consists of state-owned companies adds another layer to the problem. The government currently holds 51% of shares in the KEPCO, monopolizing the electricity transmission and retail market. The KEPCO's subsidiaries operating power generators using fossil fuel and nuclear resources have more than 85% of the market share in the electric power wholesale market.⁴⁵⁴ The government, together with the

within the OER as of April 2018.

⁴⁵⁰ Chosun-Ilbo, Search for People, at <http://db.chosun.com/people/index.html> (last visited March 30, 2018). The media report on his appointment briefly mentioned that the person was engaged in energy policies in early 1990s when he began his career as a civil servant. The detailed working history of this person before 2001 is not publicly available.

⁴⁵¹ The analysis is based on a database available in the website of Chosun-ilbo, one of the most renowned media in Korea. See Chosun-Ilbo, Search for People, at <http://db.chosun.com/people/index.html> (last visited March 30, 2018).

⁴⁵² George Stigler, *The Theory of Economic Regulation*, Bell Journal of Economics and Management Science, Vol. 3 (1971).

⁴⁵³ *Id.*; Sam Peltzman, *George Stigler's Contribution to the Economic Analysis of Regulation*, Journal of Political Economy, Vol. 101, no. 5, 818-832 (1993).

⁴⁵⁴ Korea Electric Power Statistics Information System, Power Trade Volumes in 2015, at <http://epsis.kpx.or.kr/epsis/ekmaStaticMain.do;jsessionid=MtnqYb6f13Lt1T2pThKrrz60IFbbtfkM97GFnZy2wZ7vyV2dlfpt!241999982?cmd=004052&flag=&locale=KR> (last visited Feb. 10, 2018).

KEPCO, holds more than 54% of the shares in the Korea Gas Corporation, which is also a monopolistic importer of gas. Those energy companies all operate under the supervision of the MOTIE, which makes its interests align with those of the energy companies. Deploying renewable energy or reducing fossil fuel energy consumption directly leads to the decrease of revenue of those energy companies, which will then require the MOTIE to solve another issue, whether and how to restructure those energy companies' business in the face of such new business challenges. There is also a possibility for the subtle corruption that may affect public officials in the MOTIE whose hope for future advancement may lie in working for the energy companies they are currently supposed to regulate.⁴⁵⁵ In fact, among the six CEOs of the KEPCO from 2002 up until 2017, three are from the MOTIE, one is a former civil servant in another ministry⁴⁵⁶ and the other two are from the private sector with no direct relevance to the energy industry.⁴⁵⁷ Two out of the six generation subsidiaries have a former official of the MOTIE as CEO as of 2018.⁴⁵⁸ This explains why the MOTIE was less incentivized to seek renewable energy generation or to reduce fossil fuel consumption.

B. Proposals for Reform

Two proposals for reform in energy governance are presented in this section to mitigate the aforementioned problems; one concerns the agency restructuring for creating an independent new energy agency, and the other concerns the market structure with more participation from the local government as an alternative to the current, centralized one.

⁴⁵⁵ Alfred E. Kahn, *The Economics of Regulation: Principles and Institutions*, The MIT Press, Vol. II, 11-12 (1988).

⁴⁵⁶ The current CEO of the KEPCO is also a former vice minister of the MOTIE. The information on the past CEOs of the KEPCO is available at the following news reports: H.J. Cho, *The KEPCO CEO*, H.I. Cho, *Reelected by the Shareholders' Meeting* (Fe. 22, 2016), available at http://biz.chosun.com/site/data/html_dir/2016/02/22/2016022202838.html; I.S. Kwak, *KEPCO's New CEO is I.H. Cho, the Former Vice Minister of the MOTIE*, CBS (Dec. 17, 2012), available at <http://www.nocutnews.co.kr/news/991119>; M.W. Park, W.G. Lee, *the CEO of the KEPCO*, Mael Business News (Jul. 11, 2007), available at <http://news.mk.co.kr/v3/view.php?year=2007&no=365274>; J.R. Chung, *State-Owned Companies in Untouchable Region Exempted from Reform (IV): KEPCO*, *Weekly Chosun Magazine* (Dec. 2004), available at http://weekly1.chosun.com/site/data/html_dir/2004/12/20/2004122077009.html.

⁴⁵⁷ One is a former CEO of a construction company and the other is a former CEO of a home appliances manufacturer.

⁴⁵⁸ The CEOs of the other four generation corporations are from either from the KEPCO or the research institute run by the MOTIE.

1. Agency Structure

The first step to propose is to establish a new government body, the Korea Energy Commission (Energy Commission), securing independence from the other industries and political changes.⁴⁵⁹ The proposals for the Energy Commission are modeled after the U.S. FERC with inputs from past experiences in the operation of the current Korean independent government bodies.⁴⁶⁰ The call for a central agency responsible for energy is expected to grow, given that the diversity of the energy markets is growing. More LNG generators and demand response aggregators have entered the wholesale market. The electricity sector, once regarded as a domestic business, will have foreign investors, as can be seen from the offshore wind projects.⁴⁶¹ The long-planned privatization of the power generation subsidiaries of the KEPCO might be at least partially implemented sooner or later, if proper investor groups with less political opposition are to be found. The wholesale LNG market, monopolized by the Korea Gas Corporation (KOGAS), might be opened up to private companies as well in several years, given the most recent heated debates.⁴⁶² These changes will add diversity to the market, which will result in more demand for expertise, transparency and predictability in energy policymaking.

⁴⁵⁹ It is notable that at least some of the leading OECD countries have an energy agency independent from the ministries responsible for general industry or finance. For example, Japan established the Agency for Natural Resources and Energy in 1973, which was once a bureau of the Ministry of Economy and Industry. In the U.S., the federal agency with expertise in energy regulation has been in operation since 1935, the Federal Power Commission, which was renamed the Federal Energy Regulatory Commission in 1973 when the Department of Energy was established and energy law was reorganized in response to the oil crisis. The French energy agency, Agence de l'environnement et de la maîtrise de l'énergie (ADME), is in charge of both environmental and energy matters, which is another appropriate combination in the climate change era.

⁴⁶⁰ The Financial Services Commission responsible for the financial sector with a similar role to the U.S. Securities and Exchange Commission, the Korea Fair Trade Commission is responsible for antitrust and consumer protection, and the Korea Communications Commission, similar to the U.S. Federal Communications Commission, and the Nuclear Power Safety Commission are the primary independent agencies that might be referred to as precedents.

⁴⁶¹ David Foxwell, Offshore wind boosted by significant investment in renewables, *Offshore Wind Journal* (Jul. 25, 2016), at http://www.owjonline.com/news/view/offshore-wind-boosted-by-significant-investment-in-renewables_43910.htm (last visited April 6, 2018). European wind project companies have reportedly started to be involved in Korean offshore wind power projects, though the progress has been slower than originally planned.

⁴⁶² Firms are allowed to import only the volume for their own use as of March 2018. The labor union of the KOGAS opposes further expansion of private importation, highlighting the concerns of cost increases and energy security. The labor union of the KOGAS asserts that the import price of the KOGAS is much cheaper than that of the private firms, while the individual firms argue otherwise. See, for the most recent debate, e.g., Je-Yong Chae, Expansion versus Public Concerns about Direct Importation of LNG, *Energy & Environment News* (March. 29, 2018), at <http://www.e2news.com/news/articleView.html?idxno=107500> (last visited April 6, 2018).

a. The Scope of Authority and Independence from the General Industry

Independence from the general industry can be achieved through establishing the Energy Commission to focus on the overall energy policymaking, combining the role of the Office of Energy and Resources and the Electricity Commission⁴⁶³ within the MOTIE. The authority to supervise the Korea Power Exchange (KPX) should be also transferred to the Commission, including the pricing function currently carried by the Cost Assessment Committee within the KPX.⁴⁶⁴ Public corporations and research institutes operated by the MOTIE should be also relocated.⁴⁶⁵ A new statute will be required to provide legal ground of the Energy Commission and its authority and obligations, which should make it clear that the Commission's primary mission includes making sustainable energy policy.

The Energy Commission would cover the entire energy industry, e.g., electricity and gas, the natural energy resources exploitation business and the new policies introduced to deploy renewable energy, e.g., the RPS. The scope of work would include basically all of the regulatory area, including but not limited to the licensing of the energy business, rate making and the general market oversight to secure a reliable energy supply, intervene in mergers and acquisitions between energy companies and to participate in enforcement activities.

The current Ministry of Trade, Industry and Energy would remain as the Ministry of Trade and Industry, involved in cross-border trade issues related energy. The U.S. FERC is an agency within the Department of Energy and still maintains the independency. This historical background of the creation of the two agencies⁴⁶⁶ and the current statutory support may have contributed the FERC's independence from the DOE. In the case of Korea, it might be less effective to install the Energy Commission within a certain ministry, e.g., the Ministry of Trade, Industry and Energy, due to the strict hierarchy in bureaucracy. The existing structure, in which the Office of Energy and Resources is supervised by the Minister of Trade, Industry and Energy, might undermine the independence if the Energy Commission is installed within the ministry due to the historical relationship between the MOTIE and the Office of Energy and Resources.

The authority to control the safety of nuclear power generation should remain with the Nuclear Safety and Security Commission, which is an independent agency under the Office of

⁴⁶³ The current Electricity Commission within the MOTIE is a vehicle responsible for the review of certain energy policies and disputes between the interested parties. With respect to energy policies, the Electricity Commission is simply an internal consulting body for the MOTIE and only has the obligation to review to issue a reference for the MOTIE's decision-making.

⁴⁶⁴ The Cost Assessment Committee is established based on the Power Market Operation Rule of the KPX. Once the function is transferred, the Committee need not be separately maintained within the Energy Commission.

⁴⁶⁵ The MOTIE supervises tens of public corporations for research and administration in the energy sector. For the list of public corporations and non-profit entities, see the webpages of the official website of the MOTIE at <http://www.motie.go.kr/www/main.do#> and <http://www.motie.go.kr/motie/py/sa/Nonprofit2/corporation/corporationList.do> (last visited May 1, 2018). The complete list of research institutes is not available.

⁴⁶⁶ Breger and Edles, *supra* note 171 at 41-43.

the Prime Minister, considering the highly specialized characteristics of the tasks concerning safety and security relevant to construction, operation and waste disposal.

b. Independence from Politics

It will be also important to secure systematic independence from political influence. The U.S. FERC might be a reference in this regard. The FERC has structural characteristics that are typically considered as those of an independent agency: (i) the explicit, staggered, five-year terms of each member of the commission, (ii) the balancing requirement from the political parties and (iii) the protection from at-will removal by politicians through a statutory requirement of “for cause” termination.⁴⁶⁷ The structure of the committee in the existing Korean independent agencies is similar to that of the FERC with some notable distinctions that undermine the level of independence. First, the term is normally three years and is not staggered.⁴⁶⁸ Second, the way the statutory provisions require the political balance is not as effective as that for the FERC. In the case of the FERC, all five commissioners are appointed by the President by and with the advice and consent of the Senate, and not more than three members are allowed to be members of the same political party.⁴⁶⁹ Korean law sets a more descriptive requirement, typically prohibiting a commissioner from being a member of a political party or engaged in a political campaign.⁴⁷⁰ The commissioners are typically appointed by the president with recommendation within the administration,⁴⁷¹ which means it is a part of the

⁴⁶⁷ David E. Lewis, and Jennifer L. Selin, *Sourcebook of United States Executive Agencies* (1st ed.), 48-52 (Administrative Conference of the United States, Dec. 2012).

⁴⁶⁸ See for the Financial Services Commission, Article 6, Act on Establishment of the Financial Services Commission (legislation no. 15144), for the Korea Fair Trade Commission, Article 39, Monopoly Regulation and Fair Trade Act (legislation no. 15014), and for the Korea Communications Commission, Article 7, Act on Establishment and Operation of Korea Communications Commission (legislation no. 13580).

⁴⁶⁹ 42 U.S. Code § 7171 (b)(1).

⁴⁷⁰ See for the Financial Services Commission, Article 4 and 7, Act on Establishment of the Financial Services Commission (legislation no. 15144), for the Korea Fair Trade Commission, Article 37 and 41, Monopoly Regulation and Fair Trade Act (legislation no. 15014), and for the Korea Communications Commission, Para. 2, Article 9, and Para. 1, Article 10, Act on Establishment and Operation of Korea Communications Commission (legislation no. 13580).

⁴⁷¹ See for the Financial Services Commission, Article 4 and 7, Act on Establishment of the Financial Services Commission (legislation no. 15144), for the Korea Fair Trade Commission, Article 37 and 41, Monopoly Regulation and Fair Trade Act (legislation no. 15014), and for the Korea Communications Commission, Para. 2, Article 9, and Para. 1, Article 10, Act on Establishment and Operation of Korea Communications Commission (legislation no. 13580). The FSC of Korea includes the Vice Minister of the Ministry of Strategy and Finance and a few other political appointees of the government corporations and institutions, while three commissioners are from outside of the administration. In this regard, the FSC of Korea is less independent. The appointment of the FCC of Korea is a bit different, and the National Assembly participates, which does not practically enhance the level of independence. The opposition parties have the right to appoint two out of five commissioners. Among the other three, one is appointed by the ruling party and the other two are appointed by the president, which means the number of commissioners appointed by the ruling party including the president is three out of five.

administration under the supervision of the president rather than an independent agency. So, the law prohibits only the formality, while it does not effectively set a balance between splitting political influences. Further, given that the term of lawmakers in the national congress is four years and the term of the president is five years, without a chance for reelection under the current Constitution, all the members of a commission can be changed under one administration, and the use of three-year terms without a staggering requirement makes an agency vulnerable to political influence.⁴⁷² This lower independence resulted in less consistent policies and many controversies over the commissions' past performance or policy direction when the ruling party changed.⁴⁷³ The FERC's recent decision to not adopt the plan for subsidizing coal and nuclear power plants illustrates how structural independence works to make a more cautious approach for changes in policy direction.⁴⁷⁴

Thus, for the new Energy Commission, a staggered term of longer than three years seems indispensable for securing independence. The current descriptive requirement of the political neutrality of the other independent commissions may be kept for consistency with the formality of other commissions. In addition, the appointment should be based on the nomination of the political parties and the consent of the National Assembly. The same political party should not nominate more than the majority of the commissioners. The legislative protection from an arbitrary removal is quite strong in the case of Korean independent agencies, which the Energy Commission may also adopt.

c. The Authority for the Antitrust Regulation

One last aspect to consider is whether the Energy Commission shall be granted with exclusive authority to regulate the energy industry based on the energy laws and principles reviewed so far or any other agency or legal theories, primarily competition law, should be allowed to intervene. In other words, the overlapped regulatory area will be allowed. Several historical examples in the U.S. and Korea support the option of having the antitrust regulation as a "shared regulatory space" between the Energy Commission, and the competition authority, though it allows the agency's independence affected by another agency's position.⁴⁷⁵

⁴⁷² The for-cause termination clause generally requires a commissioner to be sentenced to imprisonment or long-term illness which disables further performing the job, which is quite different from that of the FERC, where termination is allowed only for inefficiency, neglect of duty or malfeasance in office. So, relevant statutes do not allow termination for inefficiency of a commissioner, which seems to be influenced by the rigid labor law in Korea that strictly prohibits termination for underperformance.

⁴⁷³ After the ruling party changed in 2017, a former chair of the Korea Communications Commission (KCC) was reportedly referred to the public prosecutor's office by the KCC under the current administration for allegedly improper policymaking. The Korea Fair Trade Commission has been operating an internal temporary audit system to review several renowned policy decisions made during the past presidency and reversed some of the decisions by political request after the ruling party changed.

⁴⁷⁴ 162 FERC ¶ 61,012, Docket No. RM18-1-000 (Jan. 8, 2018).

⁴⁷⁵ See Breger and Edles, *supra* note 171 at 239-241.

There has long been a discussion on whether and how antitrust law can intervene in heavily regulated industries' business activities. The advocates of industry-specific regulations have good reasons for their argument: the antitrust law does not work as a price-setting framework or establish affirmative duties toward rivals; and the judges or competition authorities who are supposed to review the antitrust issues are generalists and not industry specialists.⁴⁷⁶ So, this view asserts that it would be optimal if an industry specific agency appropriately reflects the antitrust concerns when designing a regulatory scheme. We have seen cases where the relevant regulator made a decision to open up a market which had been previously regarded as a natural monopoly, in the wholesale power market in several states in the U.S., and the oil importation market in Korea. However, we did also see the cases of systematic failure of the industry-specific regulations in the halted opening of the wholesale market in Korea and some other notable cases in California.⁴⁷⁷ It is notable that area-specific regulators are to be captured by regulated industry and might not effectively work for the cases concerning whether to allow new entrants to a natural monopoly market.⁴⁷⁸ The competition authorities are comparatively insulated from the political interests and have the ability to determine an antitrust attempt to be blocked, while the regulatory agencies are heavily affected by political interests and might allow an antitrust behavior of regulated industries to happen without consideration of the efficiency of possible competition.⁴⁷⁹ Therefore, it would be reasonable to recognize at least the supplementary role of antitrust law in regulated industries. In the U.S. there are notable cases where the antitrust enforcement resolved the competition issue in a natural monopoly industry and successfully open up the relevant market, either directly or by promoting a new enactment to secure such competition.⁴⁸⁰ In Korea, as the private enforcement of competition law is not active, the role of the Korean competition authorities, Fair Trade Commission (KFTC) would be more important in this regard.

The KFTC once paid attention to the competition in the electric power wholesale market around 2010, with the suspicion that the subsidiaries of the KEPCO withheld electric power supply in order to increase the wholesale price.⁴⁸¹ The KFTC ultimately concluded that those

⁴⁷⁶ Dennis W. Carlton and Randal C. Picker, *Antitrust and Regulation*, in Nancy L. Rose ed., *Economic Regulation and Its Reform*, 25-26 (University of Chicago Press, 2014).

⁴⁷⁷ Joskow, and Kahn, *supra* note 89.

⁴⁷⁸ Carlton and Picker, *supra* note 476 at 33-34; The “captured” here does not necessarily means a type of subtle corruption often mentioned. Rather, from a more economic point of view, it is hard for a regulator to permit its own responsibility for the proper performance of certain industry to be diluted by the independent, a bunch of irresponsible firms which are not subject to its control. See Kahn, *supra* note 455 at 11-13.

⁴⁷⁹ Carlton and Picker, *supra* note 476 at 26, 33-34. In the case of the U.S. the authority to enforce the competition regulation lies in the administration and the judiciary, while Korea mostly relies on the administration for competition law issues, while the judicial review is available for an ex post measure.

⁴⁸⁰ *MCI v. AT&T*, 708 F.2d 1081 (7th Cir. 1983); *Otter Tail Power Company v. United States*, 93 S. Ct. 1022 (1973)

⁴⁸¹ G.M. Kang and J.H. Ahn, *The KFTC Imposes Administrative Fine on the Five Electric Power Generators*, Maeil Business News (Sep. 13, 2010), A-01; This case was ultimately concluded without

subsidiaries did not have enough market power to increase the wholesale price through their own agreement to withhold the power generation after some investigation in November 2010.⁴⁸² At that time, the subsidiaries were directly operated by the KEPCO, the direct parent company of them. However, it was notable that the government, around the end of such investigation, changed the management structure that the subsidiaries of the KEPCO should be directly managed by the government, separating management authority from the ownership of those companies, which indicated that the wholesale market had a potential to damage competition indeed.⁴⁸³ Though the KFTC's investigation concluded without imposing administrative punishment on the subsidiaries' withholding power generation volume, it worked as a regulatory check-and-balance signal to make the government to correct the potential anti-competitiveness of the wholesale market. This is another good example where the necessity for the competition authorities' intervention in regulatory process works efficiently.

Although the authority of the KFTC delegated by the relevant law does not have specific limitations and thus generally applies to all area of industries, the areas with specific regulatory agency has been often subject to a controversy over which agency has the authority to review the antitrust issues, and what the procedures would be.⁴⁸⁴ So, once the Energy Commission is launched, a specific statutory languages will be necessary to provide a clear ground for both agency's authority, and procedures required to reduce the inefficiency of duplicated review. A DOJ officer once stated that "the increasing relevance of antitrust law" in the electricity sector means the economic regulation is decreasing and "the markets are changing to enable a more flexible and competitive future."⁴⁸⁵

imposing fine and there is not much information publicly available.

⁴⁸² With respect to the result of the investigation, there is only one publicly available information posted by the law firm which represented the KEPCO's subsidiaries during the investigation. See the relevant post on the official website of Bae, Kim & Lee, at <http://www.bkl.co.kr/front/law/publication/publicationWorkListDetail.do?caseNo=167#.WFrBhvkrKUk> (last visited May 4, 2018).

⁴⁸³ At that time, the name of the MOTIE was Ministry of Knowledge and Economy (MKE). The MKE announced the Development Plan for the Structure of Electric Industry in August 2010 including this change in management structure of the KEPCO's electric power generating subsidiaries. See, MOTIE, Press Release: Strengthening the Competition, Efficiency and Responsible Management of Electric Power Industry (Aug. 24, 2010), available at http://motie.go.kr/motie/ne/presse/press2/bbs/bbsView.do?bbs_seq_n=63586&bbs_cd_n=81

⁴⁸⁴ In the case of financial regulation, the FSC and the KFTC recently entered into a Memorandum of Understanding to facilitate the coordinated regulatory actions. See FSC and KFTC, Press Release, (Jan. 9, 2015). In the case of telecommunications industry, the procedural coordination between the FCC and the KFTC is legislated for limited types of regulated actions. For the problems of the overlapped area of the FCC and the KFTC about the telecommunications industry and the proposals for procedural reorganization, see Bong Eui Lee, Merger Control of Korea in the Telecommunications and Broadcasting Markets, *Journal of Law & Economic Regulation*, Vol. 3, Issue 2, 7-19 (2010).

⁴⁸⁵ David S. Turetsky (Deputy Assistant Attorney General of the Antitrust Division of the DOJ), Antitrust Enforcement in the Electricity Industry (Feb. 2, 1996), available at <https://www.justice.gov/atr/speech/antitrust-enforcement-electric-industry>.

2. *Alternative for the Wholesale Market Structure*

As discussed, a significant part of the problems occurred due to the ownership structure of the government, KEPCO, and its subsidiaries, which warrants clear changes in this regard. The structural problems of the regulated wholesale market is also contributing to the lags in the climate change policies, which will be further discussed in Chapter 6. We can expect that large portion of the problems will be solved if the wholesale market becomes completely competitive assuming that a proper system is in place to reflect the social cost of greenhouse gases and the associated pollution damages is reflected in the electricity pricing. The competitive market also needs a less concentrated market share with the government ownership transferred to the private sector, through sales of the existing power plants and subsidiaries, retirement of old coal power plants, and more new LNG and renewable generators coming in. It appears however that the country will need more time to be prepared to launch a competitive market.

The attempts to sell the power generation subsidiaries have been frustrated, primarily due to political concerns of inviting investment from conglomerates or foreign investors as seen before. The resistance from the public about the electric power market with competition for the fear of price increase remains as hurdle. Several research in the U.S. proved that the restructuring of the wholesale electricity market contributed to efficiency of the power business in terms of productivity and employment and that the long term rate increase after restructuring is attributable to exogenous factors not to the restructuring,⁴⁸⁶ which has yet to be widely shared within Korea. Even if the competition is introduced, the historical government's intervention to suppress price of the consumer goods, still attracting wide support from the public, might also be a hurdle to realize a competitive market, given that there is likely to be demands from the public for the government's unofficial intervention in rate increase.⁴⁸⁷ Given these cultural and historical backgrounds, the country will need an interim measure as a bridge to a competitive market.

One option to consider is to establish several regional power exchanges supervised by local governments to devolve the central government's authority to regulate the market. Transfer of the ownership of the KEPCO's power generation subsidiaries to local governments might be also considered as part of this devolution plan.⁴⁸⁸ This would address a few

⁴⁸⁶ Kira R. Fabrizio, Nancy L. Rose, Catherine Wolfram, Do markets reduce costs? Assessing the impact of regulatory restructuring on U.S. electric generation efficiency, *American Economic Review*, Vol. 97, No. 4, 1250-1277 (2007); Lucas W. Davis, Catherine Wolfram, Deregulation, Consolidation, and Efficiency: Evidence from U.S. Nuclear Power, *American Economic Journal: Applied Economics*, Vol. 4, No. 4, 194-225 (2012); Borenstein and Bushnell, *supra* note 88.

⁴⁸⁷ The Korean government has operated various types of price control scheme for consumer goods with or without a specific legal basis. One of the remaining legislative ground is the Price Stabilization Act (legislation no. 10623), which provides a ground for the government to take a 'price stabilization measure' if relevant to 'stabilization of consumer life and economy.' The language of the Act is quite broadly drafted.

⁴⁸⁸ If financing is a serious problem, inviting the local government as a minority shareholder as an initial

important problems with the current centralized control and ownership. First, the general political concern over the privatization of the electric power business in Korea would be assuaged if this option were adopted. The local government has accumulated its own experience in energy policies despite the centralized energy sector management. Seoul city, for example, has operated a local agency, Seoul Energy Policy Commission, to review policies affecting the energy use and environment of the residents in the city, and to expand renewable energy sources.⁴⁸⁹ Second, the multiple power markets may provide the country with perform various experiments to invite competition to the power markets. Some regions could try more privatization of the power plants or competitive pricing either in the wholesale market or retail market. As the transaction between the local power markets happens, competition will be more naturally settled in the power market. Third, this structure will help to mitigate the fairness problems between the regions that happens due to the concentrated location of the power plants. The coal and nuclear power plants are concentrated in a few regions, which has created conflicts between regions. The residents living near the power plants have not been properly compensated for the health risks though the electricity generated from the power plants is primarily supplied to the residents or industrial customers in another region.⁴⁹⁰ If the regional transaction happens, the wholesale and retail price in each region will be different depending upon the supply and demand in the relevant region, which is likely to result in decrease in the less dense region with more power plants, and denser region with less power plants. Fourth, the balance of power problem between the environmental agency and the MOTIE, the owner of the fossil fuel power plants in terms of enforcing environmental regulation, which creates a serious implementation gap, would be resolved. The local government would be more interested in health problems of the residents living near the power plants than the central agency MOTIE was, as the local government has a direct political responsibility vis-à-vis the residents. The local office of the Ministry of Environment would be able to oversee the operation of the power plants without concern over potential conflict with the MOTIE. It is expected to ultimately relieve the vicious circle in which less efficient environmental regulation has created a weaker incentive to move toward a more sustainable energy industry. Finally, as the natural results of the dispersed ownership structure, the soft corruption issue would be mitigated, as well.

step would be an alternative in order to diversify the interest in the generation corporations. The minority shareholder's right granted in the corporate law would operate as another checking system.

⁴⁸⁹ Article 12, Seoul Metropolitan City Energy Ordinance. Seoul city now seeks various policy options to reduce electricity use, aiming to reduce by "one nuclear power plant volume" by 2022. For details of the policies, see Seoul Metropolitan Government, One Less Nuclear Power Plant, available at <http://energy.seoul.go.kr/seoul/energy/introduce.jsp> (last visited April 13, 2018).

⁴⁹⁰ The health problem of the residents near the power plants is actively discussed rather recently since the Fukushima Disaster, though the literature on scientific or epidemiological research is still scarce.

CHAPTER 6.

RECOMMENDATIONS FOR REFORM: MARKET-BASED REGULATORY MECHANISM

We have seen so far in Chapters 4 and 5 how to determine the social cost of greenhouse gases and improve the energy policymaking process to properly utilize it. This chapter reviews how to make the firms internalize the social cost of greenhouse gases in business decisions for energy generation or use through market mechanisms in each stage of the energy supply and consumption chain, and how to address the relevant political and economic concerns. The discussion in this chapter is on the continuum of the discussions made in Chapters 4 and 5 while focusing on the function of the market, which is expected to make the carbon pricing system more self-sustaining.

Section I reviews and analyzes the current regulations of the nation-wide cap-and-trade system for CO₂ with suggestions for reform. Section II reviews the problems of the structure of the wholesale market electricity pricing scheme and the formula used to compensate the power plants' costs to secure emissions rights, both of which seem somewhat ineffective in achieving the policy goal of reducing greenhouse gas emissions, and concludes with proposals for reform. Section III reviews and discusses the problems in design of the retail-pricing scheme for industrial customers to assess the acceptability of the potential increase of the electricity price in case the greenhouse gas adder is introduced.

I. The Nationwide Emissions Trading Scheme for Carbon Dioxide

The current regulation that may directly affect the cost of the power generation business is the nationwide emissions trading scheme for CO₂.⁴⁹¹ The Korean CO₂ emissions trading scheme (KETS) was launched in 2015 and Phase I concluded at the end of 2017; the plan is still in its initial stage. It is thus rather early to state the definite efficacy of the scheme, but it is worthwhile to review the characteristics of the current structure to assess the overall structural problems that the scheme has shown so far and improve its effectiveness going forward.⁴⁹²

⁴⁹¹ The Act for the Greenhouse Gas Emissions Rights Allotment and Transactions.

⁴⁹² The KETS is currently the only regulation of CO₂ emissions in Korea. The environmental impact assessment system also requires addressing the mitigation plan for CO₂ emissions without an independent effect because there is no preset standards for each company to comply with when preparing the environmental impact assessment as seen from the case in Chapter 4. The “transportation, energy and environmental tax” imposed on gasoline and diesel manufacturers and importers is often mentioned as relevant to a carbon tax, which is misleading. (See Article 2, the Act on Transportation, Energy and Environmental Tax, Legislation No. 13550 and Article 2 of the Annex; Article 1 of the Annex of the Act on Discontinuance of the Transportation, Energy and Environmental Tax, Legislation No. 9346.) It was originally introduced to collect tax revenue primarily in order to develop transportation infrastructure, despite the title, and thus has little relevance to environmental concerns. Further, the ratio of the power plants using oil is currently 4.4% of the entire market capacity, which will decrease; it is a sunset tax that will expire in 2018.

The Korean CO₂ emissions trading scheme (KETS) was launched as the second-largest worldwide, after the European Emissions Trading Scheme as of January 2015, which 23 industrial sectors, including the power generation sector, joined.⁴⁹³ The ratio of the freely allotted emissions rights is 100% during Phase I, 2015-2017; 97% in Phase II, 2018-2020; and 90% or less during Phase III, 2021-2025.^{494,495} There is no direct price ceiling or floor but the law provides a ground for a temporary intervention of the government if the price fluctuation deviates certain range set based on the historical price volatility.⁴⁹⁶ The price was initially kept around 8,000 Korean won (approximately \$7.2 USD) over the first year and slightly rose up 12,000 Korean won (approximately \$10.5 USD) around June 2016, when the compliance period for the first year ended.⁴⁹⁷ There was only a slight increase in the price around the end of 2017, just before the new democratic administration announced the temporary plan for Phase II, but the price again maintained the same level, around 22,000 Korean won (approximately \$19 USD) until February 2018.⁴⁹⁸

The overall technical aspects of the KETS were primarily modeled after the EU scheme based on several years of study. The technical aspects of the KETS have thus been sophisticated, although the efficacy of the system as a central mitigation policy tool has been in question for a few reasons, including the controversial national reduction goal, generous free allowances and the wholesale electricity pricing scheme, which is discussed later in this Chapter. The scheme is not an exception to the political conflicts surrounding the mitigation policies that can be observed from the process of the change in the national reduction goal, the methodology of initial allotment, the plan to allow extraterritorial reduction activities and the repeated changes in the central agency, among others. It is undeniable that those aspects and events have thus far

⁴⁹³ International Carbon Action Partnership, Emissions Trading Worldwide (2015), at <https://icapcarbonaction.com/en>.

⁴⁹⁴ Article 13, Presidential Decree of the Act for the Greenhouse Gas Emissions Rights Allotment and Transactions (Presidential Decree No. 28562). Due to the impeachment of the previous president in 2016 and the presidential election in 2017, the administration's planning of Phase II has been delayed, and a temporary allotment was made for the first half of 2018. The entire plan for Phase II will be made available in June 2018.

⁴⁹⁵ The ratio of free allowances versus paid allowances does not affect the scheme's efficacy as a mitigation policy because using the free allowances for compliance are considered opportunity cost, which will be further discussed in Section II of this Chapter.

⁴⁹⁶ The system is called market stabilization measure. Article 23, Act for the Greenhouse Gas Emissions Rights Allotment and Transactions (Legislation No. 14839).

⁴⁹⁷ Young Kim, The Analysis and Prospect of the Korea Emissions Trading Market, GHG World, Korea Environment Corporation, 4-9 (Autumn 2016). The raw market data for the emissions rights for 2015 is not available on the website of the Korea Exchange as of March 2018 because the data was removed when the trading ended in June 2016.

⁴⁹⁸ See Korea Exchange, Daily Price of Korea Allowance Unit (KAU), available at <http://marketdata.krx.co.kr/mdr?backUrl=http://open.krx.co.kr/contents/OPN/01/01050401/OPN01050401.jsp#document=070301>.

delayed the smooth establishment of KETS. While some aspects have recently been improved, others continue to affect its efficacy.

A. *The National Goal of Reduction*

The national goal of reduction was initially set to reduce 30% of the BAU amount by 2020 for the Copenhagen Accord,⁴⁹⁹ which provided the basis for the initial design of the KETS, and which was explicitly prescribed in the domestic implementation legislation.⁵⁰⁰ The goal, however, was revised to be 37% of the BAU by 2030, including 11.3% to be purchased out of Korean territory after the launch of the KETS, and ultimately submitted as the Intended Nationally Determined Contribution (INDC) of Korea for the Paris Agreement.⁵⁰¹ The amendment of domestic legislation followed soon.⁵⁰² The environmental or health impact of greenhouse gas reduction was not systematically considered either in setting the original goal or in the later amendment.⁵⁰³

The new reduction goal is apparently less stringent than the initial one proposed in the Copenhagen Accord, which put into question whether the adjusted goal was in compliance with the agreement from the COP20 to make the INDC a “progression beyond the current undertaking.”⁵⁰⁴ This change received negative feedback from environmentalists globally. The Climate Action Tracker, which evaluated the INDCs of multiple nations, assessed the reduction goal of Korea contained in the INDC as “inadequate” in 2015, while it had until 2014 maintained the comment that Korean government’s pledge of 30% below BAU in 2020 submitted for the Lima Call for Climate Action was “sufficient.”⁵⁰⁵ Some scholars in Korea

⁴⁹⁹ Ministry of Foreign Affairs and Trade of Republic of Korea, *supra* note 223.

⁵⁰⁰ Para. 1, Article 25, The Presidential Decree of the Low Carbon and Green Growth Act (Presidential Decree No. 22124, enacted on April 13, 2010).

⁵⁰¹ Republic of Korea, *supra* note 47.

⁵⁰² Para. 1 and 2, Article 25, The Presidential Decree of the Low Carbon and Green Growth Act (Presidential Decree No. 27180, amended on May 24, 2016).

⁵⁰³ The draft reduction plan for revising the original goal published for public comment specified that the government estimated the positive economic impact, the expected change in the GDP, under each option for the reduction goal, and compared the economic impact with the potential greenhouse gas reduction amount to determine the “potential reduction amount that can be borne by the industry” by modeling with the aforementioned factors. No reference to the environmental or health benefits appears throughout the draft reduction plan. See The Joint Proposal from the Relevant Agencies, Plan for Setting the Post-2020 Greenhouse Gas Reduction Goal, 5, 18-19 (June 11, 2015).

⁵⁰⁴ UNFCCC, Decision 1/CP. 20: Lima Call for Climate Action, Article 10, in the Report of the Conference of the Parties on its twentieth session, held in Lima from 1 to 14 December 2014 (Feb. 2, 2015), FCCC/CP/2014/10/Add.1.

⁵⁰⁵ Climate Action Tracker, South Korea, Rating for 2015, at <http://climateactiontracker.org/countries/southkorea/2015.html> (last visited March 18, 2018). The

pointed out that the amended goal might be a “backsliding” from the pledge submitted for the Lima Call for Climate Action.⁵⁰⁶ A renowned environmental commentator expressed concerns that the regression in the reduction goal only benefitted a portion of the industry sectors with higher energy consumption and would make Korea lag behind China in mitigation efforts.⁵⁰⁷

Those comments, however, did not receive much attention, and the amended national reduction goal was set. There might have been several systematic reasons. One important reason is that the policy goal of the domestic mitigation system was not been properly communicated to the public, which made the public and ultimately politicians less interested in the topic. The Korean government did not mention the environmental or health-related benefits from mitigating greenhouse gases when framing the national reduction goal, and instead it described the reduction obligation as an honorary and abstract goal that should be achieved at the expense of domestic cost due to foreign relations concerns or in order to join the “developed countries” group.⁵⁰⁸ Other energy policy documents reviewed in Chapter 4 also showed that the social cost of carbon or co-health benefits were not adequately communicated to the public. As the adaptation scheme has yet to be established, the climate damage directly affecting Korean territory has not been regularly investigated or announced, which has maintained a low recognition of the damage from climate change in Korea.⁵⁰⁹ The political voices advocating for the original national reduction goal thus could not gain enough public support, and so naturally the goal did not attract the attention of politicians in the legislative body. It is needless to say that the market was also less encouraged to develop a measure to mitigate the greenhouse gas emissions or save energy.

B. Methodology for Allotment of the Emissions Rights

Two aspects of the KETS in terms of oversupply of emissions rights might be considered as the primary structural problems that would provide low incentive for firms to reduce CO₂ emissions.⁵¹⁰

ratings for 2011-2014 are also available in the same webpage.

⁵⁰⁶ Hyun Jeong Choi and Soohyun Lee, Not Good Enough: South Korea’s 2030 Carbon Mitigation Target and the INDC, Issue Brief 2015-11, Asan Institute for Policy Studies, 9-10 (Aug. 13, 2015); Soon-Jin Yoon, The Reason Why the Government’s Greenhouse Reduction Goal is Inadequate (Op-ed.), Hankyoreh (July 30, 2015), at <http://ecotopia.hani.co.kr/301655>.

⁵⁰⁷ Byung-ok Ahn, It is not an upward adjustment of the mitigation goal (Op-ed.), Joongang-Ilbo (July 25, 2017), at <http://news.joins.com/article/18314210>.

⁵⁰⁸ The Joint Proposal from the Relevant Agencies, *supra* note 503. In Korea, while the recognition about the problems of criteria pollutants is rapidly increasing, the climate damage from greenhouse gas emissions has not been drawing enough attention.

⁵⁰⁹ See for the research of the Korea Fisheries Resources Agency (“FIRA”) on ocean desertification, *Supra* note 56 and 57.

⁵¹⁰ One of the most frequently discussed aspects of the KETS market in Korea is that the trading volume

First, the KETS used grandfathering methodology to determine the initial allotment for Phase I except in three industries, refinery, airlines and cement manufacturing.⁵¹¹ Grandfathering is a methodology to calculate allowances based on each participant's historical emissions amount, which is often used in designing a market-based regulation to mitigate the political economic conflicts, while it is likely to be less cost-effective.⁵¹² The concept is often contrasted with auctioning or benchmark-based distribution, the latter of which decides allowances based on a benchmark rate per unit of output typical for a certain product, where the benchmark rate and the unit of output set by the government are important. Benchmark-based methodology typically reflects the best commercially available technology that is used in the relevant sector. Thus, the allowances calculated based on the benchmark-based methodology are typically smaller than the grandfathered ones. Economic studies clearly explain that 100% free allowances based on the grandfathering method likely result in "significant overcompensation" for the regulated.⁵¹³ The benchmark-based method is known to be more effective, in that it prevents this overcompensation and distortion of the firms' incentive to excessively emit during a preceding period which will be the standard of the regulated period, and more fair in that it rewards firms that have already invested in technology for emissions reduction.⁵¹⁴

was minimal during the Phase I and that it represents one of the failures of the market design. The volume for the emissions rights for the year of 2015 traded until June 2016 and was 0.8% of the total emissions rights allotted for the entire market. See, Young Kim, *supra* note 497. The emissions rights traded in the calendar year 2017 for the emissions rights allotted for 2017 was 5,977,452 t/CO₂, 1.14% of the entire volume allotted for 2017, 521,920,000 t/Co₂. See Korea Exchange, Daily Price of Korea Allowance Unit (KAU), available at <http://marketdata.krx.co.kr/mdi?backUrl=http://open.krx.co.kr/contents/OPN/01/01050401/OPN01050401.jsp#document=070301>. It is notable, however, that less number of trades does not mean less efficacy of the KETS as a mitigation policy. It is because if the government allocates in proportion to each firm's ability to reduce, there could be no trading, but lots of reduction. The less trading volume during the Phase I may have attributed to the oversupply of the emissions rights and the generous allowance of banking amount. The latter has been resolved by the newly introduced limitation of the banking.

⁵¹¹ Seong-yong Gong, et. al., A Comparative Case Study of Benchmark-based Allocation Methodologies for Emissions Trading Scheme, Climate and Environmental Policy Research, Korea Environment Institute, 19 (2015), at <http://webbook.me.go.kr/DLi-File/091/023/009/5608915.pdf> (last visited March 19, 2018).

⁵¹² For efficiency concerns and political economic function of adopting a grandfathering in designing market-based regulations, see Meredith Fowlie, Updating the Allocation of Greenhouse Gas Emissions Permits in a Federal Cap-and-Trade Program, in Don Fullerton and Catherine Wolfram (eds.), *The Design & Implementation of US Climate Policy* (kindle ed. 2012); Robert N. Stavins, What Can We Learn from the Grand Policy Experiment? Lessons from SO₂ Allowance Trading, *Journal of Economic Perspectives*, Vol. 12, No. 3, 69-88 (Summer 1998); Robert N. Stavins, Vintage-Differentiated Environmental Regulation, *Stanford Environmental Law Journal*, Vol. 25, 29-63 (2006).

⁵¹³ Fowlie, *supra* note 512.

⁵¹⁴ Lars Zetterberg, Benchmarking in the European Union Emissions Trading System: Abatement incentives, *Energy Economics*, Vol. 43, 218-224, 219 (May 2014). The EU ETS used grandfathering for Phases 1 and 2 and changed the methodology into the benchmark-based one since 2013 for Phase 3.

In the case of the KETS, the concerns over the lower efficiency of the emission-based method were more serious because the Korean government distributed even more allowances after distributing 100% of the grandfathered emissions rights. The government once announced in 2016 that the emissions rights distributed to the participants for 2015 outnumbered the actually emitted CO₂ in 2015 by 7 million t/CO₂, which clearly shows that the allotment of the emissions rights was excessive.⁵¹⁵ The government, however, additionally allotted 17,015,000 t/CO₂ of emissions right for the year of 2017, the third year of Phase I, explaining that the upward adjustment was made to reflect the change in the national goal from the one set in the pledges submitted to the Lima Call for Climate Action to the INDC submitted for the Paris Agreement.⁵¹⁶ Granting the additional emissions rights in early 2017 made the Phase I market a pilot program and lowered the participants' incentive to reduce emissions.

The new administration announced that the finalized plan for Phase II would expand use of the benchmark-based methodology.⁵¹⁷ Banking is not allowed cross-phases, which also seems to be positive for the prospects of Phase II. However, there is a systematic factor that makes the oversupply of Phase I negatively affect the effectiveness of the Phase II market. The current guideline providing the standards of the allotment, adjustment and cancellation of the emissions rights added a provision in March 2017 that prescribes that the allowance for each participant in Phase II may be determined as the higher number between the one based on benchmark-based calculation and the grandfathered one.⁵¹⁸ This provision may have provided a misleading signal to firms and is likely to significantly undermine the effects of the benchmark-based methodology to be adopted in Phase II.

Second, the linkage with the international market for Phase II leaves something to be desired. As previously discussed, the overseas reduction goal of 11.3% of BAU by 2030 was added without prior public notice when the Korean government prepared the INDC in 2015, which made the actual goal in the INDC significantly less than the one that Korea once

⁵¹⁵ Prime Minister's Office, Press Release, 3 (May 16, 2016). The growth rate of the Korean economy in 2015 and 2016 was around 2.8%, which was similar to the three preceding years.

⁵¹⁶ The Ministry of Strategy and Finance, Amended Plan for Allotment in 2017 (Jan. 24, 2017), at http://mosf.go.kr/nw/nes/detailNesDtaView.do;jsessionid=WI09Y1+ksDi9bPzuCjklOnck.node40?searchBbsId=MOSFBBS_000000000028&searchNttId=MOSF_00000000007379&menuNo=4010100 (last visited March 10, 2018).

⁵¹⁷ Ministry of Strategy and Finance, et. al., Press Release, Establishment of the Plan for the National Emissions Trading Rights Allotment for the Phase II (2018-2020) (Dec. 19, 2017).

⁵¹⁸ Para 9, Article 9, the Guideline of Allotment, Adjustment, and Cancellation of the Greenhouse Gas Emissions Rights, Ministry of Trade, Industry, and Energy Guideline 2017-38 (March 2017) at http://www.motie.go.kr/motie/ms/nt/gosi/bbs/bbsView.do?bbs_seq_n=62973&bbs_cd_n=5¤tPage=1&search_key_n=&cate_n=&dept_v=&search_val_v= (last visited March 20, 2018). This provision of the guideline was introduced during the period when the Ministry of Trade, Industry and Energy had the authority to operate the KETS for almost all industrial sectors, with some sectors to be supervised by a few other agencies, which also introduced the same provision. As discussed below in Paragraph C, the central authority has moved back to the Ministry of Environment; however, the guideline has been maintained as of March 2018.

committed to international society in 2009. The draft plan published by the administration in March 2018 shows that the credits from the Clean Development Mechanism (CDM) obtained on or after June 2016 by the firms participating in the KETS will be recognized as fulfilling the emissions right.⁵¹⁹ It is likely that this newly introduced overseas offsets program will lead Korean firms to look for chances to obtain credits from the CDM in developing countries with lower abatement costs rather than trying to make meaningful reductions in their facilities located in Korea.⁵²⁰ This suggests that the KETS will not properly work to reduce greenhouse gases within Korean territory, which leads to the practically less implementation of the national reduction commitment. Further, because the CDM is a way to transfer “the climate-friendly technologies to developing countries,” it always raises the issue of “additionality,”⁵²¹ which means it pays the firms to reduce the greenhouse gases that they would or should have done in any chance in any case. It will be worth testing if the linkage with the CDM will be a pilot program to be prepared for the linkage with a new international market, which is expected to be developed through the COP meetings of the UNFCCC in the future. However, it will need reassessment and more consideration to prevent a situation where the CDM is utilized as a cheaper alternative to domestic reduction efforts.

The EU ETS indeed observed a very low price of emissions rights when it allowed the offsets from the CDM leading the electric power generators to have spare emissions rights during the initial phase.⁵²² Given the aforementioned oversupply of the emissions rights in KETS, this problem might be significant in Korea. The EU has limited the types and jurisdictions of CDM projects qualifying as offsets in the EU ETS, disconnecting the CDM projects in China and India in 2013.⁵²³ New Zealand once linked the domestic carbon market to the CDM, but it terminated the linkage in 2015.⁵²⁴ California takes a cautious approach and only allows offsetting with credits from domestic reduction projects⁵²⁵ and has a cap on the offsets, through which the firms

⁵¹⁹ Ministry of Strategy and Finance, et. al., Press Release, Establishment of the Plan for the National Emissions Trading Rights Allotment for the Phase II (2018-2020), Dec. 19, 2017. The offset either domestic or overseas is limited to 10% of the emissions rights that should be secured for compliance and the overseas offset is limited by 50% of the entire offsets.

⁵²⁰ Joseph E. Aldy and Robert N. Stavins, Post-Kyoto International Climate Policy: Summary for policymakers, 46-47 (2009). The professors explain that linking with the CDM will lower the price of the emissions rights which leads to a lower investment in abatement technology and disincentives the firms in a more industrialized market to make significant reduction in the market.

⁵²¹ *Id.*

⁵²² Jessica F. Green, Don't link carbon markets, *Nature*, Vol. 543, 484-486 (Mar. 23, 2017), doi:10.1038/543484a. Professor Green points out that linking the existing carbon markets without sophisticated designing led to unwanted results and argues that a centralized carbon bank system will be a solution.

⁵²³ The current EU ETS only recognizes the CDMs out of the Least Developed Countries (LDC).

⁵²⁴ Jessica F. Green, *supra* note 522.

⁵²⁵ See for the list of the projects, California Air Resources Board, Compliance Offset Program, at <https://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm> (last visited March 16, 2018). The provision for the location in each acknowledged protocol in this webpage explicitly stipulates that only the activities

can offset up to 8% of the covered emissions through the reduction of projects out of California but only within the U.S.⁵²⁶

Further, some scholars have observed that the EU's disconnection of the CDM in China and India provided incentives to the country to develop its own cap-and-trade system.⁵²⁷ Assuming that this observation has merit, the KETS' overseas offsets program allowing CDM credits at this later stage than the EU might discourage China and India to further develop their own cap-and-trade program, which would undermine the effect of the EU's disconnection with the CDM in those countries. In sum, the problems of oversupply in the initial KETS has not been addressed even in the plan for Phase II that was recently published by the new administration.

C. Institutional Structure and Political Conflicts

The changes in the structure of the agencies responsible for the KETS in recent years indicate that it went through serious political conflicts that contributed to the inefficiency problems of the scheme during Phase I. The Ministry of Environment was originally designated to operate the KETS until the launch of the scheme. In June 2016, a year or so after the launch, the vigorous lobbying efforts of the industries ultimately pushed the central authority to operate the system to be transferred to the Ministry of Trade, Industry and Energy and the Ministry of Strategy and Finance, which were known to have represented the interests of the business sector and are responsible for the economic growth.⁵²⁸ This change left the Ministry of Environment with little authority over the KETS.

The initial KETS made the Ministry of Environment the primary agency with the authority to select the firms that should participate in the KETS; decide the allowance for each participant; supervise and take measures to stabilize the emissions trading market, including the control of the price volatility; certify the actual emissions amount; and impose a surcharge on the non-compliant firms.⁵²⁹ The government's plan to relocate authority to the agencies

within the U.S. territory qualify.

⁵²⁶ Given that the California cap-and-trade currently uses 100% auction for the allotment of emissions rights, some may argue that this limitation cannot be compared with that of the KETS, which in Phase II allows 97% of emissions rights for free. However, it is indicative that the offsets program should accompany an effective qualitative and quantitative limitations.

⁵²⁷ See Ranson, and Stavins, *supra* note 391 at 290-91 (2016).

⁵²⁸ Chul-joong Kim, The Greenhouse gas trading system transferred to the Ministry of Finance and Economy, Donga Ilbo (Oct. 23, 2015), available at <http://news.donga.com/3/00/20151023/74337101/1> (last visited March 18, 2018); Jin-chul Kim, Permit allotment work for the emissions trading system transferred: more responsibility for energy agency, Korean Energy Time (Mar. 17, 2016), available at <http://energytimes.kr/news/articleView.html?idxno=36091>.

⁵²⁹ Article 6, Presidential Decree of the Act for the Greenhouse Gas Emissions Rights Allotment and Transactions (Presidential Decree No. 24180, enacted Nov. 15, 2012).

responsible for the economy was reported during the first year of the KETS,⁵³⁰ which was realized through amending the relevant Presidential Decree the following year. The 2016 Presidential Decree shifted the authority to supervise the emissions trading market to the Ministry of Strategy and Finance and the other central authorities to decide the allowance for each participant and operate the compliance systems, among others, to “the primary agency supervising the relevant sector,” which means that most of the authority was moved to the Ministry of Trade, Industry and Energy.⁵³¹ Only several months after this amendment, the government announced that an additional emissions rights would be granted to the firms, as seen in Section 2 above, even though that the market was almost inactive due to oversupply.⁵³² The new democratic government rescinded a significant portion of the relocation and returned most of the authority to the Ministry of Environment by amending the Presidential Decree in December 2017.⁵³³ The latest change is anticipated to be an important turning point for the KETS, while it caused some delay in the government’s plan for Phase II, which again has made the market unpredictable for the time being.

The aforementioned case shows that vesting the authority to operate the emissions trading scheme in an agency that has been responsible for economic growth or industry-specific economic regulations may dilute the scheme’s regulatory purpose. Though the boundary of the concept “regulatory capture” is often controversial, the case of the KETS seems to fall within the concept.⁵³⁴ It is not surprising that an agency responsible for the economic growth of firms would be captured by the relevant industry and less interested in implementing a new social regulation. The case studies in Chapter 4 showed that the Ministry of Trade, Industry and Energy has had little interest in reducing greenhouse gas emissions, especially when it comes to the power generation sector. In this regard, the most recent return of the authority to the Ministry of Environment will be a proper solution to mitigate the institutional problem.

There is, however, one more aspect to consider in order to secure regulatory stability. The legislative ground of the KETS, the Act for the Greenhouse Gas Emissions Rights Allotment and Transactions, does not designate the primary agency and simply delegates it to be decided by Presidential Decree, which made the confusion over the past years happen in a simpler way.⁵³⁵

⁵³⁰ Chul-joong Kim, The Greenhouse gas trading system transferred to the Ministry of Finance and Economy, Donga Ilbo (Oct. 23, 2015), available at <http://news.donga.com/3/00/20151023/74337101/1> (last visited March 18, 2018).

⁵³¹ Article 6, the Presidential Decree of the Act for the Greenhouse Gas Emissions Rights Allotment and Transactions, Presidential Decree No. 27181, amended on June 1, 2016.

⁵³² The Ministry of Strategy and Finance, *supra* note 516; Prime Minister’s Office, *supra* note 515.

⁵³³ Article 6, the Presidential Decree of the Act for the Greenhouse Gas Emissions Rights Allotment and Transactions, Presidential Decree No. 28562, amended on December 29, 2017;

⁵³⁴ For the discussions that emphasize the importance of defining the regulatory capture at issue and designing a proper solution depending on that definition, see David Freeman Engstrom, Corraling Capture, Harvard Journal of Law and Public Policy, Vol. 36, No. 1, 31-39 (2013); James Kwak, Cultural Capture and the Financial Crisis, 71-98, 71-80, in Daniel Carpenter and David Moss, eds., Preventing Capture: Special Interest Influence in Legislation, and How To Limit It (2013).

⁵³⁵ Article 8, the Act for the Greenhouse Gas Emissions Rights Allotment and Transactions (Legislation

The legislative structure used in the KETS is rare in other regulations, and it is common for the primary agency of a certain regulation based on a statute to be designated by that statute, while more technical matters are delegated to the Presidential Decree.⁵³⁶ There is no publicly available background of the legislative structure on whether it was intentional or made by error. Given that a presidential decree can be easily amended by a cabinet meeting, while the amendment of a statute needs the approval of the Congress, designating the primary agency of a regulation to be decided by presidential decree is not a desirable method of legislation, especially when the regulation provides such a broad foundation for a new market that calls for a stable regulatory scheme. In this regard, it is recommended to ultimately amend the Act for the Greenhouse Gas Emissions Rights Allotment and Transactions to directly provide a ground to have the Ministry of Environment as the primary agency in which the authority to operate the KETS is vested. This will provide more stability and predictability to the KETS market and make the government take a more cautious approach toward changes in the system.⁵³⁷

II. Current Wholesale Pricing with the Emissions Trading Scheme

A. Wholesale Electricity Pricing Scheme

The wholesale price is determined based on a pre-set process and formula by the Cost Assessment Committee within the KPX. The payment made to a power generator has a cost-of-service structure with a certain element of competition,⁵³⁸ which is comprised of two factors: the

No. 14839).

⁵³⁶ Korean statutes, presidential decrees and other subordinate regulations are easily searchable at a website operated by the Ministry of Government Legislation at www.moleg.go.kr/. A search with the Korean term representing “primary agency” in the website revealed that the primary agency of a regulation is normally designated by the statute. A case in which a statute provides details of a certain regulation and delegates the primary agency to be determined by a subordinate regulation, e.g., presidential decree, has not been found.

⁵³⁷ As of March 2018, the ruling party has not secured the majority of votes in the Congress, even with the votes of the more progressive parties, and this situation is expected to endure until the next election date for the Congress, which is April 2020. Thus, the current government is expected to be more cautious in using the Congressional process to amend regulations, which is the reason why some experimental deliberative systems are proposed for important energy policies outside of the Congress, as seen in Chapter 2 for nuclear power generation issue. During the past 16 years, until 2016, the ruling party held the majority of the Congress, which made amending regulations through the Congressional process easier.

⁵³⁸ The market-opening in Korea, which started in 2000, was halted half way, mostly due to political conflicts in the early 2000s. The current pricing mechanism, which was supposed to be a temporary one until the wholesale market would convert into a competitive one, has been maintained until now. This makes it more difficult for the market to embrace climate concerns and newer players.

“system marginal price” (market clearing price) to cover the variable cost, and the “capacity payment” to cover the fixed cost and maintenance cost.

The KPX determines the bid price for every hour of each generating facility based on a calculation formula set by the Cost Assessment Committee within the KPX once a month.⁵³⁹ A generator is required to submit the volume of electricity that the generator can supply the following day to the KPX. The system marginal price for each hour is determined based on the bid price, determined by the KPX, supply volume submitted by each generator and the demand. Coal and nuclear power plants with lower fuel costs are set to cover baseloads, and natural gas and renewable generators cover peak loads according to the economic dispatch order.⁵⁴⁰ More recently, the relevant law introduced a paragraph that requires environmental consideration of the dispatch order in addition to the economic one,⁵⁴¹ which has yet to result in a practical change in the system. The current formula of bid price set by the KPX consists of variable cost only, including fuel cost and start-up cost,⁵⁴² which means it does not reflect any social cost of greenhouse gas emissions from the fossil fuel power plants and only covers private fuel costs for generating a unit of electricity.

The unusual aspect of the system marginal price is the “adjustment index” applied to the price of power purchased from the subsidiaries of the KEPCO. The purchase price excluding the capacity payment for the power generated by the KEPCO’s subsidiaries is adjusted by an index that has been arbitrarily and irregularly determined by the KPX since 2008.⁵⁴³ The purpose of the adjustment index system has been explained as balancing the excessive margin of the generation subsidiaries and the potentially lower margin of the KEPCO.⁵⁴⁴ As discussed later in this Section, for the extremely low industrial retail price during the off-peak hours, the market-clearing plant is normally the peaker plant due to the higher demand that cannot be covered only by the baseload plants, making the margin of the base-load plants higher, which is

⁵³⁹ The formula for bid price is established by the Electric Power Market Operation Regulation of the KPX based on Article 43 of the Electricity Business Act.

⁵⁴⁰ The statutory ground of the economic dispatch is Article 45 of the Electricity Business Act, which requires the operation of the electricity grid to follow the order determined in the electric power market.

⁵⁴¹ Para. 2 and 3, Article 3, and Para. 5, Article 25, Electricity Business Act, South Korea Legislation No. 953, most recently amended as Legislation no. 14672 on Mar. 21, 2017.

⁵⁴² Electric Power Market Operation Regulation of the KPX (last updated March 2017). The start-up cost means the fuel cost to start the operation of a certain power plant.

⁵⁴³ For example, the adjustment index for coal in 2012 was changed four times, to be 0.1560, 0.0500, 0.0001, and 0.1352 each. See, for the adjustment index applied between 2008 and 2012, National Assembly Budget Office, Problems in the Electricity Pricing Scheme and Improvement Plan (June 2013), p. 18. The volatility and the arbitrariness of the adjustment index have been highlighted as factors that hinder predictability in the electric power market. See, e.g., Sang-Rim Lee, Research on the Stabilization of the Electric Market Price, Korea Energy Economics Institute, Basic Research Paper 13-07, 21-24 (2013).

⁵⁴⁴ *Id.*

against the basic intent of a time-of-use price mechanism adopted in the retail market.⁵⁴⁵ The adjustment index appears to have been introduced to release the burden of the KEPCO while suppressing the retail price.⁵⁴⁶ But this index system may not be maintained once the ownership of the power generation corporations currently owned by the KEPCO is diversified.

The capacity payment was set as a single number, 7.46 Korean won/per kWh (approximately \$0.065/kWh) for all types of power plants from 2006 until November 2016, which disincentivized the generators from investing in any technology to reduce greenhouse gases or alleviate health concerns.⁵⁴⁷ The capacity payment was slightly increased in a new formula for the LNG power plants in November 2016 based on a new rule, which was explained to have considered, among other factors, the environmental contribution of each power plant.⁵⁴⁸ This measure produced a misleading outcome in terms of carbon pricing because it did not affect the market clearing price, and it made the wholesale price of electricity generated by LNG plants more expensive vis-à-vis that generated by coal.⁵⁴⁹

This less refined pricing system in the wholesale market was originally devised as a bridge between a regulated market in transition to a competitive one in the 2000s. The original deregulation plan scheduled a gradually launch of the competitive wholesale market, in which privatized generation firms and transmission firms were supposed to participate in offering competitive bids between 2003 and 2008.⁵⁵⁰ The plan to sell out KEPCO's generation subsidiaries as the first step to realize the competitive wholesale market was halted due to political conflicts when a few private companies gave up submitting a bid for one of the generation subsidiaries of the KEPCO in October 2002, which has happened several times more.⁵⁵¹ The opaque and arbitrary pricing scheme in the wholesale market is also often highlighted as one of the reasons that the sale of the subsidiaries is not consummated.⁵⁵²

⁵⁴⁵ The market-clearing plant during the peak time is also the peaker plant.

⁵⁴⁶ The adjustment index system is commonly referred to as one of the measures to stabilize the electricity price. See, Sang-Rim Lee, *supra* note 543.

⁵⁴⁷ The capacity payment was slightly increased in a new formula for the LNG power plants in November 2016. Under this new scheme, the launch date of each power plant is reflected in the capacity payment.

⁵⁴⁸ Para. 8, Article 2.4.3, Electric Power Market Operation Regulation of the KPX.

⁵⁴⁹ The actual increase of payment was reportedly minimal, around 2 Korean won/kWh (approximately \$0.018/kWh). See Ki-jin Kim, Capacity Payment Increase after 11 Years, the Korea Electric Power News (Nov. 7, 2016) at <http://www.epnews.co.kr/news/articleView.html?idxno=42964> (last visited March 10, 2018).

⁵⁵⁰ Ministry of Industry and Resources, The Framework Plan for Restructuring the Power Markets (Jan. 21, 1999); National Assembly Budget Office, Problems in the Electricity Pricing Scheme and Improvement Plan, 14-15 (June 2013).

⁵⁵¹ National Assembly Budget Office, *id.*

⁵⁵² National Assembly Budget Office, *supra* note 550 at 18-19.

B. Compensation Scheme for the Cost of the Emissions Rights

The KPX added another pricing formula to reflect the cost of emissions after the launch of the KETS, a method that does not properly reflect the externalities of carbon. The new, complicated formula basically aims to fully compensate the generators' spending for the purchase of the emissions rights based on an ex-post calculation of the cost.⁵⁵³ The KPX determines a "base price" for the value of a unit of emissions rights based on the average of the emissions rights price and the average of the emission rights price paid by the generators for a certain compliance year after the year is closed. For example, the compliance year of 2015 lasts until June of 2016, and the base price for the year of 2015 is calculated based on the aforementioned average prices from January 2015 to June 2016. The number of emissions rights to be multiplied by the base price is calculated based on a complicated formula in which the freely granted allowance or the earnings from the sales of emissions rights are subtracted.

This compensation formula, within the current structure of the wholesale market and the KETS, raises efficiency questions. First, given the oversupply of the emissions rights during Phase I, high free allowances to be granted for Phase II and the loose overseas offsets program, it is doubtful that the reflection of emissions rights in the electricity price this way would effectively influence the generators' business decisions. This might be a natural outcome of the problems in the KETS. Second, the formula helps generators to pass on their cost to the purchaser of electricity. As the compensation amount is calculated and paid ex-post after a compliance year is closed, the cost of obtaining the emissions rights does not affect the ordinary competition between coal power generators for the same compliance period.⁵⁵⁴ It will instead be borne by the retailer, the KEPCO, but it is not clear whether the KEPCO will pass the cost onto the consumers, given that the owner of the KEPCO, the Ministry of Trade, Industry and Energy, is less interested in addressing the environmental externalities and more interested in suppressing the electricity price for the industrial customers that it regulates, as discussed later in this chapter. The adjustment index system has helped the arbitrary change of the profit and loss structure between the KEPCO and the generation subsidiaries. Thus, the generation subsidiaries of the KEPCO have fewer incentives to reduce CO₂ emissions under the current scheme, which will also affect the incentives of private coal power plants. Third, the opportunity costs are not reflected in the compensation scheme at all. Generation companies consider the opportunity costs when deciding whether to use the emission rights for compliance or sell them in the market even in the case where the emissions rights are provided for free.⁵⁵⁵

⁵⁵³ Articles 2.1.1.4, 2.4.5, and 4.2.1.4, Power Market Operation Rule, Korea Power Exchange; Chapter 23, Detailed Operation Rules on the Cost Assessment (added by an amendment on September 28, 2016), Korea Power Exchange.

⁵⁵⁴ Competition between coal and LNG power generators never happens under the current structure because the system marginal cost of a coal power plant is much lower than for an LNG power plant due to the lack of consideration about environmental externalities and the higher taxes levied on LNG importation.

⁵⁵⁵ Robert N. Stavins, *Wonderful Politics of Cap-and-Trade*, *The Environmental Forum*, Vol. 26, 16 (Sept./Oct. 2009); Jos Sijm, Karsten Neuhoff & Yihsu Chen *CO₂ cost passthrough and windfall profits in the power sector*, *Climate Policy*, Vol. 6, Issue 1, 49-72, 50-52 (2006); Dallas Burtraw, Karen Palmer,

So, unless the compensation formula reflects the opportunity costs to the compensation scheme, it will remain as an incomplete and less efficient one creating distortions. Fourth, as an ancillary effect, the compensation structure relying on an average price of emissions rights makes the power generators that purchased the emissions rights at a higher price subsidize the generators that purchased the emissions rights at a lower price. Apparently, this is not a result that the KETS intends. Unless these problems are addressed, the KETS cannot effectively impact the marginal decisions of the generation firms only leading to an inefficient outcome, which means that there is little chance that the greenhouse gases emitted from the coal power generators will be significantly reduced.

C. Proposals for Reform

The problems in the general wholesale pricing scheme or the compensation scheme for the emissions rights cost show that the current scheme will need reforms to be effective in reducing greenhouse gases.

Some may think of the command-and-control type regulation as a possible supplement to the KETS.⁵⁵⁶ Aside from the general efficiency of the market-based scheme vis-à-vis command-and-control regulations,⁵⁵⁷ the current institutional structure in which the Ministry of

and Danny Kahn, Allocation of CO₂ Emissions Allowances in the Regional Greenhouse Gas Cap-and-Trade Program. RFF Discussion Papers 5–7 (2005); Julia Reinaud, Impact of Carbon Emission Trading on Electricity Generation Costs, Energy Prices & Taxes Quarterly, International Energy Agency (2nd Quarter 2005), 6-18, 7.

⁵⁵⁶ A research on the political economic aspect of the KETS presented a few interviews with Korean professionals about the efficacy of the KETS, where some of interviewees stated that a market-based mechanism would not work in Korea and a command-and-control system would be better suited because Korean society did not have enough experience for such mechanism. See Janelle Knox-Hayes, *The Cultures of Markets: The Political Economy of Climate Governance*, 121-138 (Oxford University Press, 2016). However, the statements of the interviewees might be misleading because less experience in operating market-based schemes does not necessarily incapacitate a new trial for such system and Korea does have noticeable examples of successful market-based regulations despite its rather short history of modern regulation. For example, the country has been ranked first in urban waste recycling rate by the OECD for several years through a unique mechanism called the Volume-Based Waste Charge System that is considered as an exemplary case for the waste management of large cities in the world. For the details of the system, see Seejeon Park, and T.J. Lah, Analyzing the success of the volume-based waste fee system in South Korea, *Waste Management*, Vol. 43, 533-538 (2015).

⁵⁵⁷ The market-based scheme is known to “minimize the aggregate cost of achieving a given level of environmental protection” and “provide dynamic incentives for the adoption and diffusion of cheaper and better control technologies.” See Nathaniel O. Keohane, Richard L. Revesz, and Robert N. Stavins, *The Choice of Regulatory Instruments in Environmental Policy*, *Harvard Environmental Law Review*, Vol 22, 313-367, 314, 346-362 (1998). The authors in this article maintain that the aggregate demand for a market-based scheme is likely to be greater than the command-and-control type regulation when the environmental problem at issue is a new subject for regulation, though the command-and-control type regulation has been more pervasively utilized for environmental problems.

Trade, Industry and Energy intervenes in the market as the owner of the power generators makes the prospect of the implementation of command-and-control less positive. The implementation gap in monitoring and sanctioning activity seems significant. A study by the research institute of a local government showed that four coal power plants located in Chungnam province, each of which is owned by a 100% power-generating subsidiary of the KEPCO, repeatedly violated the standards for SO_x emissions during the period of 2008 to 2012, but the level or frequency of violation did not decrease for the same period.⁵⁵⁸ The agency responsible for investigating the status of compliance and enforcing the command-and-control type environmental regulation is the local office of the Ministry of Environment, while the power plants are operated and ultimately owned by the Ministry of Trade, Industry and Energy. As discussed, the Ministry of Trade, Industry and Energy leads the entire energy policy with little participation from other agencies. Thus, it is practically inconceivable that the local offices of the Ministry of Environment impose heavier sanctions on the power plants, e.g., an order to temporarily suspend the operation of a power plant, as far as the Ministry of Trade, Industry and Energy is not interested in taking proper measures to enhance the level of compliance. Given the serious implementation gap tolerated by the institutional structure, a transparent, market-based scheme will be more promising than a command-and-control type regulation in controlling the greenhouse gases in the power generation sector in Korea. In this regard, it would not be questionable that a market-based mechanism would be a more efficient scheme than a new command-and-control regulation in Korea.

As the country has already chosen the nation-wide cap-and-trade system, adjusting the current compensation mechanism in the wholesale market with improvements will be most cost-effective in building up a more effective greenhouse-gas mitigation system. If the compensation for the generation companies is more properly made for the cost of obtaining the emissions rights and opportunity cost to retain and use them for compliance, it will effectively reflect the social cost of CO₂ assuming that the KETS is also improved in the aspects that are discussed in the previous section. If properly reflected, the added social cost may result in a change in the dispatch order placing the renewables and LNG power plants before the coal power plants.⁵⁵⁹ The fuel cost for a unit used by the Korea Power Exchange for April 2017 was

⁵⁵⁸ In the case of Tae-ahn Power Plant, for example, it was found to violate the SO_x standard 10 times and the dust standard six times during five years. In-hee Lee and Hye-jeong Oh, *The Environmental and Economic Damage Caused by the Power Generation Facilities in Chungnam Province: With Focus on Thermoelectric Power Plants*, 22-25 (2013), available at http://www.cdi.re.kr/report/view.asp?id=JU&code=030401&sid=&page=8&ori_keyword=&keyword1=&cd=baKbFC7m7ZiJJs3hr6mxKQ%3D%3D. Given that the government's inspection normally happens two times a year, it appears that those power plants were in violation of the SO_x standard almost all the time during the period without proper action by the government. As the Korean system does not have a command-and-control type regulation on CO₂, and the command-and-control type regulation of NO_x has been nominal, no relevant data is available for CO₂ or NO_x.

⁵⁵⁹ It is notable that the current KETS only works for the social cost of CO₂, and the social cost of the other greenhouse gases, and criteria air pollutants, including the particulate matter that is seriously considered in Korea, should be also reflected in the electricity price. If the wholesale market becomes completely competitive and a proper regulation on the other types of greenhouse gases is in place, this issue will be naturally addressed in the market. However, so long as the wholesale market maintains the current shape, more systematic measures should be taken to reflect those social costs.

reported as 50.22 Korean won/kWh for coal and 79.25 Korean won/kWh for LNG.⁵⁶⁰ The social cost of carbon dioxide and damages from air pollution per kWh once used for internal research performed by the Ministry of Environment, discussed in Table 4, was 86.39 Korean won/kWh for coal and 16.3 Korean won/kWh for LNG. Thus, if the social cost of is added, the unit fuel cost of LNG is 95.55 Korean won/kWh, lower than 136.39 Korean won/kWh of coal, which will change the dispatch order, making the electricity from LNG power plants likely to be purchased before the generation from coal power plants.

Lastly it would be worthwhile to discuss how to mitigate the burden of the customers from the increased electricity price. One way to consider is to utilize the auction revenue from the Phase II in the KETS to mitigate the concerns over price increase for the residential customers.⁵⁶¹ A survey on the spending of the revenue from the auction of cap-and-trade system and carbon tax in various jurisdictions showed that the revenue from the cap-and-trade is more earmarked for “green spending” while the carbon tax has been spent more generally so far. California returns a significant portion of the revenue to the residential customers as “Climate Credit.”⁵⁶² The New York Independent System Operator, Inc. (NYISO) considers options to return the revenue from the newly discussed carbon tax on the wholesale electricity price to customers to mitigate the concern of price increase or use for the relevant policy purposes, e.g. energy efficiency programs or subsidies for lower income residential customers.⁵⁶³ The details of the spending plan for the revenue from the auction in Phase II of the Korean emissions trading scheme have yet to become public, and it is known to be invested environmental friendly projects.⁵⁶⁴ The plan should be carefully designed with consideration of the impact on the overall economy, while earmark spending with some flexibility will help promote policy goals and mitigate the political concerns surrounding the climate policy.⁵⁶⁵ The case of California and the NYISO’s plans for spending are useful references. The focus should be on relieving the

⁵⁶⁰ Sung-ho Jeong, The Gap between Fuel Cost of Coal vs. LNG Power Generation, Lowest Ever, Yonhapnews (May 31, 2017), at <http://www.yonhapnews.co.kr/bulletin/2017/05/30/0200000000AKR20170530151200003.HTML> (last visited March 20, 2018). The gap has been reportedly reduced due to the increase in the global market price of coal and decrease in the price of natural gas.

⁵⁶¹ See Jeremy Carl, and David Fedor, Tracking global carbon revenues: A survey of carbon taxes versus cap-and-trade in the real world, *Energy Policy*, Vol. 96, 50-77 (2016).

⁵⁶² California Public Utilities Commission, California Climate Credit, available at <http://www.cpuc.ca.gov/climatecredit/> (last visited May 4, 2018);

⁵⁶³ Samuel A. Newell, Pricing Carbon into NYISO’s Wholesale Energy Market to Support New York’s Decarbonization Goals: Prepared for NYISO, the Brattle Group, 22-23 (Aug. 10, 2017), submitted as Item No. 1 to the NYPUC in re Matter No. 17-01821.

⁵⁶⁴ The Ministry of Strategy and Finance, Amended Plan for Allotment in 2017 and Finalized Plan for Phase II of the Emission Trading Scheme, Jan. 24, 2017.

⁵⁶⁵ Donald B. Marron and Dele C. Morris, How to Use Carbon Tax Revenues, Urban Institute & Brookings Institute, Tax Policy Center (Feb. 2016) (Recommending using a part of the revenue to reduce other taxes, avoiding tight earmarks and addressing the concerns of the energy price increase of lower-income households and workers in the coal industry to sustain the public support for a carbon tax.)

burden of the residential customers through providing credits in gradually decreasing amounts; expanding the energy efficiency program, for example, by using a smart grid system for residential customers where the customer can more actively participate in controlling electricity use;⁵⁶⁶ and energy subsidies for lower-income customers, among others.⁵⁶⁷ The next section discusses the status of the retail industrial pricing scheme with the potential for more energy saving.

III. The Potential of the Retail Electricity Price for Energy Saving

The concern over the electricity price increase in relation to carbon pricing is as present in Korea as it is elsewhere. The generous pricing policy for industrial customers, which has created inefficiency and low incentives to save electricity, however, indicates that the entire industry might have the potential to significantly save electricity use going forward. Industrial use accounts for 57.06% of the entire electricity use in Korea, while residential use only accounts for 16.58% as of 2014.⁵⁶⁸ A study performed by the National Assembly Budget Office estimated that the industrial electricity consumption vis-à-vis GDP in Korea ranked fourth among the OECD countries, while the residential use ranked 26th in 2011.⁵⁶⁹ Some surveys assess the industrial price of electricity in Korea as the lowest group among the OECD countries.⁵⁷⁰

⁵⁶⁶ Korea once made various efforts to launch a smart grid system in the early 2010s, when the Smart Grid Construction and Utilization Promotion Act (legislation no. 10714, last amended as legislation no. 14674) was discussed and went into effect. A sizable prototype was designed and operated in Jeju Province, connecting the wind power turbines and solar photovoltaic power generation into the electricity grid between 2012-2013. Since the new president assumed office in 2013, however, the smart grid projects have lost political support and have been on hold. Given the high quality of the reliable electricity grid, extremely high-speed Internet network and high density in Korea, the smart grid system is no less promising than it is in other countries.

⁵⁶⁷ The industrial sector has more room for saving electricity use, which is discussed below.

⁵⁶⁸ Electric Power Statistics Information System, Comprehensive Data for Each Customer Group (2014), at <http://epsis.kpx.or.kr/epsisnew/selectEksaCscCscGrid.ajax?menuId=060801> (last visited March 30, 2018).

⁵⁶⁹ National Assembly Budget Office, *supra* note 543 at 10. One of the reasons why residential use is relatively small among the OECD countries is that heating in the urban area is primarily done using natural gas, and this system is regulated and managed as the so-called “urban gas” system.

⁵⁷⁰ Dong-ho Kang, the Direction of Restructuring the Electricity Pricing Scheme, Deloitte, 2 (October 2016). The method of calculation when comparing the electricity price seems to be controversial because the pricing scheme in each country differs, and the discounts granted to each customer group are hard to measure. In the case of Korea, the statistics published by the KEPCO do not make it clear whether the numbers reflect the discounts or any other factors in the relevant transactions. However, it is generally observed that the industrial rate in Korea is among the lowest in comparison with developed countries.

The basic formula for the industrial rate is a type of time-of-use scheme.⁵⁷¹ The time-of-use pricing is a rate scheme wherein the rate varies depending upon a few pre-set time windows or seasonal blocks.⁵⁷² It is widely used for industrial customers in the U.S. and known to be more efficient than a flat rate because it reflects the variation of supply and demand, although it does not reflect the shorter-term variation in the marginal cost of generation or supply and demand balance in as timely a way as a real-time pricing does.⁵⁷³ The rate table in 2018 for a group of manufacturing customers with the contract amount of 300 kW or more⁵⁷⁴ during the summer season between June and August consists of the base rate of 7,220 Korean won/kW, with the unit price for the peak time as 61.6 Korean won/kWh, for the partial-peak time as 114.5 Korean won/kWh and for the off-peak time as 196.6 Korean won/kWh.⁵⁷⁵

A notable phenomenon in Korea, however, is that the hourly use of electricity during the off-peak time is almost double that of peak-time use, reversing the practical peak and off-peak time. Table 5 shows the difference in the average hourly use in peak, partial peak and off-peak time of the top five industrial customers in 2012, which is the reverse of the commonly conceived demand fluctuation.⁵⁷⁶

[TABLE 5] HOURLY USE OF ELECTRICITY OF TOP 5 INDUSTRIAL CUSTOMERS (Unit: GWh)

Off-Peak	Partial Peak	Peak
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⁵⁷¹ The residential rate still uses the increasing-block scheme.

⁵⁷² Severin Borenstein, Time-Varying Retail Electricity Prices: Theory and Practice, 317-357, in James M. Griffin and Steven L. Puller (eds.), *Electricity Deregulation: Choices and Challenges* (2005).

⁵⁷³ For the efficiency of real-time pricing reflecting the marginal cost of generation, see Paul L. Joskow, and Catherine D. Wolfram, Dynamic Pricing of Electricity, *American Economic Review: Papers & Proceedings*, Vol. 102, No. 3, 381-385 (2012); Borenstein, *id.*

⁵⁷⁴ This is the customer group with the largest contract volume for the KEPCO. See KEPCO, Rate Table, at <http://cyber.kepco.co.kr/ckepeco/front/jsp/CY/E/E/CYEEHP00103.jsp> (last visited March 30, 2018).

⁵⁷⁵ *Id.* The KEPCO has maintained the structure of time-of-use price scheme since the 1970s. See KEPCO, The Status and Tasks of Electricity Pricing, 34 (March 2006), at [http://www.kemco.or.kr/up_load/blog/%EC%A0%84%EA%B8%B0%EC%9A%94%EA%B8%88%ED%98%84%ED%99%A9\(200603\)-%ED%95%9C%EC%A0%84%EC%9A%94%EA%B8%88%EC%A0%9C%EB%8F%84%ED%8C%80.ppt](http://www.kemco.or.kr/up_load/blog/%EC%A0%84%EA%B8%B0%EC%9A%94%EA%B8%88%ED%98%84%ED%99%A9(200603)-%ED%95%9C%EC%A0%84%EC%9A%94%EA%B8%88%EC%A0%9C%EB%8F%84%ED%8C%80.ppt) (last visited March 30, 2018).

⁵⁷⁶ The total usage numbers are quoted from the research of the National Assembly Budget Office. See, National Assembly Budget Office, *supra* note 543 at 45. The number of hours for each time window is from the KEPCO's past rate table for the year of 2012 at <http://cyber.kepco.co.kr/ckepeco/front/jsp/CY/E/E/CYEEHP00301.jsp>. Off-peak time was 10 hours, partial peak time was 8.67 hours on average and peak time was 5.33 hours on average in 2012. Based on the same methodology, the usage of large industrial customers shows similar patterns, while the concentrated use of electricity during the off-peak time is observed to be more salient in the case of top customers.

Total Usage	21,791	11,120	6,013
Average Hourly Usage	2,179	1,283	1,128

It is clear that this pattern of consumption is not the one usually intended by a time-of-use pricing scheme, which shows that the current unit prices for each time window do not properly incentivize customers to reduce electricity. Instead, this scheme fundamentally shifts the primary use of electricity to happen during the off-peak time, eventually helping the industrial customers to save on the electricity bill at the lowest unit price.⁵⁷⁷ The study of the National Assembly Budget Office shows that the KEPCO's cost for a unit of electricity for the off-peak time, 81.8 Korean won/kWh, is higher than the retail rate for the industrial customers for the off-peak time, 61.8 Korean won/kWh, in 2012.⁵⁷⁸ The KEPCO reportedly plans to raise the industrial rate for the off-peak time,⁵⁷⁹ but the ratio of off-peak price vis-à-vis peak price does not much differ between 2012 and 2018, at 31.14% and 31.33% for each year, respectively.⁵⁸⁰

The overconsumption amount of industrial customers has been significant. A lawmaker once disclosed the response from the KEPCO to his inquiry about the profits and losses from the electric power supply transactions for each of the 20 largest Korean companies in 2012-2014.⁵⁸¹ According to the press release from the lawmaker's office, the KEPCO's loss from those transactions amounted to 723.95 billion Korean won (\$660 million USD) in 2014 alone and 3,541.83 billion Korean won (\$3.24 billion USD) in total between 2012 and 2014.⁵⁸² The press

⁵⁷⁷ A news report explained that automated processes in manufacturing facilities enabled this pattern of use, although the exact technical know-how of the industrial customers spending more electricity during the nighttime has never been reviewed nor announced by the KEPCO or the government. See Joo-Ree Kang, Nighttime Use with Cheaper Price is 2.5-fold of Peak-time Use of Electricity, Seoul Shinmun (Aug. 17, 2017), at <http://www.seoul.co.kr/news/newsView.php?id=20170818020024> (last visited March 30, 2018).

⁵⁷⁸ See National Assembly Budget Office, *supra* note [#] at 47. The study explains that the electricity from the peaker plants has been used during the off-peak time due to the higher demand during the nighttime, which keeps the cost to procure the off-peak time electricity higher. It is not clear, however, which factor came first between the lower off-peak rate and the higher use during the off-peak time.

⁵⁷⁹ Yonhap News, Electricity Price Not Increasing? Nighttime Price for Industrial Use is an Exception, Dec. 14, 2017, at <http://www.yonhapnews.co.kr/bulletin/2017/12/14/0200000000AKR20171214070500003.HTML?from=search> (last visited March 30, 2018).

⁵⁸⁰ See for the 2018 Rate Table, <http://cyber.kepco.co.kr/ckepco/front/jsp/CY/E/E/CYEEHP00103.jsp> (last visited March 30, 2018), and for the 2012 Rate Table, <http://cyber.kepco.co.kr/ckepco/front/jsp/CY/E/E/CYEEHP00301.jsp> (last visited March 30, 2018).

⁵⁸¹ See Office of Joo-min Park, the lawmaker-elect, Press Release, May 18, 2016. The concentration ratio of the Korean economy is so high that the top 20 conglomerates' total revenue amounted to 34.1% of the whole economy in 2012 and 33.2% in 2013. See the Concentration Ratio of Top 30 Conglomerates between 2000 and 2013, Korea Economy Research Institute (Feb. 5, 2015.)

⁵⁸² See Office of Joo-min Park, the lawmaker-elect, Press Release, May 18, 2016. There have been reports or press releases by other lawmakers about similar points. The lawmaker Nak-yeon Lee, for example, also disclosed that the cost loss the KEPCO incurred from the transactions with the 20 largest

release explains that the “loss” means the gap between the supply cost and the payments received from the 20 companies.⁵⁸³ It further points out that the rates for the 20 largest companies are much lower than the average industrial rates and the residential ones.⁵⁸⁴ The explanation of the “loss” was not self-explanatory from the press release. Therefore, I filed an Information Disclosure Request with the KEPCO to check the calculation methods of this “loss” and the loss from transactions in 2015-16 from the accounts of the same companies, calculated the same way. The KEPCO rejected disclosing the information, explaining that the company had “basically” rejected disclosure requests about the cost of a specific group of customers because this was confidential business information.⁵⁸⁵ The company, however, briefly clarified how the “loss” was calculated: the gap between the cost of generation for the entire industrial electricity supply and the received payment amount from the relevant companies mentioned in the press release.⁵⁸⁶ So, it is understood that the KEPCO used the term “loss” to mean the operating loss, worked out for certain customer accounts. It is not uncommon to provide volume discounts for large customers in general commercial transactions, and a price discrimination is often adopted by a monopolistic supplier as a business strategy. However, it might not be common for a monopolist company to knowingly keep incurring operating loss from transactions with the largest customers whose total billing amount accounts for 30% of the company’s sales of a specific product.⁵⁸⁷ Thus, it appears that the low industrial electricity price has been maintained as part of the government’s industrial policy rather than the KEPCO’s business decision. This

industrial customers in 2012 is 755.2 billion Korean won, based on data submitted by the KEPCO. The ratio of the electricity consumption of the 20 companies is reportedly 29.4% of the consumption of all industrial consumers in 2012. See Ji-young Ahn, *The Lawmaker Nak-yeon Lee Talked about the KEPCO’s Loss for Benefits to Big Companies*, Chosun-Ilbo (Aug. 21, 2013). (The lawmaker referred to in this news joined the current administration, and the official website as a congressperson where the relevant press release or document was supposed to be posted is currently closed.)

⁵⁸³ *Id.*

⁵⁸⁴ *Id.* It is not clear from the material whether a special rate lower than the rate table publicized by the KEPCO has been applied for the larger customers or if it meant that a significant discount was applied for the larger customers. If neither is the case, the reverse of the peak and off-peak time and overconsumption in the off-peak time might be the only reason for this extraordinary status of those transactions with larger customers.

⁵⁸⁵ See the KEPCO, *Response to the Information Disclosure Request No. 4369325*, Dec. 12, 2017; an electronic copy is on file with the Author. The KEPCO seemed to try to explain that the disclosures at the requests of lawmakers were politically inevitable, but that they do not disclose the information to the public. The KEPCO also added that other public institutions in Korea and electric power companies in foreign countries do not disclose the supply cost for a specific group of consumers, and that it cannot be disclosed also due to the risk of potential domestic and overseas lawsuits from investors or shareholders.

⁵⁸⁶ This response was not yet clear but is understood to have meant that the gap between the proportional total cost of generation for the relevant companies vis-à-vis the entire industrial supply and the payment received from those companies.

⁵⁸⁷ The data is not available about whether the KEPCO offered a discounted rate lower than the published rate table to the larger industrial customers or a part of the published rate table, e.g., the off-peak price, was set far below the supply cost.

seems to be one the significant reasons why Korean large companies have been less interested in saving electricity through enhancing energy efficiency and developing renewable sources.⁵⁸⁸

The fairness issue has been also raised because the generous pricing of industrial use has made a cross-subsidy from the residential to the industrial customers.⁵⁸⁹ Given that only the largest customers have received the aforementioned structure of discounts, a cross-subsidy issue between the larger industrial customers and smaller ones in the same customer group may also be an issue that may have undermined the cost competitiveness of smaller companies in cases where there was an actual competition in a relevant product market.⁵⁹⁰

In sum, electricity saving in the industrial sector has yet to begin in Korea, which means that the sector has a fair amount of potential to accommodate an increased electricity price with greenhouse gas adders through each firm's energy-saving efforts. If the wholesale market attracts more competition with a more transparent, competitive pricing scheme with a greenhouse gas adder, and a time-variant pricing scheme reflecting the shorter time variations of the marginal cost of electricity is introduced for the industrial sector retail price, these will be ideal mechanisms to reflect the social cost of greenhouse gases in the electricity price, inducing far less use. If these changes do not take place soon, changing the retail pricing scheme into a time-of-use one to properly incentivize less use during the daily and seasonal peak times will be a practically achievable solution.

⁵⁸⁸ There was an illustrative event about the demand response system in 2017. As it is still in its incipient stage, it appears that a significant number of the industrial customers have recognized the system as a unilateral order to reduce electricity use rendered by the government. A few renowned news outlets reported that the government unreasonably forced the industrial customers to cut electricity usage based on anonymous interviews with industrial customers in August 2017. This was later revealed to have been an ordinary seasonal examination of the demand response system, commonly required under the demand response contract between an industrial customer participating in the demand response system and a demand response management system provider. *See*, Ministry of Trade, Industry, and Energy, Press Release for Clarification (Aug. 8, 2017). It shows that electricity saving is still not an ordinary subject that attracts business interests and that the electricity market has been operated unilaterally by the government with little active participation from the customers. There are reportedly 3,000 industrial customers participating in the demand response system, but it appears that the system would need more understanding and utilization by the participants.

⁵⁸⁹ A study assessed the cross-subsidy as one of the results of the halted deregulation of the wholesale electricity sector. *See* Russell Pittman, Which direction for South Korean electricity policy?, *Korean Energy Economic Review*, Vol. 13, No. 1 145-178, 158 (Mar. 2014).

⁵⁹⁰ Though an example of this issue is lacking due to the limited availability of the relevant data at this time, it merits further research.

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