

South Korea's Legal and Regulatory System for Carbon Capture and Sequestration: Backgrounds, Current Circumstances, and Recommendations

MoonSook Park*

Abstract

In South Korea, CCS technology is a necessary and viable option, and the important thing is to build a clear roadmap for CCS legislation and regulation. South Korea's CCS legal and regulatory systems need to be strong, set up under the principle of the precautionary principle, and in particular, it is necessary to elaborate and strengthen the standards for permit systems, environmental impact assessments, and monitoring. It is also necessary to put liability of CCS operators under the strict liability so that the strong regulatory regime can be well maintained, and that credibility on CCS investment from the private sectors can be enhanced. At the same time, South Korea needs to adopt a transfer of liability to the government after a certain period of time. Finally, if onshore sequestration becomes a reality and the issue of ownership of the pore space, which is possible sequestration areas, is raised, it is recommended to adopt the option of government ownership so that the government reduces the transaction costs and enables CCS projects to proceed quickly. In terms of preparation for an international CCS framework, South Korea needs to contemplate CCS strategies that are appropriate to the situation in South Korea.

KEY WORDS: Carbon Capture and Sequestration, carbon dioxide emission reduction, precautionary principle, CCS legal issues, liability transfer, transboundary implementation, international cooperation

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* Researcher, ChungAng University Industry Academic Cooperation Foundation, Korea

I. Introduction

One crucial technology, which is termed carbon capture and sequestration (CCS), has attracted attention as a viable option to combat the problem of climate change by directly capturing and permanently isolating carbon dioxide from its emission sources, such as fossil fuel power plants. Domestically, a number of countries have put legislative efforts toward fixing existing legal systems and preparing a new system for CCS implementation, but it is not yet complete. Setting legal and regulatory systems for CCS is important because the lack and incompleteness of these legal and regulatory systems could lead to a delay in the implementation and commercialization of CCS. This delay may result from the lack of certainty for CCS operators and, more importantly, the inability to cope with the potential risks of CCS, which may cause harm to humans and the environment.

The most important and urgent task in South Korea is to create CCS legislation: a single, comprehensive law that deals only with CCS and covers the entire process of CCS. To this end, this paper sets out desirable directions and provides a roadmap for South Korea's CCS legal and regulatory framework. Therefore, rather than presenting specific provisions of the CCS law, this paper takes a more outlined approach that suggests overall desirable directions for the CCS system to take, including a legislative form and government agency form. Meanwhile, in the case of the main legal issues (e.g., permits, environmental impact assessment, liability, pore space ownership), this paper intends to give more concrete legislative options and contents. Since each country has a different domestic industrial structure, energy supply and demand situation, and basic legal system, the analysis on these matters will be necessary background knowledge in setting up CCS legislation and regulations. Thus, before presenting recommendations for South Korea's domestic CCS system, these backgrounds will be briefly explained. Based on this background knowledge and desirable directions, this paper suggests recommendations on not only a domestic legal framework but also how to prepare for international issues and challenges associated with CCS in South Korea.

II. Actual conditions and importance of CCS in South Korean industries, energy sector, and legal and administrative structures

1. South Korean industries, energy sector, and legal and administrative structure

At the 21st Conference of the Parties (COP) of the UN Framework Convention on Climate Change (UNFCCC), held in December 2015 in Paris, the Paris Agreement, which became the foundation of a new climate system created for the participation of all countries, was adopted.¹⁾ The South Korean government set the goal of a reduction in greenhouse gas emissions to 37% for Business As Usual (BAU) by 2030.²⁾ To achieve the carbon dioxide reduction goal in South Korea, CCS technology is essential and is expected to play a critical role.³⁾ This paper reviews the meaning and

1) The Paris Agreement was adopted on 12 December, 2015. The signing of the Paris Agreement was held in April 2016, and 175 countries participated in it. This showed a global will to resolve the climate change problem and also enables a positive outlook for an early entry into force of the Paris Agreement. This Paris Agreement opened for signature for one year from April 22, 2016. According to the Article 21 of the Paris Agreement, it will enter into force when fifty-five or more countries ratify and the amount of greenhouse gas emissions of the countries accounts for at least fifty-five percent of total global emissions. Finally, the Paris Agreement entered into force on 4 November, 2016. Under the Article 4 of the Paris Agreement, each party should suggest nationally determined contributions (NDCs) every five years and have it communicated. See *Paris Agreement - Status of Ratification*, UNITED NATIONS CLIMATE CHANGE, <https://unfccc.int/process/the-paris-agreement/status-of-ratification>; *The Paris Agreement Summary*, CLIMATEFOCUS, <http://www.climatefocus.com/sites/default/files/20151228%20COP%2021%20briefing%20FIN.pdf>. See also MoonHyun Koh & TaeYoung Ahn, *Legal Issues of CCS*, 35(1) SOONGSIL LAW REVIEW 31, 34 (2016) (in Korean).

The United States and China, the world's two biggest carbon emitters, formally joined the Paris Agreement, but United States President Trump officially announced the withdrawal from the Paris Agreement in June 2017.

2) This reduction aim is higher than the initial goal of 30% reduction for BAU by 2030. It is evaluated that South Korea set up a strengthened target when compared with other countries' reduction targets. See DongKyun Seo & WonSoon Kwon, *Economical and Environmental Study on SNG Combined Cycle Integrated with CCS for Large-Scale Reduction of CO₂* (Based on NETL Report), 26(5) KOREAN HYDROGEN AND NEW ENERGY SOCIETY 499, 500 (2015) (in Korean).

3) In 2014, South Korea's government established strategies for core technology development in order to respond to climate change and selected the top six technologies,

potential impact of CCS technology for South Korea. The necessity of implementing CCS technology and establishing legal and regulatory systems for it in South Korea becomes more convincing upon understanding South Korea's industrial structure and energy sector.

The main industries of South Korea, such as automobiles, shipbuilding, semiconductors, and steel, require the installation of heavy equipment that highly relies on fossil fuel energy. Of the energy sources for the South Korean power supply, oil (37.8%), coal (29.3%), and liquefied natural gas (18.7%) account for high proportions.⁴⁾ Nuclear energy amounts only to 10.4%, and renewable energy (solar power, wind power, tidal power, etc.) amounts to 3.2% or so.⁵⁾ The industrial structure and makeup of the energy sector lead to a massive amount of greenhouse gas emissions. Among Organization for Economic Co-operation and Development (OECD) member countries, South Korea has seen a significantly increased rate of greenhouse gas emissions.⁶⁾ Therefore, the ultimate energy system goal is to

which included CCS: solar cell, fuel cell, bio-energy, secondary cell, power information technology, and CCS. See KOREA INSTITUTE OF S&T EVALUATION AND PLANNING [KISTEP], STUDY ON THE INVESTMENT EFFICIENCY OF CLIMATE CHANGE RESPONDING TECHNOLOGIES THROUGH CURRENT CIRCUMSTANCES ANALYSIS –FOCUSED ON RENEWABLE ENERGY, NUCLEAR POWER, AND GREENHOUSE GAS TREATMENT TECHNOLOGIES, 5 (2016) (in Korean).

4) In South Korea, thermal power generation accounts for over 85% of energy generation. Therefore, it is more likely that CCS implementation can have positive effects on South Korea under this industrial structure. See Koh & Ahn, *supra* note 1, at 38. Meanwhile, the synthetic natural gas which is obtained from coal can be connected to CCS technology, and there is an analysis that this connection can be a competitive alternative by using the pre-combustion capture technology for carbon dioxide. See Seo & Kwon, *supra* note 2, at 500. Additionally, with regard to energy resources, South Korea's energy resources system is characterized by a substantial dependence on imports from other countries, and the dependence on imports of energy resources accounts for about 95% of the energy sector. This situation shows that the energy security of South Korea is vulnerable. See YounSang Lee, *Nuclear Power Dilemma*, KUKMINILBO, Feb. 16, 2015, <http://news.kmib.co.kr/article/view.asp?arcid=0922962840&code=11151400&cp=nv>. As for a characteristic with regard to the electricity industry structure of South Korea, Korea Electric Power Corporation (KEPCO), which is not a private enterprise but a public enterprise, exclusively produces and supplies electric power of South Korea. The government of South Korea owns 51% of all shares and, the KEPCO is comprised of five affiliated branches: Korea South-East Power, Midland Power, Western Power, Southern Power, and East-West Power Co., Ltd.

5) See Lee, *supra* note 4.

6) South Korea is listed as one of the top ten largest carbon dioxide emitters and shows the fastest increase speed of carbon dioxide emissions for the past ten years among OECD

develop low-carbon energy sources. The South Korean government also economically supports research and development in the renewable energy field and has prepared a legislative system for distributing and developing new renewable energy.⁷⁾ However, South Korea has yet to develop renewable energy on a significant level and faces economic and geographical restrictions to the switch to a renewable energy system.⁸⁾ More interest has been drawn to CCS technology that helps to maintain the conventional fossil fuel energy-centered system and treats a massive amount of carbon dioxide.⁹⁾

In addition, a basic understanding of South Korea's legal and administrative structure is required for any preparation of a law relating to CCS, which is the ultimate purpose of this paper, and makes it possible to prepare a more systematic and efficient law. South Korea's basic legislative system consists of the Constitution (the supreme law), acts, presidential decrees, and ministerial ordinances. The legislative system is based on a strict hierarchical order, and lower laws should not violate upper laws.¹⁰⁾ In terms of lower laws, there are administrative rules and the ordinances and rules of local governments.¹¹⁾ To come up with a systematic and

member countries (24.6%), which is more than double the average increase rate of all countries including developing countries (11.2%).

7) As of 2015, the investment scale in the field of research and development for greenhouse gas treatment amounts to ninety-one billion KRW (Korean Won). On the other hand, the investment in the field of renewable energy reaches four hundred and forty billion KRW. See KOREA INSTITUTE OF S&T EVALUATION AND PLANNING [KISTEP], *supra* note 3, at 44-45.

8) Taking into account geographical conditions in South Korea, there are difficult aspects for renewable energy development. For example, in South Korea, continuous electricity production and supply can be limited due to the monsoon climate as well as the small and overpopulated territory. This is called the intermittence problem of renewable energy resources. See Lee, *supra* note 4.

9) See JooSuk Lee & EunChul Choi, *The Economic Impacts of CCS Marine Geological Storage Demonstration Project on the National Economy using Input-output Analysis*, 38(1) OCEAN AND POLAR RESEARCH 71, 72 (2016) (in Korean).

10) Both presidential orders issued by the President and ministerial orders issued by the ministers of each department have the same effect. None of these executive orders violate laws, the higher-level legislation above these executive orders. According to the Article 26 of the Jeongbu jokik beob [Government Organization Act] of South Korea, there are currently seventeen executive ministries. See NATIONAL LAW INFORMATION CENTER, <http://www.law.go.kr/lsSc.do?menuId=0&subMenu=1&query=government%20organization#undefined>.

11) The current administrative structure of South Korea is comprised of seventeen

comprehensive legal and institutional framework for CCS, it is necessary to take into account not only acts, but enforcement decrees and ordinances. Aside from the legislative system in the National Assembly and the government dimension, it is necessary to set forth guidelines and rules for CCS businesses in the industry dimension.

2. Actual conditions and meaning of CCS in South Korea

To narrow the gap with developed countries, South Korea has made efforts to develop and commercialize the source technology of CCS and has achieved some outcomes. Nevertheless, some outcomes fail to realize research and development plans suggested by the government, and there are concerns over delayed development of CCS technology and commercialization. More specifically, the South Korean government intended to determine a storage place for CCS by the mid-2010s, and tried to complete integrated verification of capture and storage of a large 100-MW (megawatt) plant and commercialize it by 2020.¹²⁾ As of now, a 10-MW carbon dioxide capture plant (treating 200 tons/day) that directly precedes the commercialization step is installed in the Boryeong Thermal Power Plant Site Division of Korea Midland Power Co., Ltd, and in the Hadong Thermal Power Plant Site Division of Korea Southern Power Co., Ltd., and their performance is being tested.¹³⁾

The core task of CCS execution is where to secure a geological storage

provincial level divisions: eight provinces, one special autonomous province, one special city, six metropolitan cities, and recently designated metropolitan autonomous city. Each provincial-level division has its own local council and heads of local government in which ordinances and rules can be created. These ordinances and rules, which address local matters, play an important role for each local government to function well.

12) See DaeHyun Im, *Carbon Capture and Storage – Current Conditions and Future Tasks*, 3(4) KISTI MARKET REPORT 12, 15 (2013) (in Korean).

13) See JiHyun Lee et al., *Development of Techno-Economic Evaluation Model for CCS (Carbon Capture & Sequestration)*, 7(2) JOURNAL OF CLIMATE CHANGE RESEARCH 111 (2016) (in Korean). These small- and medium-sized CCS projects' implementation can be contributable to future CCS commercialization by providing experiences and track records necessary for large-scale CCS projects with construction of capture facilities over 100MW or 300MW. See Arom Kim & HyungMok Kim, *Scenario Analysis of Injection Temperature and Injection Rate for Assessing the Geomechanical Stability of CCS (Carbon Capture and Sequestration) System*, 26(1) TUNNEL AND UNDERGROUND SPACE 12, 13 (2016) (in Korean).

system for injected carbon dioxide. Because of the lack of suitability for storage in the onshore geology, South Korea has focused its exploration efforts in the offshore environment. To find such an offshore site, the Ministry of Oceans and Fisheries has researched candidate storage sites since 2010. As a result, a candidate site near the continental shelf of the Ulleung Basin has been found that could support a large-scale one-million-ton test.¹⁴⁾ However, to determine if the Ulleung Basin is a suitable place, an evaluation of the subsurface geology of the site using seismic surveys and a drilling survey is required. In April 2015, the Ministry of Oceans and Fisheries applied for a preliminary feasibility survey, and a relevant survey is in progress. If the site is found to be satisfactory, it is estimated for the South Korean government to invest 722.5 billion KRW (Korean won) from 2016 to 2025 and establish the first CCS offshore geological sequestration site in the country capable of storing one million tons of carbon dioxide annually.¹⁵⁾ An additional advantage of offshore geological sequestration is that onshore geological storage requires additional social expenses caused by pore space ownership issues and compensation costs.¹⁶⁾ Nevertheless, there is a lack of research on systematic systems for integrating and connecting capture, transport, and storage. There can be various transport scenarios, including land pipeline transport, ocean pipeline transport, and

14) The Ulleung Basin, which is 60-90 kilometers away from the metropolitan city of Ulsan, is located in the sedimentary layers of the continental shelf of the East Sea, 800-3000 meters below sea level. Currently, it is estimated that this storage site can store about 5.1 billion tons of carbon dioxide. When calculated with the criterion of sequestering 32 million tons of carbon dioxide annually, which is the target to reduce through CCS by 2030, this scale is such that South Korea can sequester carbon dioxide for more 150 years. See YeonGeun Jung, *Finding for CO₂ storage site responding to new climate systems*, NAEILTIMES, Dec. 8, 2015.

Besides this storage site, South Korea's government has searched western and southern oceans as well. In 2014, the *Ministry of Marine Affairs and Fisheries* and *Korea Maritime Institute of Science and Technology Laying Vessels Offshore Plants* published a carbon dioxide storage map containing potential distribution of the promising subsea structures of South Korea and possible storage capacity associated with each structure. For example, this map includes carbon dioxide storage structure of Gunsan Basin in the West Sea and Jeju Basin in South Sea, as well as Ulleung Basin in the East Sea. See Lee & Choi, *supra* note 9, at 73.

15) See Jung, *supra* note 14.

16) *Id.* However, South Korea has possibilities to find onshore storage sites and is looking into a few possible sites on land, such as Gyeongsang Basin, Bukpyeong Basin, and Pohang Basin. See NATIONAL INSTITUTE OF ENVIRONMENTAL RESEARCH [NIER], INTERNATIONAL EXCHANGE SOURCEBOOK FOR CCS ENVIRONMENTAL MANAGEMENT 45 (2013) (in Korean).

ship transport, and research on how to use them is still being conducted.¹⁷⁾

Given the actual conditions of the South Korean industry and energy systems, CCS is essential as a promising technology and an important plan for accomplishing the goals of limiting global temperature rise, responding to climate change, and achieving South Korea's goal of aggressive reductions in carbon dioxide emissions.¹⁸⁾ In the meantime, the CCS market is predicted to keep expanding and grow larger globally.¹⁹⁾ Therefore, it is time to secure the competitiveness of CCS in South Korea. For example, carbon dioxide capture technology development and its export, as well as the construction of CCS plants and CCS plant exports, can contribute to economic development in South Korea.²⁰⁾ Numerous developed countries use onshore geological storage, whereas South Korea takes into account offshore geological sequestration of carbon dioxide captured by power plants.²¹⁾ If CCS is successfully executed in South Korea, that success can offer strong technological and legal examples to developing Asian countries that need the establishment of new CO₂-emitting power plants and have the high possibility of offshore geological sequestration. In South Korea, the noticeable effort to respond to climate change and greenhouse gas emissions also includes executing a carbon emission trading system and attracting the Green Climate Fund (GCF), which shows not only the South Korean government's will and effort to resolve climate change issues but

17) See ByeongYong Yoo et al., *A Feasibility Study of CO₂ Marine Transport in South Korea*, 37 ENERGY PROCEDIA 3199 (2013); JongHoon Han, *Study on CCS Infrastructure Through the Analysis of CCS Industry and Actual Conditions*, 2011(1) GREEN TECHNOLOGY TREND REPORT 131, 141 (2011) (in Korean). Transportation through ships (with the application of carbon dioxide transport vessels) could be a leading example of a CCS project where South Korea has a competitive position. Additionally, there is a positive view that offshore technology associated with carbon dioxide transportation will be in favor of South Korea, given South Korea's competitiveness in the shipbuilding industry, which will be helpful for CCS implementation in South Korea. See Lee & Choi, *supra* note 9, at 73; Yosep Kim, *Elimination of CCS uncertainty for commercialization*, HELLODD, Feb. 1, 2016, <http://www.hellodd.com/?mt=view&pid=56818>.

18) See Koh & Ahn, *supra* note 1, at 38.

19) See Kyongho Kim, *Carbon Capture Storage and Utilization Technology*, 2(12) KISTI MARKET REPORT 1, 4 (2011) (in Korean).

20) See Lee & Choi, *supra* note 9, at 71-78.

21) See *Promoting offshore CCS for Greenhouse Gas Reductions*, THE MINISTRY OF OCEANS AND FISHERIES, <http://www.mof.go.kr/article/list.do?menuKey=376&boardKey=10>.

the gradually increasing role of South Korea in international society.²²⁾ Accordingly, it is more important to execute CCS successfully and prepare CCS legal and regulatory systems thoroughly in South Korea. Such actions will contribute to the active participation of the South Korean government in global activities addressing the climate change issue.

III. Current state of CCS legislation in South Korea and future desirable directions to consider in preparing CCS legislation

The South Korean government established a comprehensive framework to respond to national climate change in 2008, launched the Presidential Committee on Green Growth in 2009, and announced the national climate change adaptation plan in 2010.²³⁾ In addition, the government established the National CCS Comprehensive Plan in 2010 as an effort to deal with CCS directly.²⁴⁾ According to the National CCS Comprehensive Plan, the Presidential Committee on Green Growth operates the general consultative group of CCS technology development, and the *Ministry of Strategy and Finance* supports the budget and financing. The *Ministry of Education, Science, and Technology*, the *Ministry of Knowledge Economy*, the *Ministry of Land, Transport, and Maritime Affairs*, and the *Ministry of Environment* perform CCS technology development in each field.²⁵⁾ Five years after the

22) Therefore, South Korea is faced with some new tasks of settling down a carbon emission trading system and interlocking it with a CCS legal and regulatory system for efficient implementation of CCS. Additionally, when taking into account the necessity of international financial support to developing countries for reducing carbon dioxide emissions and the possibility of financing through Green Development Fund (GDF), South Korea's role may be more important as a host country of the GDF. See GLOBAL CCS INSTITUTE [GCCSI], THE GLOBAL STATUS OF CCS 2015, SUMMARY REPORT, 12-13 (2015).

23) See KOREA INSTITUTE OF S&T EVALUATION AND PLANNING [KISTEP], *supra* note 3, at 15.

24) See Im, *supra* note 12, at 15. The roadmap for reduction targets of greenhouse gas, which is produced by the *Ministry of Environment*, also considers CCS technology as one of the core reduction methods.

25) See KOREA INSTITUTE OF S&T EVALUATION AND PLANNING [KISTEP], *supra* note 3, at 52. For example, the Ministry of the Environment seeks to develop techniques for detecting and managing possible CCS risks and techniques for evaluating environmental effects when carbon dioxide is sequestered in deep underground. For doing this, the *Ministry of the*

establishment of the National CCS Comprehensive Plan, each policy task was analyzed for finding outcomes and assessing the current state accurately to determine if the plan was well-implemented.²⁶⁾ In the analysis, it is necessary to understand the possibility of changing an original goal and design the second CCS comprehensive plan for more realistic and achievable execution. One noticeable point of the execution analysis was that relevant laws and systems were insufficiently established in terms of CCS implementation.²⁷⁾

The absence of laws pertinent to CCS causes more uncertainty in CCS implementation.²⁸⁾ An improvement in the CCS legislative system is meaningful as it would suggest the regulatory direction of the government, and such a suggestion of direction to industrial circles and enterprises would enable greater certainty and motivation.²⁹⁾ When it comes to the South Korean CCS legal conditions, the *Ministry of Oceans and Fisheries*, the *Ministry of Trade, Industry, and Energy*, and the *Ministry of Environment* drew up multiple legislative bills.³⁰⁾ The critical and urgent issue in South Korea is to integrate and improve the bills, make a CCS legislative system, and elicit the public's agreement for implementation.

This paper supports a system that takes into account two conflicting aspects: the CCS facilitation for effective execution of CCS and regulation that thoroughly prepares for the potential risks of CCS.³¹⁾ As for key legal

Environment started Korea- CO₂ Storage Environmental Management (K-COSEM) Research Center in April of 2014, and the research resulting from this center is supposed to be reflected in law or policies relevant to CCS. In particular, this kind of research by the *Ministry of Environment* is even more necessary to be linked with technical developments, which are conducted under other ministries. See Koh & Ahn, *supra* note 1, at 66.

26) This analysis covers overall areas regarding not only technical development of capture, transportation, and sequestration but also legal system improvement, interdepartmental cooperation, and international cooperation.

27) See KOREA INSTITUTE OF S&T EVALUATION AND PLANNING [KISTEP], *supra* note 3, at 71.

28) See Koh & Ahn, *supra* note 1, at 39.

29) See Kim, *supra* note 17.

30) See KyungShin Kim & SungSoon Yoon, *An Analysis of Japan CCS and Implication on Large Scale Demo Project in Korea*, THE KOREAN SOCIETY OF MARINE ENVIRONMENT & SAFETY 30, 31 (2015) (in Korean).

31) The concerns pointed out by CCS opponents primarily deal with scientific uncertainty and economic inefficiency. On the other hand, CCS technology is a necessary and upcoming technology that approaches commercialization as a bridge technology. Therefore, it would be

issues regarding CCS implementation, this paper addresses four issues, including permission, environmental risk assessments, liability, and property rights, which will be important issues with a priority in South Korea.³²⁾ The precautionary principle is important in preparing an environmental legislative system. Specifically, the precautionary principle will be an influential principle in creating a legal and regulatory framework for CCS technology, an emerging technology that has both necessity and uncertainty.³³⁾ It will also become the underlying principle in preparing South Korean CCS legal and regulatory systems. Therefore, the finding that a thorough and strong regulatory system needs to be established in accordance with the precautionary principle also applies to South Korea. However, it is also found that if all four key legal issues focus only on strict regulations, it would lead to undesirable results in terms of CCS facilitation. Accordingly, if the legal system is created with the consideration of which aspect or aspects are emphasized when addressing each legal issue, this will establish a more flexible and efficient CCS system. In this regard, the

unwise to abandon a necessary new technology due to unproven and unrealized risks. To ameliorate these concerns, a basic and important component of CCS deployment that needs to be established is the legal and regulatory framework. The legal and regulatory regime in preparation for the harms and risks of CCS technology could relieve the concerns that the opponents of CCS have. The legal system should be comprehensive and strict in order to prevent possible leakage risks during the whole process of capture, transportation, and sequestration. Additionally, the legal system needs to consider CCS facilitation, as well as a strong and comprehensive CCS regulation. It is also important to note that time is of essence because CCS technology functions as a bridge technology, which becomes insignificant as it is delayed.

32) These legal issues are fundamentally important to individual countries and should be addressed in any future systems. The legal issues that CCS will bring are so wide and diverse that it would be more effective to identify key priority issues that needs to be addressed first. It is also because these four issues are judged to be a suitable topic for comparing how the government should function efficiently in dealing with these main issues.

33) The precautionary principle is a concept that suggests a desirable direction for policy makers, faced with the problem of how to deal with potential risks that have scientific uncertainty. See John S. Applegate, *The Taming of the Precautionary Principle*, 27 WM. & MARY ENVTL. & POL'Y REV. 13 (2002). The precautionary principle supports actions to combat environmental problems against possible risks even when scientific evidence regarding the risks is lacking. Moreover, there exists an argument that a shift of the burden of proof comes from the precautionary principle, which is called the strong precautionary principle. See Noah M. Sachs, *Rescuing the Strong Precautionary Principle from Its Critics*, 2011 U. ILL. L. REV. 1285, 1295 (2011).

precautionary principle should be applied flexibly to the preparation of the CCS legal and regulatory system of South Korea.

In developing a more specified system, it is necessary to refer to the relevant systems of developed countries, such as the United States and Australia, and apply them to the South Korean CCS legislative system. Furthermore, it is also important to set forth a law that requires the consideration of the special conditions and weak points of South Korea, which can make the CCS law useful and efficient. For example, in dealing with environmental impact assessments associated with CCS, it is necessary to make legislative efforts to improve the existing problems of environmental impact assessment in South Korea. The weaknesses of communication between government ministries and relatively low social perception of environmental protection and climate change issues can be a particularly vulnerable part of South Korea, which needs to be considered for the CCS legal and regulatory framework. Additionally, if the South Korean CCS legislative system reflects technological, economic, and social factors, it will be able to become more thorough and complete.³⁴⁾

IV. Recommendations for South Korea's domestic CCS legal and regulatory system

Under these desirable directions to consider, some recommendations are suggested for the establishment of the South Korean CCS legislative and institutional system. First, it is necessary to make an approach flexible to the main legal issues of CCS and to judge which one should be emphasized between the two conflicting purposes of CCS—regulation and facilitation—and apply that judgment to the resulting legislative system. In other words, it is important to avoid preparing a legislative system emphasizing only one purpose and should instead find a plan realizing the

34) Despite the significant and expected role of CCS, there are opposing views toward CCS on the grounds that such technology poses the problems of scientific uncertainty, economic barriers, and social reluctance. Therefore, it is important to consider various elements in making the structure for the implementation of CCS and explore how these elements can influence and affect each other because a solid legal and regulatory system for CCS needs to be based on the analysis of economic, social, and technological factors.

two purposes. For instance, of the aforementioned four issues (permission, environmental risk assessments, liability, and property rights), permission and environmental risk assessments require a thorough regulation system and emphasize the precautionary principle. Developed countries make preparations with strict and specific permission criteria, whereas South Korea has vulnerable points. Additionally, given that environmental risk assessment continues to show its problems domestically, it is necessary to come up with a strict regulation system for the potential risks of CCS. Regarding property rights, it is necessary to focus on something that makes it possible to implement CCS smoothly.³⁵⁾ That is because CCS should be introduced and applied in a timely manner as the intermediate technology acting as a bridge between existing fossil-fuel and future renewable energy sources.³⁶⁾ With regard to liability, a balanced approach is specially required. Currently, various and specified solutions to carbon dioxide leakage are suggested.³⁷⁾ In other words, the issue of liability requires fair and balanced solutions.³⁸⁾

Second, the most important aspect in dealing with the four issues is to find what is needed for the legislative system. With regard to permission, the position that business permissions for capture, transport, and

35) It is true that the protection of the property rights that are relevant to CCS implementation is important. However, if the property right issues fail to be fixed early, it can cause disruption to CCS implementation because the property right issues are problems that can be raised in the early stage associated with facilities installation, rather than long-term operation or stewardship.

36) It is likely that South Korea can avoid complex and challenging pore space ownership issues which are associated with vast storage sites because South Korea is currently considering the type of offshore sequestration. However, even in the case of offshore sequestration, property right issues can be raised for the transportation linked from the onshore capturing facilities, as CCS is a connected technology between a series of processes.

37) The CCS liability issue is not a simple matter but a complicated task. In the event of a CCS leakage accident, many issues, such as who will be liable, who will actually be compensated, how to determine the scope and extent of the damage, will be raised in various ways. Rather than ending with a single decision, when it comes to making a decision regarding liability issues, alternative and complementary measures for a certain decision need to be taken together while having a multi-faceted and balanced approach.

38) In other words, a compromising approach is needed between two opposing stances: one is the CCS operator's stance arguing for a somewhat limited liability system and the other one is the CCS regulator's stance claiming a robust liability system for a safer CCS deployment.

sequestration should be given separately is also valid in South Korea.³⁹⁾ To set forth specific criteria, it is necessary to check if the matters prescribed in the legislative systems of developed countries—including the United States, Australia, and European Union nations—are neglected in South Korea. For example, with respect to the permission of capture facility installation, it is necessary to have the criterion of carbon dioxide concentration included in the legislative system.⁴⁰⁾ South Korea has no experience with carbon dioxide transport, and therefore, for safety, it is necessary to set criteria for pipeline parts and design for the future permission of any transport facility. In terms of storage fields, it is necessary to limit an injection amount, an injection temperature, and an injection pressure, and prepare relevant criteria.⁴¹⁾

Regarding environmental risk assessments, it is necessary to make sure that CCS facility installations get involved in the environmental impact evaluation explicitly.⁴²⁾ In other words, the risk assessment needs to be enforced in each phase of CCS implementation through capture, transportation, and sequestration. Currently, Article 22 of the Environmental Impact Assessment Act enumerates seventeen areas which require environmental impact assessment as subject matter, and the CCS project is not included in

39) The EU CCS Directive also provides that each permit of capture, transportation, and sequestration, can be obtained respectively. See Hyeok Jeong, *The EU's Efforts into Achieving the Goal of "2030 Framework for Climate and Energy Policies": with focus on the EU ETS and CCS*, 33(2) INSTITUTE FOR EU STUDIES 377, 395 (2015) (in Korean).

40) See Koh & Ahn, *supra* note 1, at 42. In South Korea, a carbon dioxide purity standard of 98% has been suggested in a CCS legislative draft. See NATIONAL INSTITUTE OF ENVIRONMENTAL RESEARCH [NIER], A ENVIRONMENTAL FIELD STUDY ON THE LEGAL FOUNDATION OF CARBON CAPTURE AND SEQUESTRATION [I], 161-163 (2012). On the other hand, Japan requires 99% purity of carbon dioxide. See Kazuya Goto et al., *Effect of CO₂ Purity on Energy Requirement of CO₂ Capture Processes*, 37 ENERGY PROCEDIA 806 (2013). The purity standard of carbon dioxide needs to be determined carefully in South Korea, referring to other countries' criteria because this standard can affect CCS costs and CCS safety.

41) See Kim & Kim, *supra* note 13, at 13. These conditions are necessary to be established appropriately to maximize injection capability as well as to ensure safe implementation. For these reasons, it is reasonable for those conditions to be set up thoroughly and be described in detail. For example, standards regarding conditions within storage sites as well as conditions within injection wells need to be established. Moreover, even in the standards within injection wells, specified standards between single injection wells and several injection wells need to be included. See Kim & Kim, *supra* note 13, at 21.

42) See NATIONAL INSTITUTE OF ENVIRONMENTAL RESEARCH [NIER], *supra* note 40, at 183-184.

the seventeen areas.⁴³⁾ If legal and regulatory gaps regarding risk assessment are found in a phase in the series (capture, transportation, and sequestration) and a certain step within a sequestration phase (such as exploration, injection, and closure), legislative efforts to fill the gaps will be needed. In addition, there are a lot of potential areas that can be affected by CCS implementation. Therefore, it is essential to draw evaluation items thoroughly under the environmental risk assessment system of CCS. For instance, by analyzing all possible paths of leakage, it is possible to predict a range of damage.⁴⁴⁾ Additionally, through alternative evaluation, it is necessary to find specific and actual risks and apply the methods of alternative evaluation that are used in the United States or European Union countries to the South Korean environmental risk assessment system.⁴⁵⁾ In South Korea, the private sector performs environmental influence evaluations, so there is a lack of objectivity.⁴⁶⁾ It is necessary to overcome these disadvantages institutionally. The development of an environmental risk assessment system will be able to affect CCS environmental influence

43) Hwangyeong yeonghyang pyeongga beob [Environmental Impact Assessment Act], Act No. 4567, June 11, 1993, *amended by* Act No. 14532, Jan. 17, 2017, art. 22 (S. Kor.). The Environmental Impact Assessment Act also provides the procedure of gathering consensus from residents in Article 25.

44) With regard to offshore sequestration, techniques for risk evaluation on the marine environmental and ecosystem have been developed in South Korea. See NATIONAL INSTITUTE OF ENVIRONMENTAL RESEARCH [NIER], *supra* note 40, at 180. As the techniques and methods improve more and more, South Korea needs to strengthen evaluation items and standards in order to create a robust risk assessment system for CCS.

45) For example, the alternative analysis between risk mitigation options under South Korea's risk assessment system is just simply prescribed in the Environmental Impact Assessment Act. Additionally, the enforcement decree or rule of this act has no detailed provisions regarding procedures or methods to select alternatives. For these reasons, there is a concern that the alternative evaluation method lacks effectiveness. Therefore, more specific provisions about alternative evaluation need to be included in the enforcement decree or rule under the Environmental Impact Assessment Act. (e.g., in the United States, the standard of reasonableness is provided and specified through the NEPA and CEQA.) See Vian Rhee, *Needs to Include Alternatives in EIAs of Korea: "Reasonable" & "No-Action" Alternatives*, 32(1) ENVIRONMENTAL LAW REVIEW 365, 375-376, 382, 392 (2010) (in Korean).

46) See ByungGil Jung, *A Note on the Problems and Alternative Improvement of Environmental Impact Assessment in Korea -Evaluation in an Engineer's Viewpoint*, 10(2) PUBLIC LAW JOURNAL 327, 337 (2009) (in Korean).

evaluation positively.⁴⁷⁾ The risk management for preparing long-term storage or long-term stewardship, including monitoring, verification, and reporting, is the most important aspect, but it is very vulnerable in South Korea. Accordingly, the obligatory monitoring, monitoring method, monitoring period, and monitoring frequency of execution businesses should be incorporated into a legislative system. Furthermore, it is necessary to review the provisions about the punishment for violations and about additional requirements under the government's authority, if necessary.

In South Korea, offshore geological storage is taken into account. As a result, the issue of property rights associated with long-term sequestration may not arise. Nevertheless, there is a possibility of land geological storage, and a land pipeline to transport from the capture source on land to the offshore storage site is needed under offshore sequestration.⁴⁸⁾ Therefore, it is necessary to prepare for the property rights issues. Regarding the issue of

47) In South Korea, business operator (also referred to as project implementer) should formulate environmental impact assessment report and submit the report to the approving agency pursuant to the procedures provided under the Environmental Impact Assessment Act. This approach is different from other countries' environmental impact assessment system, which requires government agencies to make assessment reports, such as the United States or Canada. The attitude of business operator's conducting of risk assessment like South Korea has an advantage that the report can be created by a person who is well aware of the business. On the other hand, it also has disadvantage of lacking objectiveness and fairness. *See id.* In South Korea, the Article 53 of the Environmental Impact Assessment Act allows business operator to engage an agent for conducting the risk assessment. However, conducting risk assessment by agency also has critics who argue that the agency is not independent from business operators, and the requirements of the agency are not strict. *See id.* at 341. In case of maintaining this attitude of making environmental impact assessment reports by operators, continuous efforts to improve objectiveness and fairness are needed in South Korea.

48) Property rights issue appears to be limited in the processes of capture and transportation. There is no eminent domain issue in a capture process because the land within the power plant facilities will be used. Additionally, in case of transportation through vehicle or ship, no eminent domain issues occur because no private land is utilized. On the other hand, property rights issue can be the most problematic during the sequestration process. Therefore, the issues of eminent domain and pore space ownership will be raised in the sequestration process with the type of onshore sequestration. (The storage site in offshore sequestration is a deep layer of the ocean, so pore space ownership issues will not be raised.) *See DongRyun Kim, Korean CCS Policy and Legislative Direction -Focused on the Land Expropriation and Public Acceptance*, 74 PUBLIC LAND LAW REVIEW 259 (2016) (in Korean).

property rights in South Korea, the ownership of underground pore spaces needs to be placed under the domain of public ownership or government ownership, rather than under the domain of private ownership.⁴⁹⁾ The *Civil Act* of South Korea, including property law, has no explicit provision to grant subsurface ownership to any entity. Instead, Article 212 of the *Civil Act* provides that “Within the scope, where a justifiable profit exists, the ownership of land extends both above and below its surface.”⁵⁰⁾ Therefore, depending on the interpretation of the term “justifiable profit,” the pore space ownership can be determined. Given the judicial cases and jurists’ theories of underground space, it is highly likely that the argument that the underground pore space for CCS is owned by the South Korean government will be accepted. If so, CCS implementation is free from complicated problems such as expropriation and compensation, and CCS activities can be done smoothly. In order to draw the decision that underground pore spaces are owned by the government, it is necessary for the public to understand CCS positively and recognize CCS as a key technology to resolve the climate change crisis. Therefore, the efforts to increase public acceptability should be made.⁵¹⁾

When it comes to CCS liability in South Korea, it is valid to impose strict liability on businesses, as strong regulation is required for preparing for the risks of CCS.⁵²⁾ Aside from that, it is necessary to draw up plans of

49) For example, according to the Carbon Capture and Storage Statutes Amendment Act 2010 of Alberta in Canada, which amended the Mines and Minerals Act, the pore space ownership of all land, except land owned by federal Crown, falls on the ownership of the provincial Crown, Alberta. Moreover, Alberta also has provisions that deem the statutory vesting of pore space is not an expropriation of the land and that prohibit anyone from claiming compensation or damages from the provincial Crown. See *Canadian property rights relating to CCS*, GLOBAL CCS INSTITUTE [GCCSI], <https://hub.globalccsinstitute.com/publications/property-rights-relation-ccs/canadian-property-rights-relating-ccs>.

50) Minbeob [Civil Act], Act No. 471, Feb. 22, 1958, amended by Act No. 14965, Oct. 31, 2017, art. 212 (S. Kor.).

51) See Koh & Ahn, *supra* note 1, at 57.

52) In South Korea, the *Act on Liability for Environmental Damage and Relief Thereof* entered into force from January 1, 2016, which provides strict liability for compensation of environmental damages. If a strict liability standard is provided under CCS liability system, it can be consistent with the existing environmental law. See SoonJa Lee, *Legislative Assessment for the Introduction of carbon dioxide capture and sequestration legislation*, KOREA LEGISLATION RESEARCH INSTITUTE [KLRI] LEGISLATIVE EVALUATION RESEARCH VOL. 9, 407-409 (2015) (in Korean).

compensation to businesses institutionally at the same time. For example, South Korea needs to adopt an appropriate method to support CCS businesses associated with CCS liability among various options (e.g., funds, insurance, bonds, and threshold of liability). Like the CCS legislative system in other countries, the South Korean CCS legislative system needs to specify a provision that liability is transferred to the government after a certain period. In fact, the legislative systems of developed countries have an uncertain scope of liability and a different time of liability transfer to the government.⁵³⁾ Accordingly, the South Korean CCS legislative system for liability should prescribe an accurate time of liability transfer and fair solutions once the main subjects of liability, scope of liability, and liability transfer are accepted. For instance, if there is a single government agency that manages and regulates CCS, the agency will be able to become the main body that has the responsibility for liability transfer to the government. In a scope of liability, the transfer of compensation for damage and of monitoring to the government needs to be prescribed accurately.⁵⁴⁾

Third, for the South Korean CCS legislative system, it is more efficient to prepare a single CCS law for regulating CCS capture, transport, and storage comprehensively. The amendment and revision of existing environmental acts (e.g., the *High-Pressure Gas Safety Control Act*, *Wastes Control Act*, *Groundwater Act*, and *Marine Environment Management Act*) are considered for preparing CCS legislative systems that cover the regulation of CCS. However, in terms of the concepts and purposes, the acts have some difficulties that may affect CCS. For example, in the case of the *High-Pressure Gas Safety Control Act*, the carbon dioxide compressed for storage is in a supercritical state, so CCS may be interpreted to not involve high-pressure gas.⁵⁵⁾ Some argue that carbon dioxide for CCS is considered to be

53) See Koh & Ahn, *supra* note 1, at 58.

54) A timing of the liability transfer to the government of fifteen years or twenty years can be potentially considered, as adopted in Australia and the EU's CCS directive. Meanwhile, in the EU, there is an opinion that this period of twenty years is too much to CCS operators. See Jeong, *supra* note 39, at 400. South Korea needs to determine an appropriate timing of liability transfer, taking into account other countries' provisions and influences from the provisions.

55) There is a view that it is difficult for the *Groundwater Act* to be applied to CCS implementation because the *Groundwater Act*'s purpose is to deal with development and use of groundwater. See JongYeong Lee, *Legal Issues of Carbon Capture and Sequestration*, 42 JOURNAL

a waste, and some provisions relating to CCS need to be added to the *Wastes Control Act*. However, this argument also faces a refutation. In other words, in the circumstances where carbon dioxide needs to be recycled biologically and chemically, it is possible to bring up a question if it is valid to see the captured carbon dioxide as a waste.⁵⁶⁾ Moreover, the *Wastes Control Act* has provisions that are inappropriate to CCS regulation. For example, according to Article 18 of the *Wastes Control Act*, the waste must be treated by the operator him or herself or by a disposal business operator who has a license for a waste treatment business. Therefore, there is an opinion that the *Wastes Control Act* is not appropriate to apply to CCS implementation because current disposal business operators may find it difficult to handle CCS transportation or sequestration due to the high cost burden.⁵⁷⁾ In the case of the *Marine Environment Management Act*, there is an argument that the act is applied only to the sea, not to the underground of the sea.⁵⁸⁾ In addition, the *Marine Environment Management Act* may have an improper legislative aspect if many regulations for storage of CCS were attempted to be included in the act.⁵⁹⁾

OF LEGISLATION RESEARCH 327, 345 (2012) (in Korean). Additionally, just amending or adding to the *Groundwater Act* is not enough for CCS implementation if South Korea is considering offshore sequestration.

56) The problem of categorizing the legal character of carbon dioxide needs to be approached carefully, since applicable laws can become different and economic and social ripple effects can be brought from the categorization. See Koh & Ahn, *supra* note 1, at 40. For example, if the definition of carbon dioxide is limited to one characterization, such as contaminants or industrial wastes, there is a possibility of conflict with a future situation where carbon dioxide has a value as a useful resource.

57) See *id.* at 44.

58) See Lee, *supra* note 55, at 350-351.

59) Meanwhile, the Article 19 of the *Marine Environment Management Act* of South Korea has a provision regarding marine environmental improvement charges. In case that this Act is applied to CCS implementation, clear interpretation is required about whether or not CCS operators are obligated to pay these charges. See *Id.* at 349. As explained before, in South Korea there was an amendment of the enforcement decree of the *Marine Environment Management Act* in which carbon dioxide stream is exceptionally allowed to be discharged to the ocean even though carbon dioxide stream is a waste generated from the land. See Koh & Ahn, *supra* note 1, at 43. This amendment intended to enable offshore sequestration of CCS in South Korea. However, just with this amendment, it is not necessary to interpret that the carbon dioxide stream is (or should be) regarded as a waste in South Korea's CCS legal and regulatory system.

Given all of these considerations, it is more proper to establish a new comprehensive act that is specific to CCS rather than to add or amend provisions in existing environmental acts simply because of the organic connection of CCS technology. In other words, many laws referred to as applicable laws are not in line with CCS implementation from the perspective of the laws' legislative intent and system. Additionally, if CCS implementation is regulated by existing laws, amendments in a variety of environmental laws and ordinances are inevitable, which leads to a considerably high legislative burden.⁶⁰⁾ On the other hand, the establishment of a single law that governs only CCS may not only deal with CCS-related activities systematically and coherently, but may also play a role in promoting social acceptance through policy attention and concentration.⁶¹⁾ The comprehensive and general legislative system of CCS is able to include all processes of capture, transport, and storage and prescribe permission matters in each step manifestly.⁶²⁾

Other detailed matters should be included in enforcement decrees and enforcement regulations as well. Since CCS is an advanced scientific technology, it is difficult for a CCS law to prescribe all detailed matters. For this reason, specific provisions need to be included in lower laws, such as enforcement decrees and regulations.⁶³⁾ Additionally, along with the development of capture and monitoring technologies, relevant laws need to be amended. In this case, amending enforcement decrees is more desirable

60) For these reasons, the argument that amendments of existing environmental laws are justified because of legislative costs and efforts to create a new CCS law can be refuted. See Lee, *supra* note 52.

61) See JongYeong Lee, *Study on the EU CCS Directive*, 14(2) CHUNGANG LAW REVIEW 26 (2012) (in Korean).

62) See InSung Cho, *Highlights and Implications of the EU Directive and the German law on the licensing law for the capture, transport and storage of CO₂*, 43 CHONBUK LAW REVIEW 299 (2014) (in Korean). Furthermore, creating a CCS law, which directly addresses only to CCS relevant activities and regulations, can be reasonable in that it can create a consistent and effective legal and regulatory system by avoiding the possibility of duplicated regulation that can be brought from multiple applications of existing environmental laws. For example, even though an environmental impact assessment is an important factor in a CCS legal and regulatory system, overlapping enforcement obligation provisions under more than one existing environmental law can cause confusion.

63) See MoonJi Rhee, *Legal and Regulatory Issues of CCS projects*, 36 ANAM LAW REVIEW 715 (2011) (in Korean).

than amending an act.⁶⁴⁾ Although it is expected that CCS will be managed by the central government under a national project, it is necessary to check if there are any relevant roles and ordinances of local governments.⁶⁵⁾ To increase the possibility of legal enforcement and make the legislative system more efficient and thorough, it is essential to prepare guidelines for private enterprises that participate in CCS project as operators.⁶⁶⁾

Fourth, it is necessary to establish an independent government agency that takes charge of CCS and requires cooperation between departments. Since CCS features the organic operations of capture, transport, and storage businesses, administrative procedures and relevant works can be complicated.⁶⁷⁾ In particular, in South Korea, which has offshore geological storage-type CCS, land work and offshore work can be processed in different departments. In this sense, more cooperation between the departments is needed.⁶⁸⁾ In reality, governmental divisions' roles for technology development and research are not allocated properly to the departments.⁶⁹⁾ Accordingly, it is necessary to determine an independent

64) As explained, one example can be a specific purity standard of carbon dioxide. It can be regulated under an enforcement decree, which is easy to amend and can respond to technical advancements. Another example can be a regulation of monitoring of long-term management of CCS risks. While important factors, such as the monitoring obligation and monitoring period, can be provided at a law level, the specific factors, such as monitoring techniques applicable to a sequestration site, can be regulated under an enforcement decree.

65) For example, CDM businesses associated with reducing greenhouse gas emissions has been primarily conducted and regulated at a local government level in South Korea. Therefore, with regard to the incorporation of CCS within the CDM and specific enforcement of relevant activities with the incorporation, ordinances or regulations at the local autonomy government level need to be utilized. Specifically, given the situation that CCS activities are expanded to various industrial fields in each local government and the need for reflection of local affairs and circumstances, the CCS legal and regulatory system of South Korea needs to cover local government-level ordinances and rules.

66) It is encouraging that corporations are getting more interested in businesses relevant to greenhouse gas emissions reduction. In the 6th Korea CCS Conference which was held in 2016, corporations' participation was remarkable, while previous conferences were focused on scientists and researchers. Yosep Kim, *Greenhouse gas Reduction Emergency*, HELLODD, Jan. 28, 2016, <http://www.hellodd.com/?md=news&mt=view&pid=56810>.

67) See Jeong, *supra* note 39, at 399.

68) See SunYoung Chae & SukJae Kwon, *A Study on Domestic Policy Framework for Application of Carbon Dioxide Capture and Storage (CCS)*, 18(6) JOURNAL OF THE KOREAN SOCIETY OF MARINE ENVIRONMENT & SAFETY 617, 622 (2012) (in Korean).

69) The performance evaluation report of the National Comprehensive CCS Strategic Plan

department that processes all required permission procedures.⁷⁰⁾ The existence of an independent, competent department will make it possible to perform consistent and efficient work by functioning as a general coordinator of CCS-related administrative tasks, such as issuance of permits. It will also have a positive impact on corporate participation in CCS.⁷¹⁾

Aside from the single government agency for CCS regulation, the possibility that CCS development activities are led by the government and CCS activities are conducted by a government organization is taken into account. With regard to the question of who will be an entity to conduct CCS activities, various options can be provided in South Korea (e.g., private sector operation, government or public institution operation, and early government-led and thereafter private sector-led operation).⁷²⁾ In this case, special care is needed not to make a regulator an operator of CCS. This is because a proper control system will not work if a governmental agency performing CCS activities and a governmental agency regulating the activities are not properly distinguished. For example, in the case of government-led businesses, it is likely that control is loosened, which leads

also indicated this problem of failure of role allocation and cooperation between governmental divisions. See KOREA INSTITUTE OF S&T EVALUATION AND PLANNING [KISTEP], *supra* note 3, at 67-68.

70) The EU's CCS directive also provides that having an independent primary agency is required, and it is necessary for integrated management of permit issuance procedures through this single main channel. See Jeong, *supra* note 39, at 395.

71) Meanwhile, it is judged that this independent department does not necessarily to be a new ministry, and it would be efficient to designate the most appropriate ministry that can be involved with CCS regulations. For example, since South Korea considers the type of offshore sequestration as a priority, the Ministry of Maritime Affairs and Fisheries can be considered, and the Ministry of Commerce, Industry, and Energy can be considered with an emphasis on the industrial aspect of CCS. However, it is persuasive that the Ministry of Environment will be the most appropriate agency, considering that CCS should be implemented in an environmentally safe manner and given the overall nature of administrative work regarding CCS.

72) See KyungShin Kim & SungSoon Yoon, *A Study on Operational Organization of CCS offshore Geological Storage*, KOREAN SOCIETY FOR MARINE ENVIRONMENT & ENERGY, 125 (2015) (in Korean). When it comes to the situation that government or public institutions can be a subject of CCS operation, a few options can be also suggested: one of the existing government agencies can be designated as a CCS operator or a new and special national entity can be created for the stable operation of CCS activities. See Cho, *supra* note 62, at 322.

to reckless business operation or corruption of government officials.⁷³⁾ Therefore, in order to avoid the negative consequences, CCS regulation and operation should be performed by different government organizations. A government organization for CCS regulation should serve objectively and fairly. Additionally, the transparency of the government agency performing the business and morality of the government agency's officials should be guaranteed.⁷⁴⁾

Fifth, a relationship between CCS implementation and a carbon trading system needs to be set up under the enforcement of a greenhouse gas emission trading system of South Korea.⁷⁵⁾ It is encouraging that the South Korean government gave economic value to a reduction in greenhouse gas emissions so as to create the efficiently functioning market under the market-based system.⁷⁶⁾ However, in circumstances where the price of carbon is not high and thereby purchase of an emission allowance, rather than CCS technology-based reduction, is selected, CCS implementation and expansion can be impeded.⁷⁷⁾ Therefore, it is necessary to operate a carbon

73) In this regard, it is also necessary to examine the governance structure of public enterprises and the problems of public enterprise operations in South Korea. The KEPCO is a public enterprise in which the South Korean government owns a 51 percent stake, and the KEPCO owns a 100 percent stake in its six branches. Recently, in the Korea Hydro & Nuclear Power Co., one of the six branches, there was a corruption case that employees received money from suppliers of parts for nuclear power plants. From this case, it can be seen that more thorough supervision is needed in case CCS is implemented as a government-led project.

74) Meanwhile, an issue of whether or not it is reasonable for this primary single agency, which is in charge of a series of permit regulations and overall regulatory matters, to address financial support matters together can arise. Since these two aspects have opposite characteristics, it would be more appropriate for funding CCS or providing financial support to be addressed by another government agency, not the same agency with the primary single responsibility suggested.

75) The Paris Agreement also supports a market-based mechanism for emissions trading and encourages countries to cooperate on carbon pricing. *See THE ENVIRONMENTAL DEFENSE FUND (EDF) & INTERNATIONAL EMISSIONS TRADING ASSOCIATION (IETA), CARBON PRICING -THE PARIS AGREEMENT'S KEY INGREDIENT* (Apr. 2016).

76) Currently, the carbon emission trading market is largely concentrated in the EU's carbon market, but carbon trading markets are expected to increasingly expand to other countries' carbon trading markets, such as the United States, China, New Zealand, Japan, and South Korea. *See ECOEYE CO., LTD., A STUDY ON THE IMPROVEMENT OF CDM BUSINESSES UNDER POST-2012 SYSTEMS*, 16-17 (2012) (in Korean).

77) *See GCCSI, SUBMISSION TO THE UNITED NATIONS FRAMEWORK CONVENTION TO CLIMATE*

trading system appropriately so as to keep the carbon price at a proper level. In addition, by taking into consideration support strategies for operators of CCS technology, such as financial support and incentives, it is necessary to lay the foundation for complementary functions of CCS technology and a carbon trading system.⁷⁸⁾

Sixth, an important task in South Korea is to increase public acceptability of CCS.⁷⁹⁾ South Korean people are still relatively unaware of CCS and have low acceptability for it, which can be obstacles to CCS implementation.⁸⁰⁾ In developed countries like the United States, the

CHANGE (UNFCCC) SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNICAL ADVICE (SBSTA) (FCCC/AWGLCA/2011/CP.17 [PARAGRAPHS 79 TO 86]) – ELABORATION OF THE MODALITIES AND PROCEDURES FOR NEW MARKET BASED MECHANISMS, 3 (2012). Meanwhile, the EU also has this problem and it reveals that purchase of credits through the EU emission trading system is more inexpensive rather than the cost of reducing carbon dioxide emission through the use of CCS technology. See Jeong, *supra* note 39, at 402. Currently, under the first period (2015-2017) of South Korea's carbon trading system, 100% free allocation has been enforced. However, in the second period after 2018, capital allocation will be introduced even though the ratio of capital allocation will be small. See GREENHOUSE GAS INVENTORY & RESEARCH CENTER OF KOREA, *available at* <http://www.gir.go.kr/home/board/read.do?menuId=19&boardId=49&boardMasterId=8>. Under the initial step of emission trading system with the type of free allocation, the carbon trading price is low, but it can be predicted that the carbon trading price is getting higher as the carbon trading system is getting stabilized. Therefore, in this future situation, CCS implementation can be more competitive and economic under South Korea's carbon emission trading system. See Lee, *supra* note 61, at 10.

78) South Korea also recognizes the problem of cost burden in implementing CCS and the necessity of financial assistance for CCS implementation to overcome this challenge. The CCS drafts mentioned above also have provisions regarding a CCS management fund. Additionally, there is an opinion that in order to bring CCS businesses' participation to develop CCS markets and to provide CCS operators with financial aid, legal grounds and incentives associated with them need to be established. See Kim, *supra* note 17. For example, CCS legislation of Texas in the United States provides that Enhanced Oil Recovery (EOR) operators can get tax exemption benefits. See Koh & Ahn, *supra* note 1, at 45-46.

79) See KyungShin Kim, *Direction on Social Acceptance for Marine Geological Storage Project of Captured Carbon Dioxide*, KOREAN SOCIETY FOR MARINE ENVIRONMENT & ENERGY, 109 (2016) (in Korean). Since CCS technology is a new and little-known technology, the role of media, such as newspaper and online discussions, is important. See Sarah Mander et al., *New energy technologies in the media – A case study of carbon capture and storage*, in *LOW-CARBON ENERGY CONTROVERSIES* 227 (Thomas Roberts eds., 2013).

80) Since the social phenomenon of NIMBY (Not In My Backyard) is shown in South Korea, it can be predicted that a problem of backlash form residents who are living close to CCS-relevant facilities will arise. See Koh & Ahn, *supra* note 1, at 65.

government communicates with the public in performing a CCS project.⁸¹⁾ The South Korean government also needs such communication with the public. To improve the public's understanding of CCS, it is necessary to provide promotion and education to citizens and corporations, let local residents participate in environmental impact assessments, communicate with local residents when a project is performed, enable the public to access information, and find other plans for more public acceptability.⁸²⁾ As such, preparing CCS laws and policies that reflect economic and social factors will allow the laying of a foundation for successful CCS implementation in South Korea.

V. South Korea's preparation and responses to CCS implementation from an international perspective

1. Circumstances and significance of international CCS implementation in South Korea

It is important to prepare the legal system to respond to the main issues of CCS domestically and research how to analyze and apply the internationally executed CCS system in South Korea. South Korea has been exempted from international reduction obligations, even though South Korea emits a large amount of carbon dioxide. In the new climate system under the Paris Agreement, it is expected for all countries to participate and to be asked to achieve their reduction goal. This means that South Korea

81) For example, the Decatur Project by Illinois State Geological Survey shows a strong effort to communicate with the public by creating a group associated with public communication. This kind of effort can enhance field efficiency with regard to CCS operation and prevent delay or cancellation of a CCS project in advance. *See Id.* at 48. It is noteworthy that Japan shows an attitude of actively communicating with the public while conducting CCS projects through various measures (e.g., showing construction field in real time and hosting periodic fora regarding CCS.) *See id.* at 60.

82) Specifically, the environmental impact assessment system of South Korea has a critique that citizen participation does not work properly, and there are drawbacks with the notification procedure for public hearings. Therefore, South Korea's environmental impact assessment system needs to be improved toward reflecting views and opinions from citizens who can be affected by CCS activities. *See Jung, supra* note 46, at 339.

should engage in international cooperation for CCS that is accepted as a means to significant greenhouse gas reduction and should assume responsibilities and obligations in preparation for international commercialization of CCS.⁸³⁾

The Clean Development Mechanism (CDM) is a system that enables developed countries to reduce greenhouse gas emissions in a cost-effective way and allows developing countries to gain technical and economic benefits as well. There are two types of CDM projects: bilateral CDM and unilateral CDM. The bilateral CDM is a traditional type of CDM, and it means a CDM project conducted between an Annex I country and a non-Annex I country. On the other hand, the unilateral CDM is carried out in a non-Annex I country unilaterally. Since CCS is incorporated in the CDM at the UNFCCC 17th Conference of the Parties (COP) in Durban, South Africa, South Korea can create diverse scenarios and opportunities. Accordingly, the country needs to take a strategic approach. To prepare for various types of international cooperation for CCS projects, it is necessary to take into account geological, technical, and diplomatic conditions to find possible cooperative nations, and to set up a plan based on more specific scenarios. For example, given the economic efficiency based on carbon dioxide transportation distance, countries that are geographically close to South Korea can be considered as a priority. Additionally, considering the technological aspects, it can be assumed that the developed countries with advanced techniques associated with CCS conduct CCS-related CDM projects in South Korea. On the other hand, South Korea, which has relatively superior technological capabilities compared to developing

83) CCS technology needs to be implemented in developing countries as well, and it would be desirable that developed and developing countries are effectively cooperating and connected with the implementation of CCS. The Paris Agreement will be applied from 2021 as an agreement to replace the Kyoto Protocol. This agreement is meaningful in that all of the participating countries, not only developed countries, have agreed to fulfill their duties. Additionally, CCS could have a great significance in developing countries with high economic and industrial development needs and strong dependence on fossil fuel energy sources. See Brad Page, *The Global Status of CCS: 100 days after the COP21 Paris Agreement*, DECARBONI.SE, Mar. 21, 2016, <http://www.decarboni.se/insights/global-status-ccs-100-days-after-cop21-paris-agreement>. See also Milagros Miranda, *The New Climate Deal Shows the Importance of CCS*, WORLD COAL ASSOCIATION [WCA], Feb. 4, 2016, <https://www.worldcoal.org/new-climate-deal-shows-importance-ccs>.

countries, can also implement such CCS-related CDM projects in other developing countries. In selecting those countries with potential for cooperation, it is necessary to judge whether they can cooperate well and benefit each other in diplomatic aspects with the country.

As of now, there are no international treaties or protocols for CCS.⁸⁴⁾ However, it is necessary to research relevant areas to prepare for their eventual establishment. To prepare the domestic CCS legislative system, it is essential to find the critical areas for international responses. In this way, it is possible to execute domestic CCS laws that meet the international CCS criteria and increase the possibility of implementing international agreements. On balance, in order for South Korea to execute CCS properly, it is necessary to cooperate with international CCS implementation in this helpful and efficient direction.

2. Recommendations for South Korea regarding international CCS implementation

Based on the response goal and direction, some recommendations for international CCS activities of South Korea are suggested as follows. First, it is important to prepare the process of getting CCS incorporated in the CDM. Since South Korea performs a carbon trading system, it is necessary to analyze accurately how Certified Emission Reductions (CERs) issued by

84) Currently, there is a lack of international analytical approach and legal disciplines in this respect, and there is no general treaty that only deals with CCS implementation. As an agreement at the regional level, there is the European Union's CCS Directive. The European Union has researched whether CCS implementation is incorporated in the existing norms or whether CCS implementation requires amendments of them. Along with coming up with the CCS Directive, the European Union has amended other Directives which are relevant to CCS implementation. Additionally, there exists the Convention for the Protection of the Marine Environment of the North-east Atlantic (OSPAR Convention) in the European Union, which addresses marine environmental protection in the area of the north-east Atlantic. The European Union has amended OSPAR in order to allow for offshore sequestration in this area. The European Union's effort gives an implication to other countries in that they need to look into their regional marine protection treaties, such as the Convention of the Protection of the Marine Environment and the Coastal Region of the Mediterranean, continuously at the regional level. See FRIEDERIKE MARIE LEHMANN, OFFSHORE CARBON DIOXIDE CAPTURE AND STORAGE – AN INTERNATIONAL ENVIRONMENTAL LAW PERSPECTIVE 167 (2013).

a CDM project connect with the carbon market for trading.⁸⁵⁾ Currently, most investors of CDM are European countries including the United Kingdom, and the main host countries of CDM are China, India, Brazil, and South Korea.⁸⁶⁾ If developed countries perform CDM-typed CCS projects in South Korea and CERs are generated, or if CERs are generated as part of South Korea's unilateral CDM projects, it is necessary to set forth more detailed rules about trading of the generated CERs.⁸⁷⁾ It is important to analyze clearly that the CERs generated by CDM-typed CCS projects conducted in South Korea are used to achieve the emission goal of South Korea and to trade in the South Korean carbon market.⁸⁸⁾ A restriction on CER trading can weaken CCS business execution. Therefore, it is necessary to review if there are any restrictions in trading the CERs generated by the domestic CDM project execution in the carbon markets of other countries that enforce carbon emission trading systems, like European Union Emission Trading System (ETS).⁸⁹⁾ Moreover, it will be possible for South

85) As explained earlier, the CERs which are issued under the CDM can be traded in carbon trading markets. The project-based carbon emission trading market, such as CDM, plays an important role in carbon trading markets, and it accounts for 20% of the carbon trading market. Meanwhile, 80% of the carbon trading market is based on an allowance trading system. See ECOEYE CO., LTD., *supra* note 76, at 16-17.

86) See *id.* at 21-22.

87) The *Act on the Allocation and Trading of Greenhouse Gas Emission Permits* of South Korea has a provision in article 36, which requires the government to endeavor for linkage of domestic carbon market with the international carbon market. However, no detailed contents and regulations associated with the connection have been provided yet. See *id.* at 68-69.

88) In other words, a mechanism that allows internationally approved credits in accordance with UNFCCC, such as CERs under the CDM, to be traded in domestic carbon market needs to be established. Additionally, in preparation for the link between the domestic and international carbon trading market, a domestic allowance registry is also necessary in order to manage and calculate these internationally approved credits. Therefore, with regard to management and settling of the credits issued by CDM projects, more details and procedures need to be created at a domestic level. See *id.* at 70, 76. As an alternative, there is an opinion that holding accounts under the Designated National Authorities (DNA) can be utilized for the link of domestic and international carbon markets. See *id.* at 81.

89) For example, under the EU ETS, there was a limitation on CERs trading in 2013, which only allows CERs generated through CDM projects conducted in Least Developing Countries (LDCs) to be traded in the EU ETS. When this kind of restriction on CERs is created in other countries' carbon trading markets, there is a concern that CERs which are issued through CDM projects in South Korea cannot be traded in those countries internationally. See THE EUROPEAN UNION AND SOUTH KOREA: THE LEGAL FRAMEWORK FOR STRENGTHENING TRADE, ECONOMIC

Korea to export CCS-related technologies to developing countries and conduct CCS projects in the developing countries as mentioned above. Considering these circumstances, it is necessary to judge strategically whether CCS execution in other countries is more advantageous than in South Korea.⁹⁰⁾ There is a critical view that South Korea lacks a CDM strategy for utilizing CCS, whereas developed countries, such as the United States, European countries, and Japan, are already contemplating CDM strategies using CCS in contact with developing countries (China, Indian, Southeast Asian countries, etc.).⁹¹⁾ As demonstrated before, CCS can have a positive impact on economic development from its domestic implementation. Therefore, while continuing CCS implementation domestically, it is necessary to carry out a more detailed analysis of the extent to which CCS projects can be implemented in developing countries and what economic benefits result from the implementation in other countries. To find if there are any international restrictions for such activities, it is necessary to keep watching rule systems in the UNFCCC or the trading system in the international carbon trading market.

Secondly, in terms of permission, environmental impact assessments, liability, and property rights, it is necessary to find any international matters to consider and analyze any international agreement types. For instance, a permission system is controlled in accordance with a domestic permission act.⁹²⁾ Nevertheless, in order to ensure CCS safety, the minimal

AND POLITICAL RELATIONS 220 (James Harrison ed., 2013). Therefore, looking into whether these restrictions exist or not is necessary for efficient and strategic enforcement of CDM projects in South Korea.

90) South Korea imports most of its energy resources from other countries and promotes foreign resources development to ensure energy security. In this regard, there is a positive opinion that CCS projects under the CDM carried on in other developing countries in connection with foreign resources development would be helpful for South Korea by realizing two goals of reducing greenhouse gas emissions and overseas resources development. See Cheol Huh et al., *Consideration of Carbon dioxide Capture and Geological Storage (CCS) as Clean Development Mechanism (CDM) Project Activities: Key Issues Related with Geological Storage and Response Strategies*, 14(1) JOURNAL OF THE KOREAN SOCIETY FOR MARINE ENVIRONMENTAL ENGINEERING 51, 62 (2011) (in Korean).

91) See JongHyeop Lee, *Analysis of international trends on technical, methodological, legal and environmental issues related to CDM commercialization of CCS technology*, 2010(3) GREEN TECHNOLOGY TREND REPORT 196 (2010) (in Korean).

92) For example, regulatory issue in a capture process is what elements should be

criteria for technological and scientific requirements need to be unified internationally.⁹³⁾ The technological matters will be able to be suggested favorably in guidelines as soft laws.⁹⁴⁾ Meanwhile, the liability legislative system can also be defined in the framework of a convention or protocol, and substantial factors can be defined differently in each country depending on their conditions. The issue of property rights is related to civil law, so it may be addressed differently depending on each country's domestic conditions. On the contrary, there is more room for the environmental influence evaluation to be handled in the framework of an international agreement or local treaty. Therefore, for environmental influence evaluations of CCS execution, it is necessary to require an international cooperative execution or agreed-upon international criteria. In these circumstances, South Korea needs to prepare.

Thirdly, CCS projects requiring international cooperation need close cooperation between adjacent countries on the basis of realistic feasibility. This is called transboundary CCS implementation, and there are various scenarios of capture, transport, and storage in these transboundary cooperation projects.⁹⁵⁾ The first scenario is the case of capture in country A

included under the capture permit system. This permit system enables the government to identify, regulate, and control carbon dioxide emitters and relevant facilities. For instance, whether the operators have enough sites for installation and whether the captured carbon dioxide stream includes any impurities can be important regulatory standards. Additionally, capture facilities require a certain degree of space, the government needs to make sure that operators secure enough room when issuing a capture permit.

93) When the strict CCS legal and regulatory system at a domestic level can reduce possible risks of physical leakage, internationally uniformed standards and criteria regarding CCS regulations can be a method to reduce possible risk of administrative leakage between countries.

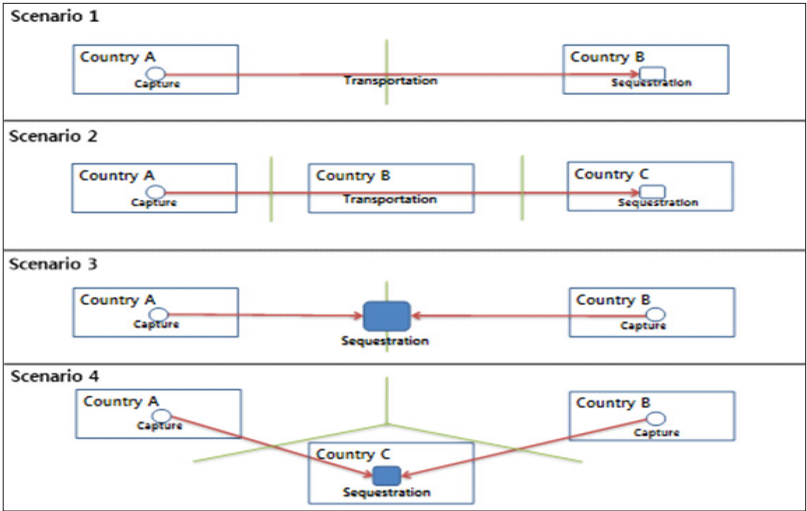
94) For example, there exist international standards from the International Organization for Standardization (ISO), and it is expected that more standardization regarding technical and scientific requirements will be created. South Korea has to make an effort to grasp current situations when developing international norms and meeting international standards.

95) Transboundary CCS implementation means that the series of CCS activities in capture, transportation, and sequestration may not be limited by the boundary of any single country. Additionally, CCS implementation needs long-term sequestration in areas of appropriate storage sites. Therefore, countries without such a site domestically need to try to locate such a sequestration place in other countries. See CATO-2, TRANSBOUNDARY LEGAL ISSUES IN CCS – ECONOMICS, CROSS BORDER REGULATION AND FINANCIAL LIABILITY OF CO₂ TRANSPORT AND STORAGE INFRASTRUCTURE 22 (2011). Even though the possibility of actual performance between

and sequestration in country B. The second scenario is the case of carbon dioxide capture in country A and transportation through country B to sequester in country C. The third scenario is for country A and B to share the sequestration area. The fourth scenario is the case of separate capture by country A and B and sequestration in country C, even though this scenario is less likely and less discussed.⁹⁶⁾ It is necessary to analyze the countries that South Korea is able to cooperate with and the types of transboundary CCS execution in order to satisfy the different conditions under these scenarios.⁹⁷⁾ In particular, since South Korea is highly likely to cooperate with China and Japan in terms of CCS execution and mutual influence, it is

countries with regards to transboundary CCS implementation may not be high, diverse scenarios can exist. In this context, a more thoroughly-structured system for transboundary CCCS implementation needs to be established by reviewing diverse scenarios associated with carbon dioxide capture, transportation, and sequestration between countries and by exploring necessary legal and regulatory schemes.

96) Diagram. Scenarios regarding transboundary CCS projects.



97) For example, when South Korea carries on transboundary CCS projects with other countries, possible scenarios that can be applied to the CCS projects can differ country by country. For example, among possible scenarios, the first scenario can be applied to South Korea and China CCS projects. On the other hand, as for the cooperative CCS project between South Korea and Australia, the second scenario can be considered, and the third scenario can be reviewed as an applicable scenario between South Korea and Japan. Therefore, preparation for transboundary CCS projects needs to be prepared by country, recognizing each requirement by scenario.

worthwhile to make a more thorough attempt at cooperation regarding legislation and policy.⁹⁸⁾

Fourthly, what is most needed in order to realize these recommendations is the exchange of relevant information. CCS is an advanced organic system-based technology and a new technology. Additionally, there is not much accumulated information on possible risks of CCS implementation. Therefore, it is critical to share information between countries. If an international agreement on CCS is created, a procedure for analyzing data through information sharing channels and for sharing knowledge and experience will be needed.⁹⁹⁾ Although South Korea participates in the projects led by developed countries including the United States and Australia, there is still a lack of international cooperation.¹⁰⁰⁾ Therefore, South Korea needs to acquire the experience and information of developed countries through international cooperation, such as the participation of the developed country-led projects, until a channel of information exchange is created under an international convention. Given the point that CCS implementation and commercialization are important in developing countries, it is more essential to exchange information to quickly deliver the technological and legal experiences of developed countries to developing countries.

VI. Conclusion

98) There is a critical view that the collaborative level for environmental protection between East Asian countries has not been too high, particularly compared to European countries. See Ickpyo Hong, *A Critical Assessment of the Environmental Cooperation in Northeast Asia: Focusing on the Constraints of the Cooperation*, 52(3) KOREAN ASSOCIATION OF INTERNATIONAL STUDIES 171, 173 (2012) (in Korean). Therefore, various channels for international or regional agreements to resolve environmental issues need to be explored through legal, political, and diplomatic means.

99) In this regard, it is recommendable to have a clearinghouse for exchanging a lot of information relevant to CCS implementation between countries.

100) It is noteworthy that China shows strengths in collaborative CCS projects with many developed countries. South Korea also needs to endeavor to share information regarding technical development, projects experiences, and risk assessment results through cooperative works with China as well as with developed countries.

In South Korea, CCS technology is a necessary and viable option, given the country's energy industry structure and technological and geographical possibilities, and CCS implementation becomes more meaningful in South Korea considering the urgent need to reduce carbon dioxide and the achievement of attracting the Green Climate Fund (GCF). The important thing in South Korea is to build a clear roadmap for CCS legislation and regulation, and to do so, it would be reasonable to reflect the positive implications from developed countries' CCS systems and to complement the existing weaknesses of environmental law in South Korea. Essentially, South Korea's CCS legal and regulatory systems need to be strong, set up under the precautionary principle, and in particular, it is necessary to elaborate and strengthen the standards for permit systems, environmental impact assessments, and monitoring. It is also necessary to put CCS operators under strict liability so that the strong regulatory regime can be well maintained, and so that credibility of CCS investment from the private sectors can be enhanced. At the same time, South Korea needs to adopt a transfer of liability to the government after a certain period of time. Finally, if onshore sequestration becomes a reality and the issue of ownership of the pore space, which is a possible sequestration area, is raised, it is recommended to adopt the option of government ownership so that the government reduces the transaction costs and enables CCS projects to proceed quickly.

Taking into account the complexity of CCS's technological linkage, organicity, and also considering the problems of the government's responsibility avoidance between agencies that has continued to grow in South Korea, the CCS law of South Korea needs to be aimed at a single law that covers capture, transportation, and sequestration together. In the same vein, it is judged that the existence of a single government department that manages this is also efficient. Additionally, it is necessary to focus more on preventing the relaxation of regulations or loosening of oversight rather than the problem of a CCS project being cancelled due to a lack of financial aid from the government, given the particular situation of government-led CCS implementation in the early stages.

In terms of preparation for an international CCS framework, South Korea needs to contemplate CCS strategies that are appropriate to the

situation in South Korea so as to assert them in international legal negotiations. Particularly, it is necessary to preemptively review and address the transboundary issues in CCS projects with China and Japan, and the legal issues arising from CCS-related CDM projects in developing countries in Asia where there is much room for CCS to be executed. Moreover, South Korea needs to cooperate with other countries in creating an international legal framework for CCS. For example, it is necessary to actively participate in the establishment of international standards for the technical elements of CCS, the establishment of international standards for CCS-related environment impact assessment, and information exchange between countries.