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under the United Nations Framework Convention on Climate Change

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The Government of
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Royal azaleas of Hwangmaesan Mountain, Hapcheon-gun, Gyeongsangnam-do

Executive Summary

1. National Circumstances

The Republic of Korea (ROK) is a mountainous country with four distinct seasons, and has a total population of 51,607,000 (2018). Exports and the manufacturing sector play a significant role in the national economy, and as of 2017, dependence on exports stood at 37.5%, while the share of the manufacturing sector accounted for 30.4% of the nominal GDP in 2017.

Even under the socio-economic structure of continuous population growth and high manufacturing and export share, the ROK has been taking active measures, such as ratifying the Paris Agreement in November 2016, to shift to a low-carbon economic structure and move forward with international community's endeavors to respond to climate change.

2. National Greenhouse Gas Inventory

The ROK prepared the national greenhouse gas (GHG) inventory from 1990 to 2016 in accordance with the IPCC (Intergovernmental Panel on Climate Change) Guidelines for Energy; Industrial Processes; Agriculture; LULUCF (Land Use, Land-Use Change and Forestry); and Waste sectors. The national GHG inventory includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide(N_2O), hydrochlorofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6) defined in the Kyoto Protocol, and they are expressed by carbon dioxide equivalent (CO_2eq.) using the Global Warming Potentials (GWPs) in the IPCC Second Assessment Report (SAR).

In 2016, the national GHG emissions were 694.1 million tons CO_2eq. and net emissions including sinks were 649.6 million tons CO_2eq. Total emissions in 2016 were 0.2% higher than those in 2015 because of increased emissions from road transport (4.4 million tons, by 4.9%), residential (1.8 million tons, by 6.0%), chemicals (1.4 million tons, by 3.8%), and petroleum refining (1.3 million tons, by 8.1%) sectors. It was analyzed that the increased emissions in road transport were due to increased fuel consumption caused by the increase in the number of registered vehicles (by 3.9%).

Ssanggyeru Pavilion of Baegyangsa Temple in Jangseon-gun, Jeollanam-do
Photographs: Korea Tourism Organization (Yeo Jin-mo)

3. Mitigation Policies and Actions

In May 2015, the ROK set a new national GHG reduction target of 37% below business-as-usual (BAU) level by 2030. The ROK prepared the Roadmap to Achieve the National GHG Reduction Target for 2030 in September 2017 to provide basic directions for achieving the national GHG reduction target. This roadmap specifies the emissions projection, reduction target, and major reduction plans by sector and sub-sector for 2030. According to the roadmap, the ROK will reduce GHG emissions by implementing technologies and policies taking into consideration sector-specific circumstances for energy transformation, industry, buildings, transportation, waste, public/other, and agriculture and livestock sectors.

The ROK established a separate basic plan for each sector in setting mid- and long-term targets and directions and is making efforts to reduce GHG emissions by implementing detailed policies and measures. Along with these, the ROK is promoting policies to increase the share of new and renewable energy through the Renewable Portfolio Standard (RPS) in the power generation sector, strengthening energy demand management and expanding the supply of high-efficiency equipment in the industrial and buildings sectors, and popularizing eco-friendly vehicles and improving the transportation logistics system in the transportation sector.

4. International Support and Awareness of Climate Change

In spite of restrictions such as the global financial crisis and rising financial deficit, the ROK announced the contribution of USD 100 million to the Green Climate Fund (GCF) at the UN Climate Summit in September 2014. Moreover, at the 22nd session of the Conference of the Parties (COP 22) to the United Nations Framework Convention on Climate Change (UNFCCC) in November 2016, the ROK with the European Union (EU) and 7 developed countries pledged a joint statement for a financial contribution of USD 23 million for the Climate Technology Center and Network (CTCN), which was unprecedented for non-Annex I countries.

Government organizations, including the Greenhouse Gas Inventory and Research Center of Korea (GIR), the Korea Forest Service, and the Ministry of Environment, operate their own capacity-building programs to foster experts in the fields of greenhouse gas inventory, reduction of emissions from deforestation and forest degradation, and adaptation in developing countries.

[Clepsydra] A water clock equipped with automatic time signal device

CHAPTER 1

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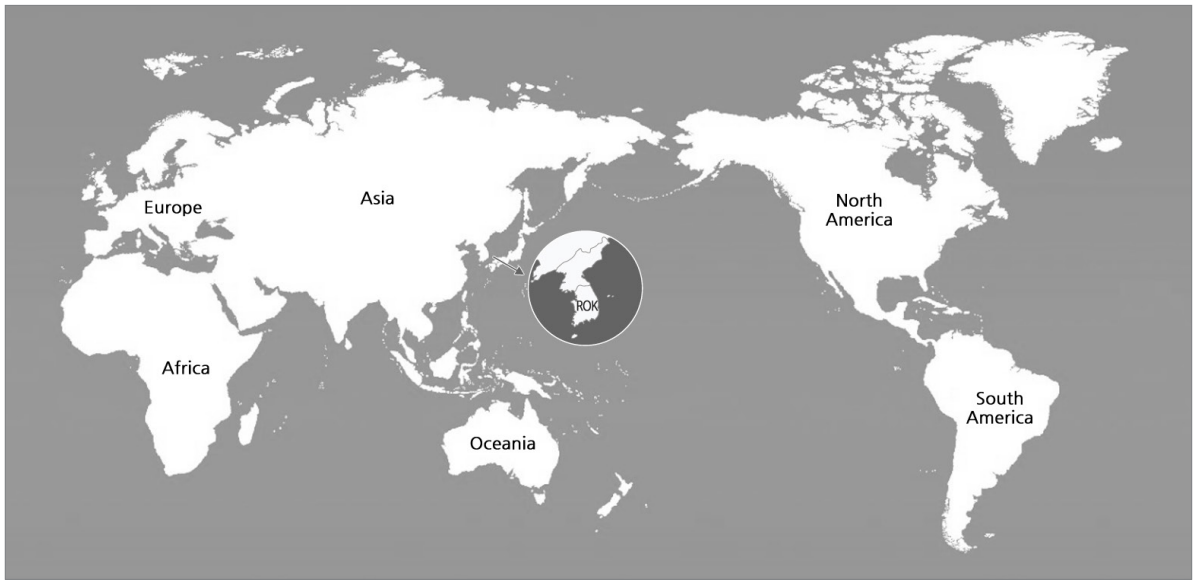
National Circumstances

1. Geography

In terms of geographic location, the ROK shares the Yellow Sea with People's Republic of China to the west, and the East Sea and Korean Straits with Japan to the east and the south, respectively.

[Figure 1-1] Geographic Location



In addition, the ROK's topography features slope to the Yellow Sea starting from the mountain ranges in the east of the country. As they reach the Yellow Sea, the slope gradually decreases. The slope to the East Sea is steep, leading to the development and distribution of mountain area and plain terrain and the distinct flow of rivers. The ROK's land area is 100,364㎢, covering 45% of the entire Korean peninsula. The average altitude above sea level is 482m and the highlands above 1,000m are mostly located in the northern region of the peninsula, whereas the southern region consists of mountains of 500 m or less.

Mountain areas exceed river basins because most of the land is mountainous. The river flows are extremely irregular, and, thus more than 60% of the annual precipitation is discharged as flooding due to heavy rains in summer, and due to these strong river flows, large amounts of sand and gravel are transported from mountains to downstream areas or estuaries.

Most of the ROK's plain terrain is separated by mountain ranges in the directions of Liaodong and China and located on the west and south coasts, most of which are developed downstream of large rivers. Dividing the ROK's total land area of 100,364㎢ according to usage reveals forest lands cover 63,834㎢ (63.6%), paddy fields 11,282㎢ (11.2%), dry fields 7,611㎢ (7.6%), and roads 3,251㎢ (3.2%) in descending order.

2. Climate

The ROK is located in the four-season mid-latitude temperate climate zone, where winters are cold and dry due to the continental high atmospheric pressure, and summers are generally hot and humid because of the North Pacific anticyclone. During spring and autumn, the migratory anticyclones often provide relatively clear skies and dry conditions. Over the 29 years (1990-2018), the annual mean temperature of the ROK is 12.8℃; the hottest month is August with a mean temperature of 25.3℃, and the coldest month is January with a mean temperature of −0.8℃.

〈Table 1-1〉 Monthly Mean Temperature and Precipitation (1990-2018)

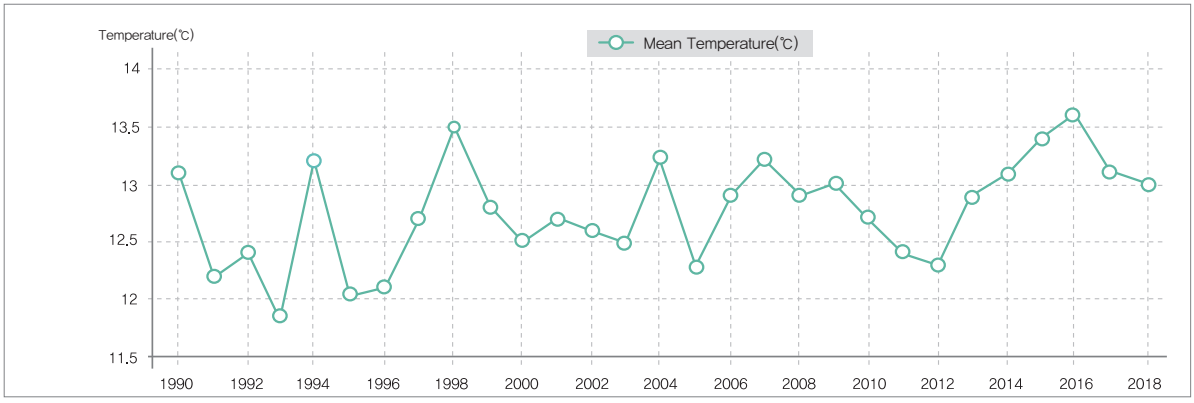
Temp. and Prec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mean Temperature (℃)	−0.8	1.5	6.3	12.3	17.4	21.5	24.9	25.3	20.7	14.5	8.0	1.5
Highest Temperature (℃)	4.5	7.1	12.3	18.7	23.5	26.8	29.2	29.9	26.1	20.9	13.8	6.8
Lowest Temperature (℃)	−5.4	−3.5	0.8	6.3	11.8	17.1	21.5	21.78	16.4	9.3	2.9	−3.2
Precipitation (mm)	25.4	36.9	57.5	90.0	101.1	149.8	285.5	274.0	153.0	59.5	48.6	28.4

※ Source: Annual Weather Report (Korea Meteorological Administration)

Also, the Northwesterly wind in winter and the southwesterly wind in summer are strong, respectively, and the ROK has not only seasonally distinctive wind systems, but also distinct sea breeze effects in coastal areas. Humidity ranges from 60% to 75% throughout the country; 70-85% in July and August and 50-70% in March and April. About 26 typhoons occur per year in the northwest Pacific and move northward from May to October, with 90% affecting the Korean Peninsula from July to September.

The ROK is a mostly mountainous country with four distinct seasons. In the ROK, the solar radiation in spring and summer is 20% and 25% higher than the annual average, respectively, whereas in autumn and winter, 12% and 33% lower than the average, respectively.[1] When measuring wind power efficiency, it is found that 25% of onshore wind and 40% of offshore wind can be used for power generation.

[Figure 1-2] Annual Average Temperature (1990-2018)



1 2016 New and Renewable Energy White Paper (Ministry of Trade, Industry and Energy, 2016)

3. Population

As of 2018, the ROK's population was approximately 51,607,000. This is about 0.7% of the world's population and is the 27th largest country in terms of population. The ROK's population density is about 515 people/km^2, ranking behind only Bangladesh and Taiwan, excluding city states and small countries.

The average annual population growth rate in the ROK was about 3% in the 1960s. However, as the measures to suppress population growth were implemented, the rate gradually decreased and dropped sharply to less than 0.5% in 2005. Given these trends, the ROK's population is expected to reach 51,781,000 in 2020 and 51,927,000 in 2030.

In terms of age characteristics, the median age increased from 31.8 in 2000 to 42.6 in 2018 and life expectancy increased from 75.6 years (71.7 years for male and 79.2 for female) in 1999 to 80.6 years (77.0 years for male and 83.8 for female) in 2009. The proportion of the population aged 65 years or over also rose from 7.2% in 2000 to 11.0% in 2010. As such, population aging in the ROK society is proceeding at a very rapid pace.

4. Economy

The ROK's economic growth rate remained high at more than 7% before the foreign currency crisis in 1998, but decreased to 4% from the 2000s. Since 2008, the ROK's growth rate has fallen to around 3% due to the global economic recession caused by the global financial crisis and European financial crisis. As of 2017, the ROK's real GDP was approximately KRW 1.556 quadrillion. In terms of GDP per capita, it is equivalent to KRW 30.25 million.

〈Table 1-2〉 Gross Domestic Product and Economic Growth Rate

Descriptions	1970	1980	1990	2000	2005	2010	2015	2016	2017
GDP (Nominal, KRW 1 billion)	2,795	39,471	197,712	635,185	919,797	1,265,308	1,564,124	1,641,786	1,730,399
Economic Growth Rate (Real, %)	10.0	−1.7	9.8	8.9	3.9	6.5	2.8	2.9	3.1

※ Source: National Income (Bank of Korea)

The ROK has promoted export-led economic growth since its initial development, and as a result, both exports, with their need for raw materials and capital goods, and imports have expanded rapidly. In addition, Factor Income from the Rest of the World has expanded at a rate similar to that of imports and exports—approximately 4%. As a result, the ROK's ratio of imports and exports to Gross National Income (GNI) increased from 53.6% in 1990 to 84.0% in 2017. These figures confirm that the ROK's proportion of import and export is relatively high compared to other countries.

〈Table 1-3〉 Ratio of Imports and Exports to Factor Income from the Rest of the World and GNI

Descriptions	1970	1980	1990	2000	2005	2010	2015	2016	2017
Exports (Trillion KRW)	0.3	11.2	50.1	222.4	338.6	625.3	709.1	694.2	745.6
Imports (Trillion KRW)	0.6	14.7	51.2	209.2	316.2	585.0	600.2	581.7	652.2

※ Source: National Account (Bank of Korea)

While the economy's dependence on exports and share of the manufacturing sector recently decreased after having continuously increased from 1990 to 2011, they still play a significant role in the national economy. As of 2017, the ROK's dependence on exports stood at 37.5% and the share of the manufacturing sector accounted for 30.4% of the GDP.

〈Table 1-4〉 Dependence on Exports and Share of Manufacturing Sector in the National Economy

Descriptions	1990	2000	2010	2011	2012	2013	2014	2015	2016	2017
Export Dependence (%)	23.3	30.7	42.6	46.2	44.8	42.9	40.6	38.1	35.0	37.5
Share of Manufacturing (%)	27.3	29.0	30.7	31.4	31.0	31.0	30.2	29.8	29.5	30.4

※ Source: Korean Statistical Information Service (KOSIS), Bank of Korea's Economic Statistics System websites (ECOS)

5. Institutional and Legal Frameworks

To improve the quality of life of the people and fulfill the responsibility to the international community by realizing a low carbon society, the ROK decided in a cabinet meeting its national mid-term reduction target, which includes the "reduction of 30% of GHG emissions projections by 2020," and announced to the international community in November 2009 and enacted the Framework Act on Low Carbon, Green Growth in 2010 to build the legal basis for coping with climate change.

Also, to reach the national GHG reduction target, the ROK introduced the GHG and Energy Target Management System (TMS) for companies that emit and consume high levels of GHG and energy in 2010 and established a legal basis by enacting the Act on the Allocation and Trading of Greenhouse-Gas Emission Permits and its Enforcement Decree in 2012. It introduced an emissions trading system for 525 companies in earnest for Phase I (2015-2017) in 2015.

In 2008, Korea introduced the National Strategy for Green Growth, the Climate Change Response Master Plan, and the National Climate Change Adaptation General Plan to pursue systematic response and measures for climate change in the mid- to long-term. The National Strategy for Green Growth is a long-term strategy for 2009-2050, which sets forth the policy goals, strategies, and directions for low-carbon green growth, including matters related to responses to climate change, energy, and sustainable development policies.

The ROK submitted the Intended Nationally Determined Contributions (INDCs) in June 2015, before the conclusion of the Paris Agreement, and legislated the reduction target for 2030 by amending the Enforcement Decree of the Framework Act on Low Carbon, Green Growth in May 2016. Measures are being taken by the ROK for its effective implementation.

In order to actively participate in global efforts to cope with climate change, the Climate Change Response Master Plan is established and implemented every five years in accordance with the basic principles of climate change response to achieve GHG reduction targets using regulations, markets, and technology and minimize the impact of climate change.

The National Climate Change Adaptation General Plan is a basic nationwide plan that presents the vision and direction of national adaptation policies as a long-term strategy for 2009-2030. For a short-term plan, the relevant ministries jointly established and implemented the First National Climate Change Adaptation Measures (2010) and the Second National Climate Change Adaptation Measures (2015). The ROK is currently implementing a mid- to long-term plan to minimize the damage caused by climate change, take advantage of climate change adaptation as a new opportunity, and turn it into a new growth engine through short-term periods (2009-2012) focused on priority projects such as vulnerability assessment and foundation building.

Moreover, in June 2015, to actively participate in the international community's efforts to respond to climate change under the Paris Agreement, the ROK submitted an Intended Nationally Determined Contributions (INDCs) that includes the GHG reduction target of 37% below BAU level by 2030 before the conclusion of the Agreement and legislated the reduction target for 2030 by amending the Enforcement Decree of the Framework Act on Low Carbon, Green Growth in May 2016. The ROK is continuing its efforts to achieve the reduction target by effective implementation measures and is pursuing basic research to submit to the international community the Nation's 2050 Long-term Low-carbon Development Strategy in compliance with the Paris Agreement for 2020.

[Celestial Globe] An astronomical device to observe and measure the orbital movements of celestial objects

CHAPTER 2

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National Greenhouse Gas Inventory

1. National Greenhouse Gas Inventory System

1.1 Organizational System

The Greenhouse Gas Inventory and Research Center (GIR) is in charge of tasks related to the national GHG inventory.[2] With respect of the national GHG inventory, the GIR is in charge of (1) establishing the Regulations on the Management of the National GHG Inventory; (2) providing Guidelines for Measurement, Reporting, and Verification (MRV Guidelines) for the calculation of the national GHG inventory; (3) reviewing the national GHG inventory data as well as emission and removal factors; (4) organizing and managing the National GHG Inventory Management Committee (Management Committee), the National GHG Working Group (Working Group), and National GHG Technical Group (Technical Group); (5) collecting and preparing the national GHG inventory; and (6) developing and operating the IT system for data management.

The sectoral responsible ministries of the five sectors subject to GHG inventory[3] measurement oversee the management of the GHG inventory. A responsible ministry designates an agency with expertise in the inventory of a relevant sector (measurement agency[4]) to calculate the GHG inventory of that sector and perform tasks including the development of country-specific emission and removal factors, and reviews the draft inventory compiled by the measurement agency and submits the results to GIR. Meanwhile, a change in the organizational structure in the 2nd Biennial Update Report for 2017 is that the calculation agency for the settlement and other land categories in the LULUCF sector has been changed from the Korea Research Institute for Human Settlements to the L&H Land Housing Research Institute.

The Technical Group, as a technical advisor in relation to the measurement, reporting, and verification (MRV) of the national GHG inventory and country-specific emission and removal factors, consists of external experts from academia and research institutes. The Working Group has been established to facilitate discussions among relevant organizations with respect to the MRV of the national GHG inventory, the development and verification of emission and removal factors, and the provision and revision of relevant guidelines. The Working Group, chaired by the president of GIR, consists of director-level government officials from responsible sectoral ministries and relevant organizations such as Statistics Korea (KOSTAT), the Korea Forest Service (KFS), etc.

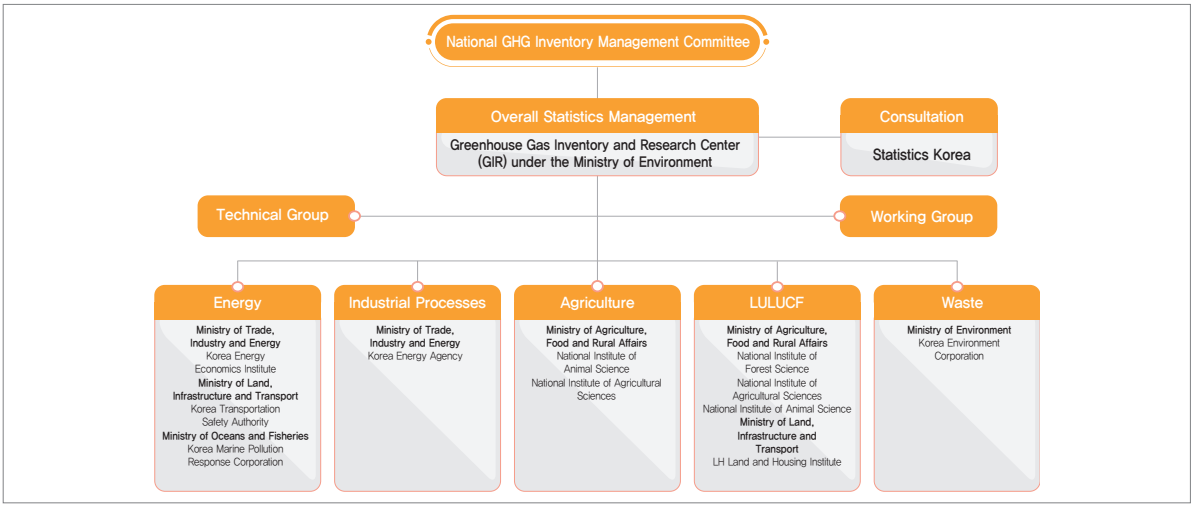
2 Article 45 of the Framework Act on Low Carbon, Green Growth and Article 36 of the Enforcement Decree of the Act

3 The sectoral responsible ministries are (1) Energy: Ministry of Trade, Industry and Energy (fuel combustion (power generation, industry) and fugitive emissions), Ministry of Land, Infrastructure and Transport (transportation (aviation, roads, and railways) and buildings), and Ministry of Oceans and Fisheries (fisheries, shipping, and ports); (2) Industrial processes: Ministry of Trade, Industry and Energy; (3) Agriculture: Ministry of Agriculture, Food and Rural Affairs; (4) LULUCF: Ministry of Agriculture, Food and Rural Affairs (forest land, wetland, grassland, and farmland); and (5) Waste: Ministry of Environment

4 (1) Energy: Korea Energy Economics Institute, Korea Transportation Safety Authority, and Korea Marine Pollution Response Corporation, (2) Industrial processes: Korea Energy Agency; (3) Agriculture: National Institute of Animal Science and National Institute of Agricultural Sciences, (4) LULUCF: National Institute of Forest Science, National Institute of Agricultural Sciences, National Institute of Animal Science, and LH Land and Housing Institute, (5) Waste: Korea Environment Corporation

The Management Committee is the decision-making body that approves the final drafts such as the national GHG inventory and country-specific emission and removal factors submitted after the consultation of the Working Group. The Management Committee, chaired by a Vice Minister of Environment, consists of not more than 15 members; director general-level officials from sectoral responsible ministries and Statistics Korea and for appointed members, experts from academia and the public sector.

[Figure 2-1] Organization for Preparation of the National GHG Inventory



1.2 Preparation Process

To enhance the transparency and accuracy of the national GHG inventory, the measurement and verification of inventory has been segregated and the review of the Working Group and the deliberation of the Management Committee has been performed step by step.

– Measurement and Reporting

The first step in preparing the national GHG inventory is to determine the methodology. To enhance the inventory quality, GIR prepares revised MRV Guidelines at the beginning of each year reflecting the areas for improvement identified during the verification process in the previous year. Once the revised MRV Guidelines are confirmed through the review of the Working Group and the deliberation of the Management Committee, GIR distributes it in March to the sectoral responsible ministries and measurement agencies. Afterward, based on the distributed MRV Guidelines, sectoral responsible ministries review their inventories estimated by the agencies and submit them to GIR by June 30.

– Verification

After collecting the inventory draft reports submitted by sectoral responsible ministries, GIR verifies measurement methodology, activity data, the appropriateness of emission and removal factors and detects any errors in the emission calculations of subcategories.

GIR requests these ministries to revise and complement their drafts by correcting errors and improving areas identified during the verification process. After confirmation of the inventory drafts that have been revised by the ministries, GIR prepares a final draft.

– Final Confirmation and Publication

GIR hosts the Working Group meetings for the review of the final draft of the inventory revised for each sector, and through the final deliberation of the Management Committee, the national GHG inventory is confirmed by December. Afterward, GIR publishes the approved national GHG inventory through several platforms including its website.

2. Measurement Scope and Method

2.1 Scope of Greenhouse Gases

The ROK's national GHG inventory includes the anthropogenic emissions and removals of GHGs defined by the Kyoto Protocol; carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrochlorofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Since greenhouse gases have different levels of heat dissipation for the residency period in the atmosphere, the national total emissions are expressed with CO_2 equivalent (CO_2eq.) calculated using the 100-year time horizon GWP for the purpose of understanding the levels and comparing each other. Meanwhile, the ROK calculated CO_2eq. of CH_4, N_2O, HFCs, PFCs, SF_6 using the GWP of the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR).

2.2 Scope of Sectors and Time Period

The ROK calculates the national GHG inventory for Energy, Industrial Processes, Agriculture, LULUCF, and Waste sectors in accordance with the IPCC Guidelines. Also, the report of the national GHG inventory covers 27 years from 1990 to 2016.

2.3 Measurement Methodology

The national GHG inventory was primarily prepared based on the 1996 IPCC Guidelines, but in some categories, the ROK applied the 2000 IPCC Good Practice Guidance (GPG 2000), 2003 IPCC Good Practice Guidance for LULUCF (GPG LULUCF), and 2006 IPCC Guidelines. The GPG 2000 was applied to (1) Civil Aviation in the Energy sector and (2) Landfills, Wastewater Treatment, and Waste Incineration in the Waste sector, and the IPCC GPG LULUCF and the 2006 IPCC Guidelines were applied to the LULUCF sector. The 2006 IPCC Guidelines were applied to the sub-sectors of (1) semiconductor and display manufacturing, and heavy electric equipment in the Industrial Processes sector, (2) rice cultivation

and agricultural soil management in the Agriculture sector, (3) above-ground biomass of forest land and wetlands in the LULUCF sector and (4) others in the Waste sector.

Also, the ROK continues to develop country-specific emission and removal factors (country-specific emission factors) to ensure the accuracy of the inventory. The use of country-specific emission factors is determined through MRV processes similar to the MRV processes for the national GHG inventory. In addition, the country-specific emission factors surveyed and analyzed by research institutes, etc., are submitted to GIR through the responsible ministry and then, GIR organizes a verification team consisting of experts in the Technical Group and internal experts to review the appropriateness of the development method, representativeness of factors, accuracy of measurement and analysis, etc. After verification, the emission factors are confirmed by the review of the Working Group and deliberation of the Management Committee.

In 2018, measurements were based on 70 country-specific emission factors, which accounted for about 80% of the total emissions. Country-specific emission factors were applied to the sectors of (1) Energy (33 factors) (2) rice cultivation and agriculture soil in Agriculture (13 factors), (3) forest land in LULUCF (6 factors), and (4) landfills, water waste treatment, and waste incineration in Waste (18 factors). Compared to the country-specific emission factors (57 in total) applied in the Second Biennial Update Report, 13 factors have been added in public electricity, heat production, and fugitive in the energy sector and sewage and wastewater treatment in the waste sector.

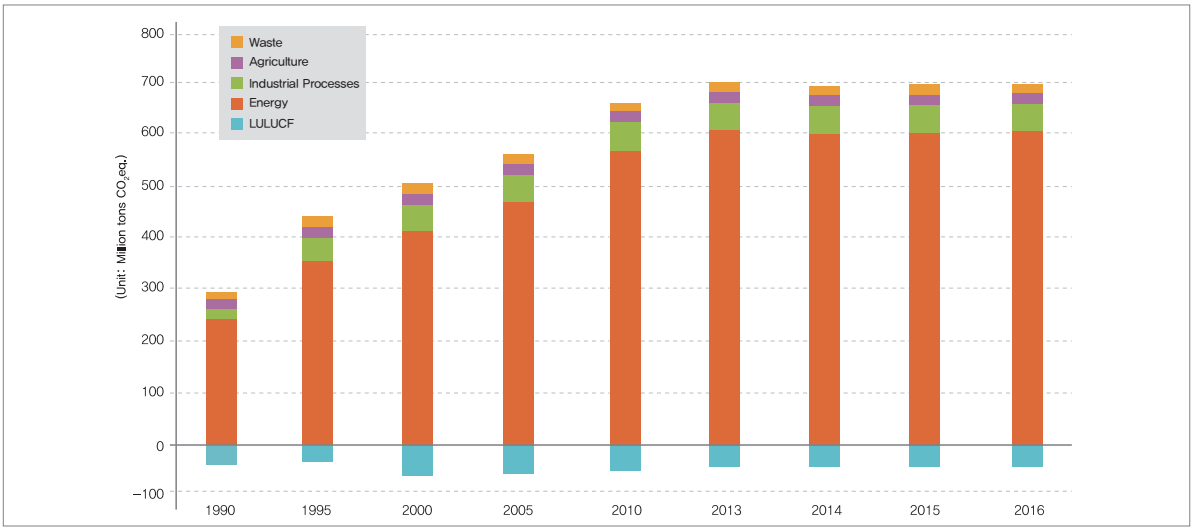
The emissions of sub-sectors not estimated with country-specific emission factors were mostly calculated with the default emission factors in the 1996 IPCC Guidelines and there were some sub-sectors to which the default emission factors in the 2006 IPCC Guidelines were applied. The default factors of the 2006 IPCC Guidelines were applied to the items of (1) fuel combustion of refinery gas and LPG fuel and fugitive emissions from oil and natural gas in the energy sector, (2) semiconductor and display manufacturing and heavy electric equipment in the industrial processes sector, (3) wetlands in the LULUCF sector, and (4) biological treatment of solid waste, etc., in the waste sector.

Meanwhile, the ROK is conducting research to build grounds in response to the mandatory application of the 2006 IPCC Guidelines under the Paris rulebook (confirmed at COP 24 in November 2018). Accordingly, since 2018, GIR has been conducting research and trial calculations with relevant authorities to improve the activity data, emission factors, etc., required to apply the 2006 IPCC Guidelines and plans to reflect these in future national GHG inventories.

3. Greenhouse Gas Emissions and Trends

The total GHG emissions in the ROK in 2016 were 694.1 million tons CO_2eq. and net emissions including sinks were 649.6 million tons CO_2eq. Total emissions in 2016 increased by 136.9% compared with 1990 and increased by 0.2% compared with 2015. The largest contributor to emissions growth in 2016 was the energy sector, which also accounted for the largest share of national emissions. This sector's GHG emissions increased by 2.4 million tons CO_2eq. compared to the previous year, due to increased emissions from road transport (4.4 million tons, by 4.9%), residential (1.8 million tons, by 6.0%), chemicals (1.4 million tons, by 3.8%), and petroleum refining (1.3 million tons, by 8.1%) sectors. It was analyzed that the increased emissions in road transport were due to increased fuel consumption caused by the increased number of registered vehicles (by 3.9%). The residential sector's increased emissions were mainly due to the increase in heating degree days[5] (130.6 heating degree days year-on-year, 5.3% increase[6]), and the increased emissions in chemical and petroleum refining sectors were due to the increased production caused by low oil prices (Dubai average $41/barrel[7]).

[Figure 2-2] Trends in National Greenhouse Gas Emissions and Removals (1990-2016)



5 The value of the accumulated daily difference between daily average temperature and the reference temperature of 18℃. If the daily average temperature is lower than the reference temperature, it is calculated as a heating degree day

6 Monthly Energy Statistics, Korea Energy Economics Institute, 2018

7 International oil prices (Dubai): $97/bbl in 2014, $51/bbl in 2015, $41/bbl in 2016 (Yearbook of Energy Statistics, 2017), bbl: Barrel (oil capacity unit, and 1 bbl is equivalent to about 159 liters)

〈Table 2-1〉 National Greenhouse Gas Emissions and Change

(Unit: Million tons CO_2eq.)

Sectors	1990	1995	2000	2005	2010	2013	2014	2015	2016
Total Emissions (excluding LULUCF)	292.9	437.3	501.4	559.1	657.4	696.7	690.9	692.9	694.1
Net Emissions (including LULUCF)	254.7	406	442.2	504.3	603	652	648.3	650.1	649.6
Energy	241.5	354.4	410.8	466.9	565.8	606.2	598.8	602.4	604.8
Industrial Processes	19.8	44.1	50.2	54.7	54.4	53.3	56	53.3	51.5
Agriculture	21.3	23.2	21.6	20.8	22.2	21.4	20.8	20.9	21.2
LULUCF	-38.2	-31.3	-59.3	-54.9	-54.4	-44.7	-42.7	-42.9	-44.5
Waste	10.4	15.7	18.8	16.7	15	15.9	15.4	16.4	16.5

Looking at the trend of the total emissions for each year, from 1990 to 1997, emissions increased by an average of 8.0% but in 2009, emissions increased only 0.8% year-on-year due to the economic downturn caused by the global financial crisis. However, in 2010, emissions increased by 10% year-on-year as the economy recovered and demands for industrial and heating power surged. Total emissions in 2013 reached a record high of 696.7 million tons CO_2eq. but in 2014, GHG emissions decreased by 0.8% from the previous year for the first time since the 1998 financial crisis. Since then in 2015 and 2016, emissions increased slightly by 0.3% and 0.2%, respectively.

3.1 Emission and Removal by Sector

In 2016, the GHG emissions in the energy sector were 604.8 million tons CO_2eq., accounted for 87.1% of the national GHG emissions. This represented a 150.5% increase compared with that in 1990 and a 0.4% increase from that of the previous year. Looking at the trend of emissions, after emissions increased from 1990 to 1997 but reduced following the economic crisis in 1998, they tended to rise again as the economy recovered. For the recent situation, the total emissions decreased by 1.2% in 2014, which marked the first time except 1998, the year of economic crisis and then, they increased by 0.6% and 0.4%, respectively, in 2015 and 2016.

In 2016, the GHG emissions in the industrial processes sector were 51.5 million tons CO_2eq., which accounted for 7.4% of the national GHG emissions. This represented a 160.2% increase compared with that in 1990 and a 3.4% decrease from that of the previous year. Looking at the trend of emissions, they increased by an average of 13.9% from 1990 to 1997, but subsequently declined due to the economic crisis from 1998 to 2004, and increased again to the highest record (year 2004) in the industrial processes sector as the economy recovered. In addition, emissions generally declined from 2005 to 2009, when the global financial crisis hit, and there have been slight increases or decreases since 2010, but the level was maintained until 2016.

In 2016, the GHG emissions in the agriculture sector were 21.2 million tons CO_2eq., accounted for 3.1% of the national GHG emissions. This represented a 0.1% decrease compared with that in 1990 and a 1.6% increase from that of the previous year. An increase of emissions in livestock manure treatment even though emissions from the rice cultivation sub-sector continued to decrease due to the decrease in cultivated acreage was the reason for the increase in emissions compared with the previous year.

Looking at the share of emissions and removal in the LULUCF sector in 2016, among sinks, the forest lands' removal was -48.5 million tons CO_2eq., accounting for 99.9% of the total removal in the LULUCF sector and the grassland's removal was -0.1 million tons CO_2eq., accounting for 0.1% of the total removal in the sector. Among emission sources, the farmlands sub-sector emitted 3.7 million tons CO_2eq., accounting for 91.2% of the total emissions in the LULUCF sector, and the wetland sub-sector emitted 0.4 million tons CO_2eq., accounting for 8.8% of the total emission in the sector.

In 2016, the GHG emissions in the waste sector were 16.5 million tons CO_2eq., accounting for 2.4% of the national GHG emissions, representing a 58.8% increase compared with that in 1990 and a 1.0% increase from that of the previous year. Among emissions in the waste sector, the waste landfills sub-sector emitted 7.6 million tons CO_2eq., which is 46.0% of the total emissions in the waste sector, and the waste incineration sub-sector emitted 7.1 million tons CO_2eq., accounting for 43.3% of the total emission in the sector. In addition, the wastewater treatment sub-sector emitted 1.4 million tons CO_2eq., accounting for 8.6% of the total emissions in the waste sector, and the other sub-sectors emitted 0.4 million tons CO_2eq., accounting for 2.2% of the total emissions in the sector.

3.2 Trends of Emission and Removal by GHG

Total emissions of CO_2 (excluding LULUCF) reached 637.6 million tons CO_2eq. in 2016, which accounted for 91.9% of the national GHG emissions. This represents a 152.7% increase compared with 252.3 million tons CO_2eq. in 1990. Meanwhile, the rates of change in emissions year-on-year in the last three years decreased by 1.1% in 2014, which was the first decrease in emissions since the 1998 financial crisis. However, the rate increased by 0.8% and 0.5% in 2015 and 2016, respectively.

Total emission of CH_4 (excluding LULUCF) was 26.0 million tons CO_2eq. in 2016, which accounted for 3.7% of the national GHG emissions (excluding LULUCF). It decreased by 14.2% compared with emissions of 30.3 million tons CO_2eq. in 1990, but increased by 0.02% compared with the previous year.

The total emissions of N_2O (excluding LULUCF) were 14.8 million tons CO_2eq. in 2016, which accounted for 2.1% of the national GHG emissions (excluding LULUCF). This represents a 62.0% increase compared with 9.2 million tons CO_2eq. in 1990 and a 3.6% increase compared with 14.3 million tons CO_2eq. in 2015.

The emissions of HFCs were 7.4 million tons CO_2eq., accounting for 1.1% of the national GHG emissions (excluding LULUCF). This represented a 649.5% increase compared with 1990 and a 7.1% decrease compared with the previous year. All HFCs are emitted in the industrial processes sector with the sub-sectors of halocarbon and sulfur hexafluoride production and consumption.

The emissions of PFCs were 1.5 million tons CO_2eq., accounting for 0.2% of the national GHG emissions (excluding LULUCF). This represented a 539,488.7% increase compared with 1992, the first measurement year, and a 2.1 % decrease compared with the previous year. All PFCs are emitted in the industrial processes sector.

Emissions of SF_6 were 6.8 million tons CO_2eq., accounting for 1.0% of the national GHG emissions (excluding LULUCF). This represents an increase of 3,810.5% compared with that in 1990 and a decrease of 21.8 % compared with the previous year. All SF_6 are emitted in the industrial processes sector.

〈Table 2-2〉 Emissions and Percentage Changes by GHG

(Unit: Million tons CO_2eq.)

GHGs		1990	2000	2010	2014	2015	2016	Change compared with 1990 (%)	Change compared with 2015 (%)
Total Emissions (excluding LULUCF)		292.9	501.4	657.4	690.9	692.9	694.1	136.9	0.2
CO_2	Emissions	252.3	441.6	594.7	629.7	637.6	637.6	152.7	0.5
	Share (%)	86.1	88.1	90.5	91.1	91.9	91.9		
CH_4	Emissions	30.3	27.5	26.9	26.0	26.0	26.0	-14.2	0.02
	Share (%)	10.3	5.5	4.1	3.8	3.7	3.7		
N_2O	Emissions	9.2	18.3	13.6	13.9	14.8	14.8	62.0	3.6
	Share (%)	3.1	3.7	2.1	2.0	2.1	2.1		
HFCs	Emissions	1.0	8.4	8.1	8.5	7.4	7.4	649.5	-7.1
	Share (%)	0.3	1.7	1.2	1.2	1.1	1.1		
PFCs	Emissions	0.0	2.2	2.3	2.4	1.5	1.5	539,489	-2.1
	Share (%)	0.0	0.4	0.3	0.4	0.2	0.2		
SF_6	Emissions	0.2	3.2	11.9	10.4	6.8	6.8	3811	-21.8
	Share (%)	0.1	0.6	1.8	1.5	1.0	1.0		

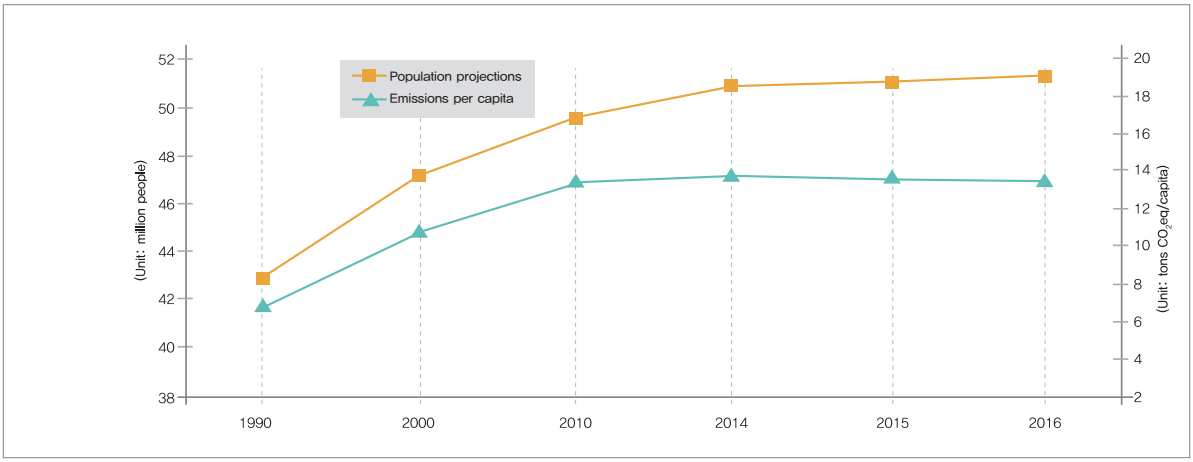
※ The rate of change of PFCs was calculated based on the emissions in 1992 when the data was collected for the first time.
※ The analysis of net emissions, including the LULUCF sector, refers to the analysis of emission and removal trends by GHG

3.3 Trends of Emissions per Capita and GDP

– Greenhouse Gas Emissions per Capita

In 2016, the ROK's total greenhouse gas emissions per capita amounted to 13.5 tons CO_2eq., which is about twice that of 1990. This increase in per capita GHG emissions is caused by a significant increase in GHG emissions due to industrial development rather than population growth. However, the growth of GHG emissions began to slow in 2012, and GHG emissions per capita changed to a decreasing trend. With the exception of the economic crisis in 1998, the decline over the last three years is the first instance since 1990.

[Figure 2-3] Greenhouse Gas Emissions per Capita and Estimated Population (1990-2016)

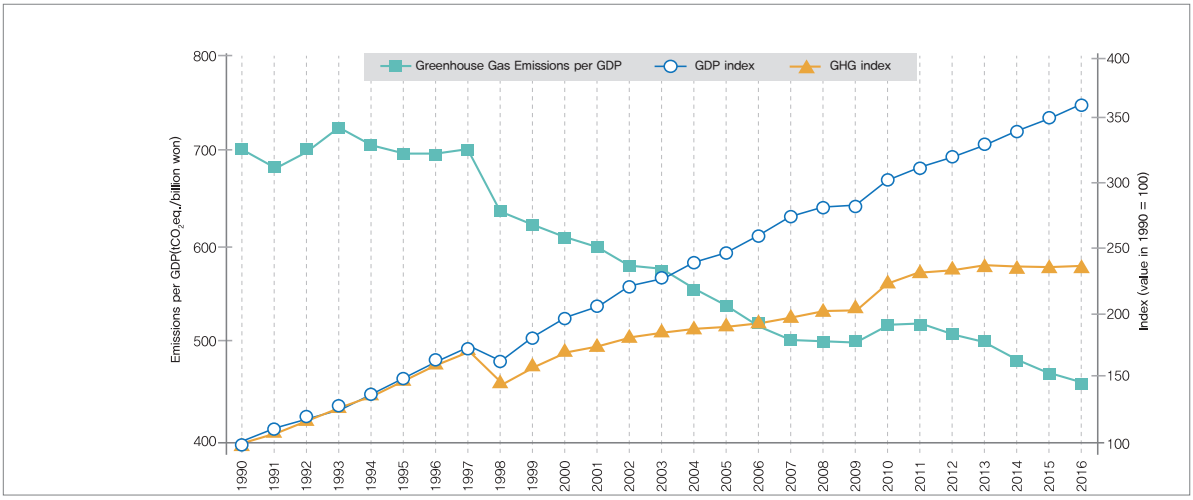


※ Source: Population Projections for the ROK (Statistics Korea, 2018)

– Emissions per Real GDP

Total GHG emissions per 2016 GDP (the year 2015) calculated based on GDP data published by the Bank of Korea in 2018 were 459.7 tons CO_2eq./billion won. This represented a 34.2% decrease compared with 698.3 tons CO_2eq./billion won in 1990, and a 2.7% decrease compared with 472.4 tons CO_2eq./billion won in 2015.

[Figure 2-4] Greenhouse Gas Emissions to GDP (1990-2016)



※ Source: National Account (as of 2010), Real GDP by Economic Activity, Bank of Korea, 2018

[Hemispherical Sundial] Concave Pot-shaped Sundial in the Joseon Dynasty period

CHAPTER 3

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Mitigation Policies and Actions

1. Emission Projections and Reduction Target

The long-term GHG emission projections for the ROK, where the GHG emissions of the energy sector accounted for more than 85% (87.2% in 2012) of total emissions, were prepared using the 3rd Energy Master Plan (2019), which included energy demand projections through 2040, and the 8th Master Plan for Electricity Supply and Demand (2017), as basic data for analysis. Industrial processes and agricultural, livestock sectors, etc., which were not included in the Energy Master Plan, were newly projected for 2030 using the latest data.

After having declared Low Carbon Green Growth as the national vision in 2008, the ROK for the first time established the national GHG reduction target for 2009 and announced a mid-term national GHG reduction target to reduce emissions by 30% of the business-as-usual (BAU) level by 2020. Since then, the ROK organized and operated the Joint Working Group composed of relevant ministries around GIR. The Working Group determined yearly reduction targets for 25 sub-sectors in 7 sectors through 2020 in 2011 and established in 2014 a Roadmap to Achieve the National GHG Reduction Target for 2020 which contains action plans by sector to achieve the yearly targets. However, since establishing the 2020 Reduction Roadmap, GHG emissions by the ROK reached 690.9 million tons in 2014, 692.9 million tons in 2015, and 694.1 million tons in 2016.

〈Table 3-1〉 Amendment to the Roadmap for the National GHG Reduction for 2030

(Unit: Million tons, %)

Sub-sectors		BAU	Reduction compared to BAU	Reduction rate compared to BAU
Reduction Measures	Total	850.8	-314.8	37.0%
	Domestic Reduction	-	-276.4	32.5%
	Overseas Reduction	-	-38.3	4.5%

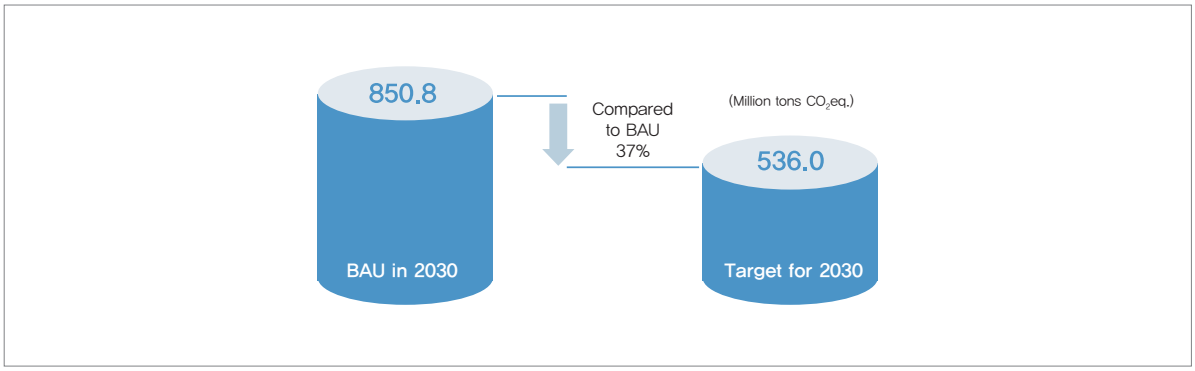
Meanwhile, the Paris Agreement, as the basis for the post-2020 new climate regime, was globally adopted in 2015 and went into effect in 2016 to establish a universal climate change scheme participated by almost all nations in the global community. Accordingly, there was a need to establish reduction targets beyond 2020. Therefore, the ROK organized and operated the Post-2020 Joint Working Group, which confirmed the target to reduce emissions 37% below BAU level by 2030 in 2015 including domestic reductions and overseas reductions using the international carbon market, and submitted it to the UN.

In accordance with these domestic and overseas conditions, the ROK presented specific policy directions to implement the reduction targets through consultations between private and public sectors, such as relevant associations, organizations, and major corporations around the ministries

and offices concerned and established the 2030 Roadmap in 2016, and the amendment to the 2030 Roadmap in 2018 to effectively implement these policies.

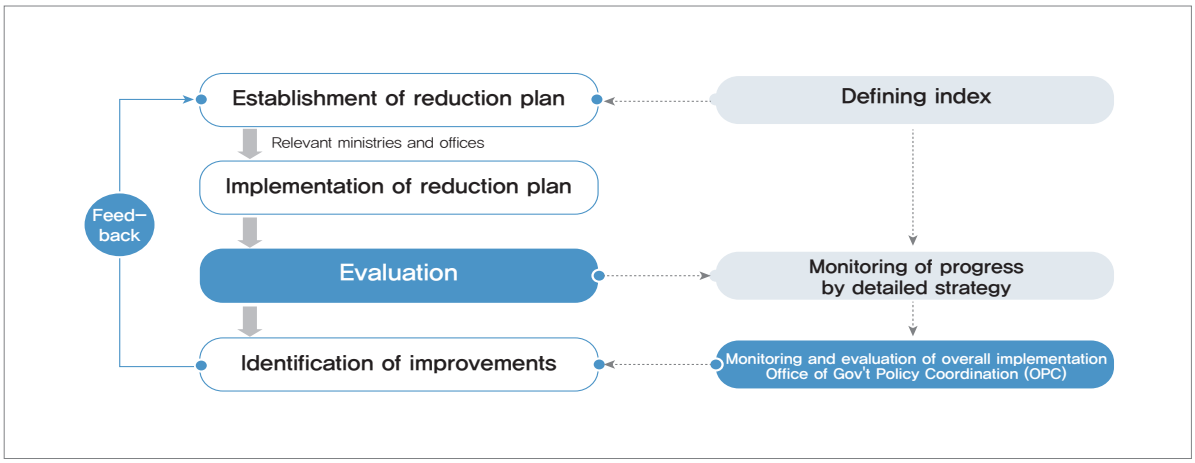
In accordance with the amendment to the 2030 Roadmap, the ROK set the national GHG emissions at 536.0 million tons CO_2eq., which is 37% lower than the BAU level and 22.3% lower than in 2015. It also committed itself to a further reduction in GHG emissions through the use of forest sinks, overseas reductions, and other methods in addition to domestic reductions in each sector. The ROK will fulfill its detailed plan with due consideration to trends arising from follow-up measures to the Paris Agreement.

[Figure 3-1] National GHG Reduction Target for 2030



To enhance the predictability of future reduction policies and strengthen the implementation management of the reduction targets, the ROK will set intermediate goals every three years by gathering opinions of experts and civil communities on the linkage with the allocation period of the emissions trading system and the feasibility, etc., of the path target performance management during the remaining time to the target year, 2030.

[Figure 3-2] 2030 Roadmap Evaluation System



2. Mitigation Actions by Sector

2.1 General Reduction Policy

– Emissions Trading System

The ROK established a legal basis by enacting the Act on the Allocation and Trading of Greenhouse Gas Emission Permits and the Enforcement Decree of the same Act in 2012 and introduced an emissions trading system to 525 companies for Phase I (2015–2017) in January 2015. The government suggested a basic direction, main targets, and detailed operational directions for each phase[8] with the goal of "effectively achieving national GHG emission reduction targets" to operate the emissions trading system pursuant to the five fundamental principles stipulated in Article 3 of the Act. In addition, the government established and announced the National Emission Allowance Allocation Plan for Phase I (2015–2017) of the GHG Emissions Trading System in 2014, which includes details such as sectors and sub–sectors eligible for allocation, total number of emission allowances, numbers allocated to each sub–sector, allocation standards for each entity, and emission allowances in reserve, pursuant to Article 2 (1) of the Enforcement Decree of the Act, considering the compatibility of the 1st Master Plan with the national GHG reduction targets.

The main targets of the system for each phase presented in the 1st Master Plan stipulated the government's progressive and stable system operation plan as the settlement of the emissions trading system during Phase I, the effective reduction of greenhouse gases during Phase II, and the active reduction of GHG during Phase III, and provided long–term system standards to stakeholders such as business entities eligible for being allocated. In the 2nd Master Plan for the emissions trading system, three sub–operational strategies were established: promoting low–carbon industry innovation and green investment, reducing greenhouse gases in cost–effective and flexible ways and achieving national reduction targets and preemptively supporting international carbon markets.

8 ① Complying with the principles set forth in the United Nations Framework Conventions on Climate Change and relevant protocols and considering international negotiations on climate change, ② considering the impact of an emissions trading system on the international competitiveness of economic sectors, ③ making the most of market mechanisms to achieve national greenhouse gas reduction targets effectively, ④ ensuring that emission permits are traded in a fair and transparent manner in accordance with general trading rules, and ⑤ implementing policies that are suitable to international standards, considering the linkage with international carbon markets.

〈Table 3-2〉 Operational Directions for Each Phase under the 2nd Master Plan

Descriptions	Phase I (2015-2017)	Phase II (2018-2020)
Allocation of allowances	• Applying GF[9] method – Applying BM[10] method to three sub-sectors • Fully free allocation	• Expanding the BM method – Leading to improve facility efficiency • Implementing allocation at a cost (3%)
Reducing emissions in external projects	• Diversifying reduction methodologies – 29 in Korea and granting CDM to 211 entities • Activating external projects – Upgrading small scale projects, etc	• Activating domestic external emission projects – Promoting project discovery for each sector • Encouraging overseas reduction activities – Recognizing overseas reductions of domestic companies as domestic trades
Verification and certification of emissions	• Establishing a verification and certification system • Expanding verification experts	• Elaborating the emissions statement – Expanding the BM method • Establishing an international level of a verification system
Markets for trading allowances	• Commencing an emission permits exchange (KRX) • Implementing measures for market stabilization	• Implementing periodic auctions • Reviewing the introduction of market makers
International cooperation and industrial support	• Promoting international cooperation projects – Korea-EU cooperation project and forum between Korea, China, Japan • Financial support and tax incentives such as a reduction facility support project	• Expanding international cooperation projects – Providing Korean bilateral cooperation projects • Reinvesting allocation revenues – Reusing the revenue as eco-friendly investment funds

※ Source: The 2nd Master Plan for the Emissions Trading System, Ministry of Strategy and Finance, 2017

While 23 subsectors were subject to Phase I, three were subsequently added, bringing the total to 26. The allocation method based on past emissions was applied to 20 of these sub-sectors, and the three types of businesses—cement, oil refining, and airlines, were pre-allocated by applying the allocation method based on the past activity data volume (hereinafter referred to as "benchmark method"). During Phase I, emission permits were allocated to all sub-sectors free of charge to minimize the economic burden on business entities and to settle the system. The preliminary allocation for the operation of Phase I was 1,622.6 million Korean Allowance Units (KAUs), with an additional allocation of 43.3 million KAUs, but 42 million KAUs were revoked. Also, the offset credits, which are acquired through external reduction projects of business entities including Clean Development Mechanism (CDM) projects, are recognized, and 22.5 million Korean Offset Credits (KOCs)[11] were supplied to the market through 81 external reduction projects as of August 2018. Of all KOCs, 15.4 million tons (70%) were converted to KCUs and used for trading and submission of emission allowances.

9 Grandfathering (GF): A method, based on past greenhouse gas emissions, of allocating emission allowances at or below the level of past emissions.

10 Benchmark (BM): A method of allocating emission allowances considering facility efficiency based on past activity data by business entity, such as product production

11 Reductions: Reducing N_2O 9.66 million tons $CO_2eq.$, 5.88 million tons $CO_2eq.$ by using landfill gas, SF_6 4.57 million tons $CO_2eq.$, 2.12 million tons $CO_2eq.$ by using new and renewable energy, 0.21 million tons $CO_2eq.$ by fuel conversion, 0.03 million tons $CO_2eq.$ by providing bio-energy

During Phase II, the technical innovation of business entities will be induced by expanding the benchmark method, which is favorable to companies with high facility efficiency, and companies that reduce greenhouse gas emissions by investing in green facilities are given incentives[12] at the allocation. The second allowances allocation plan sets the total emission allowances of 591 companies at 1,777,100,000 KAUs and the additional allowances in reserve of 19 million KAUs, reflecting an increase due to the expansion of the eligible facilities and the upward revision of the emission factors compared to the first allocation plan. In the second allocation period, among 63 sub-sectors, 97% of the allowances are allocated free of charge to 26 sub-sectors including power generation companies, and the partial onerous allocation that 3% of the allowances are being allocated at a cost through auctions, etc., is underway for the remaining 37 sub-sectors.[13] The government plans to increase the liquidity of the emission trading market and promote its activation by supplying emission allowances allocated at a cost to the market through periodic auctions. The government also plans to build an integration platform for exchanging information that mitigates the information asymmetry problem of the participants in the emission trading market and provides trading volume and price information for the activation of the trading market. The ROK decided that it would resolve the emissions that are difficult to reduce by domestic reduction measures by using forest sinks and overseas reductions, and that the detailed plan for it would be established by reflecting the results of the follow-up negotiations of the Paris Agreement.

〈Table 3-3〉 Main Operational Directions for Phase II (2018-2020)

Descriptions	Contents
Allocation of allowances	• Leading to improve facility efficiency by expanding the benchmark method • Implementing allocation at cost (3% of the allowances allocated to the eligible business entities)
External reduction projects	• Activating domestic external emission projects • Promoting overseas reduction activities by recognizing overseas reduction results of domestic companies as domestic trades
Markets for trading allowances	• Implementing periodic auctions of allocation at a cost • Building an information integration platform for the emissions trading system
Industrial support	• Reinvesting revenues of allocation at a cost as eco-friendly investment funds

※ Source: The 2nd Master Plan for the Emissions Trading System, Ministry of Strategy and Finance, 2017

– GHG and Energy Target Management System

Since 2010, to achieve national greenhouse gas reduction targets in accordance with the Framework Act on Low Carbon, Green Growth, the ROK has implemented a GHG and energy target management system to set and manage GHG reduction targets and energy-saving targets by designating the business entities or business places that emit and consume a certain level of GHG and energy as controlled business entities. As the emissions trading

12 When an additional allocation is made for new or additional facilities and when GF method is applied, reduction results are reflected.

13 97% of emission permits to be allocated to the eligible business entities are free of charge and 3% of emission permits are allocated at a cost.

system was implemented in 2015, large business places with high GHG emissions already using it in their operational management. Accordingly, the target management system has become a system in which small and medium-sized companies prepare for the emissions trading system before they are eligible to participate in it.

The target management system manages and supports the target implementation of controlled business entities by setting targets of GHG emissions and energy consumption. The ROK adopts a direct regulatory system in which the government establishes GHG emission targets with controlled business entities and imposes improvement orders or fines when they fail to meet the targets. The operation is divided into a lead ministry, which directs the system and performs a coordination function, and responsible ministries by sector, which set and manage the targets of controlled business entities.

The responsible ministries set annual reduction targets of controlled business entities to achieve the national GHG reduction targets, considering the new and expanded plans and reduction potentials of controlled business entities, and continue to manage the targets of GHG reduction and energy-saving by assessing implementation plans and results. The process of promoting the target management system consists of several processes—controlled business entities submit statements of GHG emissions and energy usage (in March), establish targets for the next year in consultation with the government (in September), then, establish implementation plans (in December), fulfill the targets for one year (one year in the next year), and submit performance outputs to the government (in March of the year after next).

The controlled business entities of the target management system are divided into a company (corporation) unit and a business place unit, and the numbers subject to the application is expanding annually. For those subject to the GHG emission regulation, business entities whose annual average GHG emission and energy usage are 50,000 tons CO_2eq. or more and 200 terajoules (TJ) or more, respectively, or business places whose greenhouse gas emissions and energy usage are 15,000 tons CO_2eq. or more and 80TJ or more, respectively, are designated as controlled business entities. Under the notice of change in the criteria for controlled business entities as of 2017, there are 348 business places subject to the GHG and energy target management. In terms of responsible ministries, they are divided into 110 units for the Ministry of Land, Infrastructure and Transport, 197 units for the Ministry of Trade, Industry and Energy, 19 units for the Ministry of Agriculture, Food and Rural Affairs, 10 units for the Ministry of Oceans and Fisheries, 12 units for the Ministry of Environment, and 826 units for the public sector.

〈Table 3-4〉 Designation Criteria for Controlled Business Entities of the GHG and Energy Target Management System

Descriptions	By 2011		From 2012		From 2014	
	Business entity criteria	Business place criteria	Business entity criteria	Business place criteria	Business entity criteria	Business place criteria
Greenhouse gas ($tCO_2eq.$) Emissions	125,000	25,000	87,500	20,000	50,000	15,000
Energy (TJ) usage	500	100	350	90	200	80

※ Source: Guidelines for the Operation of the GHG and Energy Target Management System

2.2 Reduction Policies and Actions by Sector

– Transformation Sector

The ROK confirmed the Energy Transformation Roadmap in 2017 containing the plan to phase out nuclear power plants and increase the proportion of renewable energy power generation to 30-35% by 2040 and included specific implementation plans in the 8th Master Plan for Electricity Supply and Demand (2017) and the 3rd Energy Master Plan (2019).

The Master Plan for Electricity Supply and Demand is a 15-year, long-term plan (8th planning period: 2017-2031), which is established every two years to forecast the mid- to long-term demand for electricity and accordingly, expand the power facilities. Reflecting the targets and direction of the government's energy transformation roadmap, in particular, the 8th Master Plan for Electricity Supply and Demand presents the key direction to promote energy promotion, such as the phase out of nuclear and coal power plants and the expansion of renewable energy, a power mix centered on Environment and Safety, and a power supply and demand policy centered on demand management. Therefore, the Master Plan focuses on setting optimal target demands through demand management rather than promoting power plant construction first and is prioritizing eco-friendly and distributed renewable energy and LNG power generation, away from large-scale nuclear and coal power generation.

In the case of coal power, the ROK plans to reduce the share of power generation, such as closing old coal power plants and in principle, limiting the entry of new coal power into the power market, to cope with climate change and fine dust issues. While generators under construction or to be built (20 coal power plants reflected in the 4th to 6th Master Plans for Electricity Supply and Demand) will be built as scheduled, the power generation system with the highest efficiency level[14] (ultra-supercritical) will be introduced and built with the enhanced emission standards. In principle, the ROK plans to limit new coal power when establishing the Master Plan for Electricity Supply and Demand, cover the growing demand for electricity with low carbon and green power sources, and also reduce the power generation of coal-fired power generators in the mid- and long-term.

14 Power generation efficiency by system: 35-39% for sub-critical, 41% for super-critical, and 43% for ultra-supercritical

In addition, the ROK presented the target to expand the share of renewable energy power generation to 30–35% by 2040, establishing the 3rd Energy Master Plan in June 2019. According to the plan, the ROK will present a plan to distribute renewable energy facilities, a target for the share of renewable energy by year, etc., in the Master Plan for Electricity Supply and Demand and the Master Plan for New and Renewable Energy, while aiming to achieve the targets by establishing the Renewable Integrated Control Management System (RMS) and expanding flexible facilities to cope with renewable energy output volatility.

In the case of new and renewable energy, the ROK implemented the Renewable Portfolio Standard (RPS) in January 2012 and has increased the annual mandatory supply rate to promote the use of renewable energy sources by power producers. The annual mandatory supply rate of renewable energy has increased gradually from 2.0% in 2012 to 5.0% in 2018 and was adjusted to 10% beyond 2023.

Since having implemented the RPS system, the amount of renewable energy generation increased from 17,346 GWh in 2011 to 46,619 GWh in 2017, and the share of renewable energy generation in total power generation increased by about 4.61 percentage points and the annual average of about 0.77 percentage points over six years. In the early stages of the 2012 RPS implementation, the implementation performance was weak compared to the target mandatory rate but since 2015, it has been continuously improving, exceeding 90%. Meanwhile, to foster the domestic solar industry beginning in 2017, support stable performance of mandatory supplies, and to induce investment stabilization of photovoltaic (PV) power producers, the ROK complementarily operates the Fixed Price Contract in the Competitive Bidding System.

〈Table 3-5〉 Status of Annual Power Generated from Renewable Energy and Total Supply Capacity of Accumulated Power Facilities

Descriptions	2013	2014	2015	2016	2017
Renewable energy power generation (GWh)	21,438	26,882	37,079	40,656	46,623
Share of total power generation (%)	3.95	4.92	6.61	7.24	8.08
Cumulative new and renewable energy total supply capacity (MW)	9,937	11,960,	13,729	13,845	15,703

※ Source: New and Renewable Energy Statistics, Ministry of Trade, Industry and Energy/Korea Energy Agency, 2017

The ROK has carried out an integrated energy project since 1985. The integrated energy project improves energy use efficiency, leading to large energy savings and GHG reduction, provides the convenience in residential and industrial sectors by integrated energy supply, and contributes to the national power supply and demand diversification by securing distributed power. Furthermore, the project contributes to mitigating the power peak

load in the summer by expanding the distribution of regional air-conditioning and increases the utilization of unutilized energy, leading to improved national energy use efficiency and reduced oil dependence.

As of the end of 2017, 75 business entities supplied integrated energy at 106 business places. In the case of regional air-conditioning, the integrated energy was supplied to 2,896,000 multi-family housing units, which was equivalent to supplying regional air-conditioning to 16.9% of the[15] total 17,123,000 residential in the ROK. In the case of industry, integrated energy supplied process steam to 939 business entities. As a result, the energy supplies by integrated energy facilities reached 47,291,000 MWh as of 2017.

– Industrial Sector

To reduce the burden of declining industrial competitiveness due to GHG reduction and participate in the global low carbon economy, industrial sector policies in responding to climate change focuses on improving energy efficiency and demand management, which enable companies to improve their competitiveness as well as reduce GHG emissions.

Legal grounds for energy demand management includes the Framework Act on Low Carbon, Green Growth, the Energy Act, the Energy Use Rationalization Act, and other statutes. The Framework Act on Low Carbon, Green Growth is the grounds for GHG reduction and the Energy Act is the grounds for the policy establishment and implementation of local governments, which are important subjects of energy demand management policy. In addition, the Energy Use Rationalization Act provides grounds for efficiency standards, information disclosure, and incentive policies in the industry, transport and equipment sectors. Also, the Energy Use Rationalization Master Plan is a representative implementation plan related to energy demand management, which mainly builds the foundation of energy use rationalization and provides contents related to energy efficiency enhancement in the industrial, transport and equipment sectors.

Above all, energy use rationalization funds, which are prepared as part of the energy use rationalization to support energy demand management policy, are used to support a part of the capital invested by companies as long-term, low-interest loans when companies invest in energy-saving facilities to save energy and reduce GHG. The size of the energy use rationalization funds in 2015 was KRW 500 billion annually, which allocated KRW 225 billion for the investment project of enterprises specialized in energy-saving, KRW 50 billion for the investment project of target management business entities, and KRW 225 billion for the energy-saving facility installation projects.

15 Total national housing: Korean Statistical Information Service (KOSIS), 2017 Housing Census, Statistics Korea

In addition, supporting the establishment of an energy management system (EnMS) induces private companies to systematically implement energy-saving and demand management. The EnMS means the management activity scheme that energy users or energy suppliers set targets to improve energy use efficiency in and that systematically and continuously manages human/physical resources and management systems in accordance with certain procedures and methods. Therefore, the Korea Energy Agency supports infrastructure construction consulting, measurement infrastructure construction, monitoring system construction, etc., to encourage companies to build and use EnMS.

Meanwhile, the energy diagnosis system allows consumers to accurately grasp information about the potential for improving energy use efficiency across industries and buildings beyond providing energy efficiency information for individual equipment units. Those subject to the mandatory diagnosis total 627, including 496 industries and 131 buildings, by which the energy used is 14,257,000 TOE in 2018. As a result of the diagnosis, the total energy-saving potential was 552,000 TOE/year, and the GHG reduction potential was 1,588 million tons CO_2eq./year. Along with these, the investment required to implement the improvement plans is KRW 694.3 billion and the expected savings is KRW 296.7 billion, which can be expected to be 32.4 times the diagnostic cost if all the improvement plans are fulfilled.

– Buildings Sector

The ROK enacted the Green Building Establishment Support Act in 2013 to reach the GHG reduction target in the building sector and indirectly implement efforts to expand green buildings by the Building Act and the Act on the Improvement of Urban Areas and Residential Environments. In accordance with these, the Ministry of Land, Infrastructure and Transport established the 1st Master Plan on Green Building in 2014, which contains plans to revitalize green buildings and presented strategies on the promotion of energy efficiency improvement of new buildings, inducement of energy-saving of building energy users, green building technology development, and infrastructure construction.

The ROK has established various institutional devices to quantitatively evaluate the eco-friendly efficiency of buildings and induce the activation of green buildings. While the green building certification system evaluates the degree of energy-saving and environmental pollution reduction throughout the life cycle of buildings, the building energy efficiency rating certification system classifies energy efficiency with quantitative and objective information on the energy efficiency of buildings.

〈Table 3-6〉 Status of Green Building Certification by Year

2013	2014	2015	2016	2017
727 cases	1,034 cases	1,369 cases	1,639 cases	1,763 cases

※ Source: Korea Institute of Civil Engineering and Building Technology

The Ministry of Land, Infrastructure and Transport has been implementing the zero-energy building certification system (Zero Certification System) since January 2017. The Zero Certification System quantitatively evaluates the energy efficiency of buildings and classifies them into five classes according to the degree of zero-energy realization, which aims to reduce 5.5 million tons of CO_2eq. by 2030 in accordance with the GHG roadmap by expanding the buildings subject to the mandatory zero energy certification from public buildings of more than 10,000 ㎡ to the same size of private buildings in 2020.

The Ministry is also disseminating and expanding the building energy management system (BEMS) that monitors and controls the energy situation by connecting sensors and measurement equipment, analysis S/W, etc., by building energy sources to wired and wireless communication networks. Moreover, the Ministry revised the Regulations on Promotion of Energy Use Rationalization in Public Institutions in January 2017, making the installation of BEMS mandatory when constructing public buildings with floor areas exceeding 10,000 ㎡.

Green remodeling is a policy project to improve energy efficiency through insulation and window replacement and increase the value of existing old buildings by reducing GHG emissions. The Green Remodeling Creation Center was established to promote the project in July 2013. The public sector support project was also introduced in 2013 for the existing public buildings and provided about KRW 7 billion to 107 places by 2018. The private sector interest support project provides up to 3% interest for five years when borrowing for construction costs to improve the energy efficiency of old buildings.

〈Table 3-7〉 Major Results of Green Remodeling Projects

Descriptions		2014	2015	2016	2017	Total
Projects	No. of cases	352	2,753	7,742	8,551	19,398
	Amount (million KRW)	55,702	36,483	75,949	95,763	263,897

※ Source: Green Remodeling Creation Center Website

– Transportation Sector

The transportation sector sought to transform the existing transportation logistics system into an environment-friendly and energy-saving low carbon transportation logistics system in preparation for changes in circumstances of the transportation logistics system, such as climate change, energy crisis, and environmental protection, based on the Sustainable Transportation Logistics Development Act enacted in December 2009. Accordingly, the 1st Sustainable National Transportation Logistics Development Master Plan (2011) is a basic plan for GHG reduction in the transportation sector, which establishes mid- and long-term policy targets and strategies to systematically promote transportation and logistics policies and provides a comprehensive overview of the development of sustainable transportation logistics which was fragmented in several laws.

Greenhouse Gas Reduction Policies and Means in the Transport Sector are largely divided into roads, shipping, railway and aviation sectors and recently, fine dust reduction as well as greenhouse gas reduction are being considered.

In addition, the Passenger Cars Average Fuel Efficiency System manages the average fuel efficiency of passenger cars sold yearly by vehicle manufacturers in the ROK, which reduces GHG emissions through tire efficiency rating system and lightweight vehicle, etc., to improve fuel economy. The system establishes average fuel efficiency targets by 2020 so that the average fuel economy reaches the level of developed countries and plans to expand vehicles subject to the average fuel consumption regulation in the future. As of 2016, 1,788 models of vehicles registered for fuel efficiency have been registered and managed.

〈Table 3-8〉 Fuel Efficiency Standards by Year

Descriptions	2016	2017	2018	2019	2020
Fuel efficiency (km/l)	18.60	19.20	19.60	21.40	24.30
GHG (g/km)	127.00	123.00	120.00	110.00	97.00

※ Source: Vehicle Average Greenhouse Gas Emission and Fuel Efficiency Standards for the Next Period (2016-2020), Ministry of Environment, 2014

The road sector focuses on improving the fuel efficiency of internal combustion engine vehicles as well as the distribution of environment-friendly vehicles. In the case of the distribution of environment-friendly cars, the Master Plan for Development and Distribution of Environment-Friendly Vehicles is established on a five-year basis in accordance with the Act on Promotion of Development and Distribution of Environment-Friendly Motor Vehicles, and the expansion of environment-friendly vehicles is promoted by providing subsidies, developing and distributing high efficiency and low-cost hybrid vehicles (HYB), improving the performance of electric vehicles (EV)

and expanding charging facilities, diversifying charging forms, improving durability and stability of fuel cell electric vehicles (FCEV), and conducting demonstration projects.

〈Table 3-9〉 Eco-friendly Vehicles Distribution Plan

Descriptions		2017	2020	2022
Eco-friendly vehicles (accumulated)	Total	250,000 units	1,500,000 units	2,000,000 units
	EVs	12,000 units	250,000 units	350,000 units
	FCEVs	100 units	10,000 units	15,000 units
	HYBs	238,000 units	1,240,000 units	1,635,000 units
Charging infrastructure (accumulated)	Total	764 units	3,100 units	10,310 units
	Electricity (rapid)	750 units	3,000 units	10,000 units
	Hydrogen	14 places	100 places	310 places

※ Source: Comprehensive Set of Measures for Fine Dust Control, Jointly Report by relevant Ministries, 2017

Also, the Renewable Fuel Standard (RFS) mandates that the fuel for transportation (diesel) should be supplied being mixed with a certain ratio or more of renewable fuel (biodiesel). Accordingly, the mixed-use at a 0.5% rate began in 2007, which was mandated at 2% in 2010 and then, increased to 3% in 2018. Biodiesel is mainly made from recycled used cooking oil, of which 152,000 tons were recycled, saving KRW 259.2 billion in the treatment cost of pollutants as of 2016.

The shipping sector reduces GHG emissions by improving energy efficiency by introducing fuel-efficient linear technology, high-efficiency propellers, gas engines, and electric propulsion systems and supplying environment-friendly ships. For these purposes, the government has supported ocean-going vessels to be replaced with eco-friendly vessels since 2018 and plans to induce the transition of coastal vessels to eco-friendly vessels by interest subsidy and fund support for the modernization of coastal vessels. Since the International Maritime Organization (IMO) plans to regulate the SOx content of ship fuel oil from 3.5% to 0.5% by 2020 and environmental regulations for NOx also are enhanced, the government responds to the environmental regulations by expanding the use of AMPs and introducing LNG propulsion ships by establishing the Green Port Construction General Plan.

In the air transportation sector, the government has concluded the Agreement on Voluntary Greenhouse Gas Reduction in Aviation[16] with the national flag airlines and responded to climate change and GHG emission regulations since 2010. By the action, about 450,000 tons CO_2eq. have been reduced as of 2017. Based on these airlines' know-how, GHG emissions are reduced with 1.3% of fuel efficiency improvement rate every year by discovering additional reduction measures and improving air traffic control and airport operations.

16 Airlines for domestic air routes are subject to the national emissions trading system in accordance with the Act on the Allocation and Trading of Greenhouse Gas Emission Permits, and airlines for international air routes voluntarily participate in the Agreement.

In addition, the transportation sector also extends and expands BRT and operates transit centers and restricted public transportation districts to increase the share of public transportation and also, increases the share of railway transportation by expanding urban/metropolitan railway network and expanding national high-speed railway operations. Also, the combined inter-modal transportation system was strengthened by the modal shift project, which shifts road freight into rail and coastal shipping, and GHG emissions were reduced by 945,000 tons CO_2eq. were reduced as of 2018 by improving railway transportation operation efficiency and transportation capacity.

As part of the traffic demand management by policies to restrict passenger cars, such as walking and using bicycles, expanding telework, and activating economic driving, this sector develops and implements the Action Plan for the Vitalization of Non-Powered and Carbon-Free Means of Transportation to vitalize walking and bicycle use in 2011. In addition, the sector established a safe and convenient base for bicycle use, such as connecting walking measures and bicycles and connecting public transportation and bicycles. The sector also induces energy savings and GHG reduction by the operation of an eco-drive training program to improve drivers' economic driving practice rate and the expansion of educational systems.

– Waste Sector

The ROK's targets for waste policies have been developed from safe waste treatment to recycling waste and then to resource circulation. The Waste Control Act was enacted in 1986 to unify the waste management system, which had been divided by the Natural Environment Conservation Act and the Filth Cleaning Act. Also, the Act on the Promotion of Saving and Recycling of Resources was enacted in 1992, shifting from conventional waste control policies to reduction and recycling of waste, and as the Act was revised in 2008, the concept of resource circulation was introduced as the direction of waste control policy shifted from simple recycling-centered policy to occurrence suppression and recycling expansion.

In 2018, the Ministry of Environment established the 1st Resource Circulation Action Plan (2018-2027) as a blueprint for transforming the ROK's economic and social structure into a resource circulation scheme. The Action Plan is a national strategy for every 10 years (2018-2027) on the efficient use of resources, the suppression of waste generation and the promotion of circulation, which was established based on the Framework Act on Resource Circulation which was implemented from January 2018. The resource circulation policy is divided into three aspects: ① reduction and reuse, ② recycling, and ③ energy recovery.

Reduction and reuse policies include restrictions of disposable products, regulations against over-packaging, volume-based waste fee system,

business place waste reduction systems, and deposit return scheme. The Business place waste reduction system fundamentally suppresses waste generation from the product production stage as well as the product distribution and consumption stage, which introduced the Resources Circulation Performance Management System to establish a virtuous cycle of resources in 2018.

Also, recycling policies have introduced various advanced systems such as waste charges, mandatory separate discharge, extended producer responsibility (EPR), and environmental assessment for recycling waste, to promote the recycling of waste.

The energy recovery policy focuses on energy recovery of waste resources, such as using organic waste resources as energy and establishing solid refuse fuel (SRF) and environment-friendly energy towns. In other words, the policy essentially prioritizes the recycling of materials, taking into account the priority of waste treatment (reduction〉 reuse〉 recycling〉 energy recovery) and then, promotes energy recovery.

The Ministry of Environment established the 4th National General Environment Plan (2016-2035) in December 2015 and selected key indicators after setting the national mid- to long-term resource circulation targets by stage to restrict the generation of waste and promote circulation.

〈Table 3-10〉 Key Indicators of Low-carbon and Resource Circulation in the 4th National General Environmental Plan

Key Indicators	Unit	2015	2025	2035
GHG emissions	$tCO_2eq.$	688 million tons (as of 2012)	–	536 million tons (as of 2030)
Resource productivity	KRW/kg	1,382 (as of 2014)	2,000	3,500
Recycling rate (recycling capacity/domestic waste generation)	%	83.2 (as of 2013)	91.0	97.0
Landfill rate	%	9.6	2.5	1.0
Share of environmental industry (to GDP)	%	6.6 (as of 2013)	8	10

※Source: 4th National General Environment Plan, Ministry of Environment, 2015

– Public and Other Sectors

The ROK is implementing the public sector GHG and energy target management system for 826 institutions in the public sector (as of 2017) including central administrative agencies, local governments, public institutions, and national universities. The first period (2011-2015) aims to reduce 20% of baseline emissions by 2015, and the second period (2016-2020) aims to reduce them by 30% by 2020. The public sector reduction targets were

set in consideration of the 2020 national greenhouse gas reduction target, public sector reduction target and emission forecasts announced in 2009, which were higher than others in the public sector to set a good example.

The Ministry of Environment has been providing financial support (government subsidy of 50%) to the project since 2012, such as establishment of a greenhouse gas reduction monitoring system, to achieve the greenhouse gas reduction target of the public sector, and links its GHG reduction performance with an external valuation system to increase public sector reduction rates. The valuation is implemented, that is, public institutions are evaluated by the Ministry of Strategy and Finance, and local governments and local public enterprises by the Ministry of the Interior and Safety. As a result, the reduction rate was 18.3% in 2017, increased by 12.5% from the beginning (2011) of the system, and emissions were reduced by 12% compared with 2011.

〈Table 3-11〉 Operational Results of the Public Sector of the GHG and Energy Target Management System

Descriptions	2011	2012	2013	2014	2015	2016	2017
eline emissions (Thousand tons CO_2eq.)	5,024	4,888	4,541	4,890	4,761	4,990	4,985
Yearly emissions (Thousand tons CO_2eq.)	4,734	4,492	4,093	4,152	3,935	4,204	4,172
Yearly reduction rate (%)	5.8	8.1	9.9	15.1	17.5	16.0	18.3

※ Source: Presentation Material on 2017 Public Sector Greenhouse Gas and Energy Target Management Operational Performance Report Contest, Ministry of Environment, 2018

– Agricultural and Livestock Sector

The ROK has finalized and announced the Action Plan for Climate Change in Agriculture, Fishery, and Foods (2011-2020) to proactively respond to climate change in agriculture, fisheries, and foods sectors in November 2011. The detailed plan is implemented to disseminate low carbon farming and energy-saving facilities and expand renewable energy facilities to reduce GHG emissions in the agriculture sector. It also continues to expand livestock manure resources and energy facilities in the livestock sector and pursue measures to reduce GHG caused by the enteric fermentation of ruminants by supplying low-methane feed and high-quality coarse feed. Also, there are, as greenhouse gas reduction projects in the agricultural industry, the agriculture and rural voluntary greenhouse gas reduction project that directly reduces GHG emissions from agricultural production sites and the low carbon agricultural products certification system to reduce GHG in terms of distribution and consumption.

The agriculture and rural voluntary greenhouse gas reduction project, implemented since 2012, acts as a carbon offset system, which encourages farmers to reduce GHG emissions based on economic incentives. Currently,

the project provides incentives of KRW 10,000 per ton CO_2eq. for the reduced GHG emissions, and those subject to the project include agriculture and forest cooperatives, industry and academia institutes, and agricultural organizations including farms, cooperative units, and farming association corporations.

Representative GHG reduction low-carbon agricultural technologies are biogas plants and geothermal energy; 10,111 tons CO_2eq. and 4,959 tons CO_2eq. of GHG emissions were reduced by using biogas plants and geothermal energy, respectively, as of 2017.

The low carbon agricultural products certification system is a national certification system where low-carbon agricultural technologies are applied to the agricultural products that have received the Good Agricultural Practices (GAP) certification. As part of the Action Plan for Climate Change in Agriculture, Fishery, and Foods, a pilot project was launched in 2012 and in parallel, the awarding of the certification was implemented in 2014. Beginning with the certification of seven agricultural management bodies (60 farms) in 2012, 478 agricultural management bodies (2,763 farms) have been certified as of December 2017. The key points of the low carbon agricultural products certification system are to minimize the environmental load on climate change and build an efficient agricultural production system by quantitatively managing and verifying various farming materials put into production and by inducing the production to meet the certification criteria.

– Forest Sector

The ROK enacted the Forest Act in 1961, rapidly moved forward to reforestation in accordance with the national forest development plan in 1960's to 1970's and has been promoting forest projects by establishing the forest basic plan since 1973. Meanwhile, the national forest carbon removal is expected to be about 22 million tons CO_2eq. by 2030 under the domestic sustainable forest management policy.

〈Table 3-12〉 Status of Forest Carbon Removal

(Unit: Thousand tons CO_2eq.)

Descriptions	2017	2018	2019	2020	2025	2030
Removal	42,050	39,279	37,544	35,773	28,673	22,246

※ Source: The 2nd Forest Carbon Sink Enhancement Plan, Korea Forest Service, 2018

The sector enacted the Act on the Management and Improvement of Carbon Sink in 2013 and in the same year, notified the Social Contribution Forest Carbon Offset Management Standard to promote voluntary forest carbon sink. Thus, the social contribution forest carbon offset system has been implemented since 2013. The Korea Forest Service is making efforts to increase domestic forest carbon sinks by establishing the Forest Carbon Sink Enhancement Plan, Forest Basic Plan, etc. Moreover, to get the maximum

recognition of domestic forest carbon removal, the Korea Forest Service is conducting research and advancement of forest inventory to set the forest management baseline as zero in the international community and pilot projects for Reducing Emissions from Deforestation and Forest Degradation (REDD+) in developing countries such as Cambodia and Indonesia.

The forest carbon offset system specifies that the Korea Forest Service certifies removal to business entities that voluntarily perform forest carbon offset activities, which provide information on the types of projects for forest carbon offsets and assists business entities in carrying out administrative procedures to activate the forest carbon offset system. As of 2017, 157 projects were registered for the forest carbon offset system, and the annual estimated forest carbon removal accounted for 119,000 tons CO_2eq.

[Rain Gauge] Instrument used to measure rainfall in the Joseon Dynasty period

CHAPTER 4

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International Support and Awareness of Climate Change

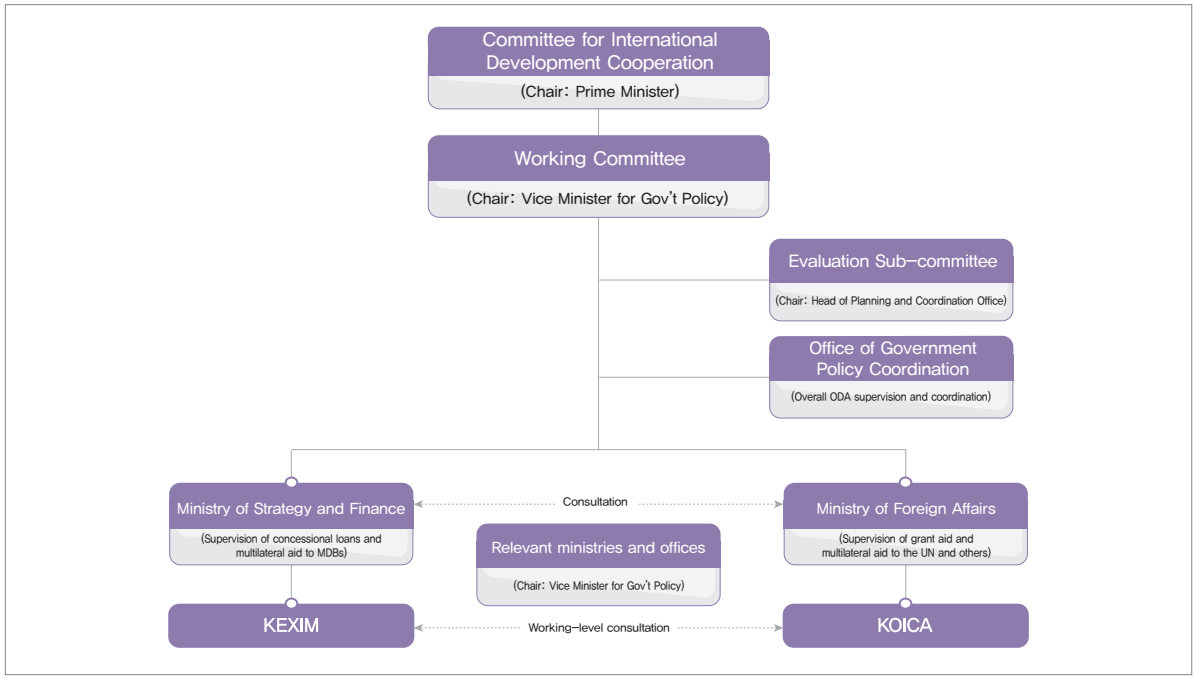
1. Financial Support

The ROK acknowledges the importance of cooperation among nations for climate change response and has been amplifying its assistance to developing countries to cope with climate change. The ROK will share the related information by this report and continues to participate in the cooperative efforts of the international community.

The ROK is providing concessional loans and grant aid, through the ODA (Official Development Assistance) and other means for developing countries and voluntarily carries out assistance projects such as technology development and transfer and capacity building. At the same time, the ROK is gaining expertise from the European Union via the EU-Korea Emissions Trading Scheme Project (2016-2018) and continues to enhance its capacity related to climate change mitigation.

The ODA of the ROK is supervised and coordinated by the Committee for International Development Cooperation chaired by the Prime Minister in accordance with the Framework Act on International Development Cooperation, and the head of OPC (Director-General for Development and Cooperation Policy) serves as the secretary of the committee. While concessional loans are supervised by the Ministry of Strategy and Finance and implemented by the Export-Import Bank of Korea (KEXIM), grant aids are supervised by the Ministry of Foreign Affairs, and implemented by the Korea International Cooperation Agency (KOICA). Other individual ministries and local governments are also engaged in grant aid projects based on their expertise.

[Figure 6-1] ROK's ODA Implementing Arrangements



While overcoming struggles of the global financial crisis and rising financial deficit, the ROK is making efforts to contribute as a member of the international community. Under the 1st International Development and Cooperation Master Plan (2011–2015), the amount of ODA grew by an annual average of around 12% from USD 1.17 billion to USD 1.85 billion, which is quite high compared to other donor countries. In addition, the 2nd International Development and Cooperation Master Plan (2016–2020) was established in 2015 and is currently being executed.

Meanwhile, an implementation plan incorporating both concessional loans and grant aid is established every year, based on which the ROK is assisting developing countries. The general direction for international development cooperation reflected in the ROK's 2018 Implementation Plan for International Development Cooperation established in June 2017 is as follows:

The ROK plans to distribute ODA resources and implement projects focused on strengthening assistance for recipient countries achieving the Sustainable Development Goals. In particular, with respect to climate change mitigation response, the ROK plans to assist in 45 projects in 2018. For climate change adaptation, the ROK plans to enhance the capabilities of developing countries by carrying out projects for improving water resource safety and sanitation, such as water and sewage treatment and drinking water facilities, comprehensive development and transfer of farming techniques for self-reliant rural communities, etc.

At the UN Climate Summit in September 2014, the ROK announced the contribution of USD 100 million to the Green Climate Fund (GCF) and is taking the initiative in mobilizing the initial funds for GCF after concluding the contribution agreement of USD 100 million equivalent in June 2015. Also, the ROK established the Global Green Growth Institute in 2012 and contributes USD 10 million annually as a contribution to international organization to support developing countries' transition to green growth and response to climate change. The financial support provided via multilateral institutions continued to increase from KRW 38,657 million in 2014 to KRW 103,675 million in 2017, which accounted for the average annual growth rate of 38.9%, and the financial support through bilateral, regional, and other channels continued to increase from KRW 72,978 million in 2014 to KRW 171,547 million in 2017, which accounted for the average annual growth rate of 32.9%.

For concessional loans, KEXIM develops climate change-related projects as a top priority financing solar power stations, small hydroelectric power stations, environment-friendly transportation, waste treatment, etc., and pays special attention to related projects by offering preferential treatment.

〈Table 4-1〉 Status of Financial Support (2014-2017)

Descriptions	Year	Financed Total Amount	
		million KRW	thousand USD
nancial support provided via multilateral institutions	2014	38,657	36,709
	2015	68,909	60,912
	2016	101,438	87,657
	2017	103,675	91,696
Financial support provided through bilateral, regional, and other channels	2014	72,978	69,301
	2015	339,564	300,153
	2016	68,533	59,050
	2017	171,547	151,730

※ Source: Export-Import Bank of Korea
※ Exchange Rates of Korean Won (KRW) per 1 USD (2014-2017):
KRW 1,053.064/USD (2014), KRW 1,131.309/USD (2015), KR 1,160.589/USD (2016), KRW 1,130.635/USD (2017)

2. Technology Development and Transfer

Ahead of the adoption of the Paris Agreement, the ROK designated and registered the Ministry of Science and ICT as a National Designated Entity (NDE) for technology development and transfer at the end of 2015. After this, the Ministry of Science and ICT established relevant policies and strategies and supported their implementation to promote international cooperation in climate technology in accordance with the UNFCCC.

The ROK has established a global climate technology cooperation model in terms of policy and strategy and supports the development and diffusion of domestic climate technologies. The ROK established the Global Technology Cooperation Promotion Strategy for Climate Change in September 2015 and decided to actively participate in the technical mechanisms[17] established and operated on the basis of the UNFCCC. Also, it established the Climate Technology Roadmap (CTR)[18] in 2016 and revised it in 2018. After this, the Ministry of Science and ICT established the Mid- to Long-term Plan for Climate Technology Cooperation (2018-2020) in 2018. The five key tasks pursued by the plan include ① support R&D based on innovation technology, ② systematization of global climate technology cooperation projects, ③ foundation for climate technology cooperation, ④ activation of the participation in technology mechanisms, and ⑤ governmental departments' cooperation.

Multilateral support has been provided to implement technical cooperation. First, the ROK launched a 2.5 billion won climate technology localization

17 A system that supports smoother development and transfer of climate technology between parties under the UNFCCC

18 CTR stands for Climate Technology Roadmap, which is a strategy for managing the R&D of the government's climate technologies to achieve Korea's Nationally Determined Contributions (NDC). It is composed of three technology groups (carbon reduction technology, carbon utilization technology, climate change adaptation technology), top ten climate technologies, and 50 detailed technology groups.

project to support developing countries' response to climate change based on excellent climate technology in 2017. The project carried out 13 support projects, such as identifying technology demand, feasibility study for promising technology cooperation projects, and technology demonstration in developing countries. In addition, the ROK has been organizing the Korea Climate Technology every year since 2017 to gather many stakeholders related to climate technology to promote R&D for climate change and Korea's climate industry. This supported networking where public officials in developing countries and relevant national organizations can communicate directly and lead to efforts to identify regional demand and to link with new technical support cooperation projects.

Second, the ROK supported various climate technology cooperation activities through the Climate Technology Center and Network (CTCN), an organization for implementing technological mechanisms. The CTCM made efforts to spread and raise awareness of international cooperation in climate technology. As a result, the number of CTCN members in the ROK has grown from 9 in 2015 to 51 as of October 2018, which is the largest number of CTCN member institutions in the world. Also, the CTCN operated the Korean CTCN member council for these member institutions since 2016, having seven meetings and disseminating information on international climate technology cooperation.

3. Capacity Building

To strengthen the capacity of developing countries to respond to the climate environment, KOICA has opened 15 training courses during 2014–2018, including the reinforcement of national development policy capacity in response to climate change, forest complex management to respond to climate change in Latin America, renewable energy and waste-to-energy to respond to climate change, sustainable water management in response to climate change, and special courses for the Pacific Islands. A total of 123 trainees participated in the courses.

The Greenhouse Gas Inventory & Research Center of Korea (GIR) has held a 3 to 4 weeks professional training programs every year to build the capacity for GHG management in developing countries. GIR invites government officials and researchers from non-Annex I countries to participate in intensive lectures and hands-on exercises on GHG inventory preparation and mitigation modeling analysis by sector.

29 trainees from 28 countries graduated from the 4th training program in 2014, followed by 34 trainees from 26 countries in 2015, 30 trainees from 23 countries in 2016, and 28 trainees from 28 countries in 2017. The number of

countries seeking to participate in the training program is steadily increasing, and the ROK is internationally recognized for its excellence in the training programs and signed a memorandum of understanding with the UNFCCC secretariat in March 2017 to jointly run the training program.

[Figure 4-2] UNFCCC-GIR-CASTT Programme on GHGs: Opening Ceremony (Left), Practice (Right)

GIR has also convened the Cooperative Green Growth Modeling Forum (C2GMF) on an annual or semi-annual basis since 2011 to assist developing countries in establishing GHG reduction targets and building capacity to evaluate the progress of mitigation actions through modeling analysis. By 2017, 12 forums had been held and 4 joint research projects (power, waste, buildings, residential, transportation, and forest sub-sectors) have been carried out.

Moreover, GIR launched the new Capacity Building Initiative for Nationally Determined Contributions (CBINDC) during the 2016 forum, in which nine Asian countries participated. After the launch, the establishment of GHG reduction targets, domestic implementation mitigation trends, National Communication preparation state, and areas that require mitigation potential analysis for each country were shared in the forum.

The Korea Forest Service carries out climate change-related projects to prevent the land-use change of forest land jointly with developing countries including Indonesia, Myanmar, and Cambodia. The Forest Service supports the Reducing Emissions from Deforestation and forest Degradation (REDD+) of developing countries by establishing and implementing deforestation measures and field project plans that graft its successful reforestation experience, identifying the cause of land-use change of forest land and deforestation. Also, the Korea Forest Service provides REDD+ capacity building programs to government officials from developing countries, such as national forest monitoring systems and GHG reduction strategies. From 2012 to 2016, 129 people from 11 countries were invited to conduct capacity building training.

Appendix

1. GHG Inventory Details[1]

〈Table 1–1〉 GHG Emissions Trends – Summary

Greenhouse Gas Emissions[2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003
	kt CO_2eq.[3]	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.
CO_2 emissions including net CO_2 from LULUCF	213,592.77	240,804.45	265,494.97	302,776.87	322,756.59	353,608.39	382,639.40	403,690.01	328,727.55	353,143.34	382,073.29	397,971.08	419,032.31	428,076.73
CO_2 emissions excluding net CO_2 from LULUCF	252,328.68	275,230.28	299,001.70	334,403.66	356,378.12	385,188.31	417,749.87	443,604.94	377,357.38	409,614.21	441,633.45	456,996.88	475,805.24	484,163.27
CH_4 emissions including CH_4 from LULUCF	30,511.05	30,400.26	29,801.77	29,229.07	29,218.43	28,834.03	29,173.71	29,391.94	28,142.90	27,799.64	27,779.31	28,084.07	28,230.04	28,203.42
CH_4 emissions excluding CH_4 from LULUCF	30,301.26	30,205.11	29,596.87	29,031.46	29,016.19	28,631.57	28,969.09	29,167.72	27,909.81	27,572.78	27,539.00	27,836.41	27,971.28	27,943.99
N_2O emissions including N_2O from LULUCF	9,431.90	9,908.21	12,484.03	12,962.22	13,750.45	14,803.19	15,828.59	16,819.65	17,088.79	17,611.86	18,413.17	18,584.19	18,421.19	21,819.14
emissions excluding N_2O from LULUCF	9,152.87	9,668.41	12,298.00	12,822.37	13,676.13	14,728.10	15,770.33	16,761.90	17,022.63	17,543.34	18,344.78	18,522.52	18,353.01	21,757.14
HFCs	982.80	798.88	1,877.22	2,117.21	3,837.90	5,084.87	5,779.02	7,160.07	4,911.10	8,061.49	8,443.31	5,851.64	8,652.61	6,442.92
PFCs	NA[5], NE[6], NO[7]	NA, NE, NO	0.28	1.62	NA, NE, NO	63.21	587.40	1,682.59	1,649.15	1,890.01	2,249.73	1,989.49	1,973.16	2,266.90
SF_6	173.58	332.61	373.15	385.85	923.62	3,599.31	2,263.70	2,443.48	1,375.85	3,604.76	3,219.79	3,439.56	3,254.83	3,753.55
Total (including LULUCF)	254,692.10	282,244.42	310,031.42	347,472.84	370,486.99	405,992.99	436,271.81	461,187.75	381,895.35	412,111.10	442,178.60	455,920.04	479,564.15	490,562.67
Total (excluding LULUCF	292,939.20	316,235.29	343,147.23	378,762.17	403,831.96	437,295.37	471,119.41	500,820.70	430,225.93	468,286.60	501,430.06	514,636.51	536,010.13	546,327.79

Greenhouse Gas Emissions[2]	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to last reported year
	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	(%)
CO_2 emissions including net CO_2 from LULUCF	432,869.14	439,306.38	444,771.86	465,804.37	478,552.42	483,986.86	539,953.25	569,721.49	577,772.71	591,342.24	586,730.26	591,283.56	592,814.21	177.5
CO_2 emissions excluding net CO_2 from LULUCF	490,197.53	494,464.19	501,107.19	522,787.60	536,424.71	541,396.87	594,697.20	624,256.53	627,219.62	636,397.55	629,715.21	634,487.22	637,599.56	152.7
CH_4 emissions including CH_4 from LULUCF	27,268.26	27,183.33	27,138.63	26,801.37	26,758.22	26,748.60	27,161.66	26,856.27	26,806.22	26,772.78	26,310.83	26,302.38	26,288.84	–13.8
CH_4 emissions excluding CH_4 from LULUCF	27,013.79	26,942.85	26,881.48	26,538.67	26,482.45	26,482.09	26,902.96	26,581.73	26,546.56	26,507.15	26,032.65	25,988.67	25,993.47	–14.2
N_2O emissions including N_2O from LULUCF	24,342.40	22,919.91	22,216.24	13,140.06	12,577.10	13,005.38	13,683.24	13,432.00	13,996.57	14,198.91	13,913.41	14,344.43	14,867.49	57.6
emissions excluding N_2O from LULUCF	24,283.89	22,862.80	22,163.82	13,079.87	12,514.93	12,941.54	13,618.26	13,371.45	13,942.76	14,151.45	13,877.97	14,319.48	14,829.72	62.0
HFCs	6,590.97	6,651.18	6,097.96	7,362.99	6,881.07	5,846.15	8,087.59	7,907.00	8,694.42	8,094.74	8,537.55	7,931.23	7,365.92	649.5
PFCs	2,774.07	2,796.76	2,925.12	2,978.31	2,792.80	2,047.14	2,264.59	2,071.79	2,267.88	2,320.56	2,426.90	1,521.49	1,489.26	539,487
SF_6	4,310.53	5,428.23	5,280.79	6,779.12	7,612.64	8,849.74	11,856.90	8,756.46	8,455.25	9,277.43	10,354.07	8,676.04	6,787.92	3810.5
Total (including LULUCF)	498,155.38	504,285.78	508,430.60	522,866.21	535,174.26	540,483.87	603,007.23	628,745.01	637,993.05	652,006.66	648,273.03	650,059.13	649,613.65	155.1
Total (excluding LULUCF	555,170.78	559,146.02	564,456.37	579,526.57	592,708.60	597,563.54	657,427.50	682,944.95	687,126.48	696,748.88	690,944.35	692,924.13	694,065.86	136.9

Greenhouse Gas Emissions[2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003
	kt CO_2eq.[3]	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.
1. Energy	241,498.30	259,480.04	279,348.88	309,458.67	328,560.24	354,367.99	386,192.58	410,554.60	350,651.48	381,472.18	410,835.04	424,892.85	443,614.36	451,238.79
2. Industrial Processes	19,773.06	23,547.97	29,088.30	33,375.25	37,986.36	44,050.57	44,683.97	49,318.42	40,173.03	47,791.60	50,217.31	49,014.47	52,869.98	55,745.77
3. Solvent and Other Product Use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4. Agriculture	21,262.31	21,551.99	21,971.76	22,442.29	22,883.82	23,151.12	23,668.83	23,661.47	23,354.38	22,168.71	21,555.54	21,017.46	20,860.51	20,580.82
5. LULUCF[4]	−38,247.10	−33,990.87	−33,115.82	−31,289.33	−33,344.97	−31,302.37	−34,847.60	−39,632.95	−48,330.58	−56,175.50	−59,251.46	−58,716.47	−56,445.98	−55,765.11
6. Waste	10,405.53	11,655.29	12,738.30	13,485.96	14,401.54	15,725.69	16,574.03	17,286.20	16,047.04	16,854.10	18,822.17	19,711.74	18,665.29	18,762.41
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	254,692.10	282,244.42	310,031.42	347,472.84	370,486.99	405,992.99	436,271.81	461,187.75	381,895.35	412,111.10	442,178.60	455,920.04	479,564.15	490,562.67

Greenhouse Gas Emissions[2]	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to last reported year
	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	kt CO_2eq.	(%)
1. Energy	458,901.30	466,879.88	473,190.23	492,115.70	505,633.78	512,882.68	565,843.86	594,230.45	596,918.72	606,222.22	598,816.43	602,398.76	604,843.37	150.5
2. Industrial Processes	57,938.71	54,729.84	53,309.61	50,590.96	50,399.40	47,552.70	54,365.62	52,086.56	52,980.47	53,299.73	56,000.36	53,252.89	51,456.09	160.2
3. Solvent and Other Product Use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4. Agriculture	20,663.88	20,839.33	20,946.51	21,171.89	21,228.59	21,744.02	22,178.95	21,156.77	21,495.23	21,351.99	20,754.41	20,918.91	21,245.40	−0.1
5. LULUCF[4]	−57,015.41	−54,860.24	−56,025.77	−56,660.35	−57,534.34	−57,079.67	−54,420.28	−54,199.94	−49,133.44	−44,742.22	−42,671.32	−42,865.00	−44,452.21	16.2
6. Waste	17,666.89	16,696.96	17,010.01	15,648.02	15,446.83	15,384.14	15,039.07	15,471.17	15,732.07	15,874.94	15,373.16	16,353.57	16,521.01	58.8
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	498,155.38	504,285.78	508,430.60	522,866.21	535,174.26	540,483.87	603,007.23	628,745.01	637,993.05	652,006.66	648,273.03	650,059.13	649,613.65	155.1

1) Detail information is listed as "Emission trends (CO_2)," "Emission trends (CH_4)," "Emission trends (N_2O)," and "Emission trends (HFCs, PFCs and SF_6)" according to the common reporting format;
2) 2016 is the most recent year for which inventory data is available
3) 1 kt CO_2eq. is equal to 1 Gg CO_2eq.
4) Includes net CO_2, CH_4 and N_2O from LULUCF
5) NA : Not Applicable
6) NE : Not Estimated
7) NO : Not Occurring

〈Table 1-1〉 GHG Emissions Trends – CO_2

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999[1]	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change in 2016 to 1990
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	(%)
1. Energy	232,686.74	251,598.44	272,605.34	303,540.64	323,263.17	349,450.00	381,206.27	405,402.68	345,948.09	376,405.90	405,391.78	419,282.16	437,797.01	445,257.60	452,574.11	460,378.16	466,486.77	485,042.24	498,406.75	505,796.94	557,867.15	585,782.50	588,080.37	597,036.43	589,881.65	593,605.10	595,830.85	156.1
A. Fuel combustion	232,686.74	251,598.44	272,605.34	303,540.64	323,263.17	349,450.00	381,206.27	405,402.68	345,948.09	376,405.90	405,391.78	419,282.16	437,797.01	445,257.60	452,574.11	460,378.16	466,486.77	485,042.24	498,406.75	505,796.94	557,867.15	585,782.50	588,080.37	597,036.43	589,881.65	593,605.10	595,830.85	156.1
1. Energy industries	47,611.98	54,031.22	61,469.59	68,500.91	82,294.43	91,304.40	107,202.41	120,710.19	104,710.02	114,360.65	134,397.09	145,475.81	153,878.80	157,941.35	171,359.03	176,517.10	185,560.69	196,958.33	210,168.12	229,113.69	254,412.01	262,148.51	266,151.08	272,536.57	257,797.39	260,023.51	261,306.19	448.8
2. Manufacturing industries and construction	76,131.86	88,257.22	97,369.10	107,481.34	112,455.69	116,134.87	123,746.80	127,499.35	118,612.01	124,237.14	128,895.16	129,279.06	134,814.23	137,040.37	134,430.02	133,796.62	135,177.22	141,587.53	146,205.73	136,208.46	160,414.96	181,580.60	178,789.78	180,871.17	192,833.39	187,522.03	182,385.00	139.6
3. Transportation	35,256.78	38,336.35	43,663.21	55,191.66	57,175.98	64,289.26	68,330.20	73,687.06	57,118.55	62,092.53	69,374.99	72,495.41	77,439.41	80,223.89	80,372.05	81,175.81	81,977.38	84,346.48	82,173.22	83,022.39	84,727.48	84,405.52	85,773.24	87,689.94	88,011.63	93,464.65	97,972.42	177.9
4. Other sectors	73,505.62	66,344.37	67,178.62	69,236.15	68,514.90	74,925.21	78,875.38	80,601.46	62,869.12	73,006.63	70,336.54	68,940.47	68,850.71	66,758.37	63,289.92	65,687.06	60,945.02	59,267.71	57,280.45	54,599.96	55,389.85	54,791.54	54,462.12	52,980.99	48,400.35	49,519.95	51,117.10	-30.5
5. Other	180.49	4,623.29	2,924.83	3,130.59	2,822.18	2,796.26	3,051.47	2,904.62	2,638.38	2,708.95	2,387.99	3,091.41	2,813.86	3,293.62	3,123.08	3,201.56	2,826.46	2,882.20	2,579.23	2,852.45	2,922.86	2,856.33	2,904.14	2,957.78	2,838.89	3,074.97	3,050.14	1589.9
B. Fugitive emission from fuels	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	
1. Solid fuels	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	
2. Oil and natural gas	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	
2. Industrial processes	18,248.57	21,759.70	24,073.85	28,033.42	30,124.03	31,666.21	31,929.22	33,088.08	26,626.76	27,629.45	28,796.55	29,848.05	31,280.93	32,126.97	30,857.35	28,274.32	28,166.93	32,008.69	32,345.27	30,084.77	31,435.57	32,520.83	32,588.18	32,677.13	33,790.04	34,318.36	34,908.70	91.3
A. Mineral industry	18,151.19	21,679.62	23,986.64	27,923.32	29,999.48	31,524.13	31,778.38	32,916.85	26,486.20	27,454.99	28,617.13	29,673.57	31,097.09	31,939.48	30,656.48	28,069.08	28,021.74	31,826.68	32,124.44	29,927.97	31,256.08	32,340.53	32,405.01	32,497.70	33,617.31	34,179.01	34,756.33	91.5
B. Chemical industry	1.95	2.18	2.37	2.57	3.63	4.28	5.12	4.60	3.43	32.90	31.71	30.86	30.45	30.33	31.50	11.07	2.13	1.83	1.84	1.53	1.73	1.83	1.81	1.77	1.72	1.58	1.56	-20.0
C. Metal industry	95.43	77.90	84.84	107.53	120.91	137.80	145.72	166.63	137.13	141.56	147.70	143.61	153.39	157.16	169.36	194.18	143.05	180.18	218.99	155.27	177.77	178.47	181.37	177.65	171.01	137.78	150.81	58.0
D. Other industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
E. Production of Halocarbons and SF_6																												
F. Consumption of Halocarbons and SF_6																												
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3. Solvent and Other Product Use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
4. Agriculture																												
A. Enteric fermentation																												
B. Manure management																												
C. Rice cultivation																												
D. Agricultural soils																												
E. Prescribed burning of savannas																												
F. Field burning of agricultural residues																												
G. Other																												

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change in 2016 to 1990
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	(%)
5. Land Use, Land-Use Change and forestry[1]	-38,735.91	-34,425.82	-33,506.73	-31,626.79	-33,621.52	-31,579.92	-35,110.48	-39,914.93	-48,629.83	-56,470.87	-59,560.16	-59,025.80	-56,772.93	-56,086.54	-57,328.39	-55,157.82	-56,335.33	-56,983.23	-57,872.29	-57,410.02	-54,743.96	-54,535.04	-49,446.91	-45,055.31	-42,984.95	-43,203.66	-44,785.35	15.6
A. Forest land	-38,687.21	-34,603.37	-34,035.16	-32,439.29	-34,810.25	-33,484.00	-37,523.56	-42,536.86	-51,347.36	-59,161.29	-62,229.80	-61,800.16	-59,693.90	-59,110.52	-60,410.61	-58,402.29	-60,000.81	-61,021.89	-62,222.04	-61,988.73	-59,414.38	-59,352.59	-53,685.73	-49,259.78	-47,250.00	-47,008.44	-48,506.97	25.4
B. Cropland	400.40	665.83	994.20	1,272.98	1,647.71	2,363.19	2,889.19	3,107.71	3,204.45	3,180.64	3,164.86	3,249.51	3,359.02	3,453.81	3,486.58	3,605.21	3,900.79	4,205.63	4,473.33	4,686.47	4,768.73	4,876.38	4,313.55	4,267.94	4,313.52	3,819.95	3,711.02	826.8
C. Grassland	-535.71	-567.90	-548.87	-543.35	-542.16	-555.91	-568.28	-580.01	-581.84	-581.23	-587.40	-568.68	-532.49	-519.41	-484.80	-415.29	-282.50	-217.12	-184.08	-169.20	-155.57	-117.70	-127.35	-116.37	-102.94	-77.76	-54.58	-89.8
D. Wetlands	86.62	79.62	83.10	82.88	83.17	96.80	92.18	94.22	94.91	91.01	92.18	93.53	94.44	89.58	80.44	54.55	47.19	50.15	60.50	61.45	57.26	58.87	52.62	52.90	54.48	62.59	65.17	-24.8
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
6. Waste	1,393.37	1,872.14	2,322.51	2,829.60	2,990.92	4,072.10	4,614.38	5,114.18	4,782.53	5,578.86	7,445.13	7,866.68	6,727.30	6,778.70	6,766.07	5,811.71	6,453.49	5,736.67	5,672.69	5,515.16	5,394.48	5,953.20	6,551.07	6,683.99	6,043.52	6,563.75	6,860.01	392.3
A. Waste landfill	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	
B. Sewage and wastewater treatment																												
C. Waste incineration	1,393.37	1,872.14	2,322.51	2,829.60	2,990.92	4,072.10	4,614.38	5,114.18	4,782.53	5,578.86	7,445.13	7,866.68	6,727.30	6,778.70	6,766.07	5,811.71	6,453.49	5,736.67	5,672.69	5,515.16	5,394.48	5,953.20	6,551.07	6,683.99	6,043.52	6,563.75	6,860.01	392.3
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total CO_2 emissions including net CO_2 from LULUCF	213,592.77	240,804.45	265,494.97	302,776.87	322,756.59	353,608.39	382,639.40	403,690.01	328,727.55	353,143.34	382,073.29	397,971.08	419,032.31	428,076.73	432,869.14	439,306.38	444,771.86	465,804.37	478,552.42	483,986.86	539,953.25	569,721.49	577,772.71	591,342.24	586,730.26	591,283.56	592,814.21	177.5
Total CO_2 emissions excluding net CO_2 from LULUCF	252,328.68	275,230.28	299,001.70	334,403.66	356,378.12	385,188.31	417,749.87	443,604.94	377,357.38	409,614.21	441,633.45	456,996.88	475,805.24	484,163.27	490,197.53	494,464.19	501,107.19	522,787.60	536,424.71	541,396.87	594,697.20	624,256.53	627,219.62	636,397.55	629,715.21	634,487.22	637,599.56	152.7
Memo items:																												
International bunkers	13,859.73	16,680.92	20,706.17	21,933.96	25,284.11	29,134.19	34,721.80	38,107.65	37,689.70	40,790.37	38,667.09	37,787.90	37,868.08	40,495.71	42,270.72	42,721.11	40,806.40	41,383.94	38,926.62	35,735.67	38,238.39	37,962.87	37,164.47	37,228.62	37,771.22	40,815.45	45,842.15	230.8
International aviation	6,186.01	4,220.22	5,048.96	5,575.01	6,260.69	7,081.66	7,739.19	8,428.55	6,974.97	7,216.94	7,617.70	7,982.79	9,016.73	9,476.44	10,099.19	10,510.30	8,522.62	12,006.59	10,954.16	10,433.84	11,615.98	11,715.28	11,804.66	12,464.00	12,494.12	12,849.44	14,354.34	132.0
International marine	7,673.72	12,460.70	15,657.21	16,358.96	19,023.42	22,052.53	26,982.61	29,679.09	30,714.73	33,573.43	31,049.39	29,805.11	28,851.35	31,019.28	32,171.53	32,210.81	32,283.78	29,377.36	27,972.46	25,301.83	26,622.41	26,247.59	25,359.81	24,764.61	25,277.10	27,966.01	31,487.81	310.3
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO_2 emissions from biomass	2,999.40	2,281.75	2,672.44	2,737.52	3,343.92	3,733.31	3,903.51	4,439.23	5,122.35	6,190.18	7,813.52	9,217.32	10,972.99	11,931.04	14,919.46	14,806.78	16,012.32	17,359.18	18,707.44	19,092.14	20,856.76	22,899.61	28,515.17	31,653.16	39,581.03	45,515.08	47,147.77	1,471.9

〈Table 1-1〉 GHG Emissions Trends – CH_4

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change in 2016 to 1990
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	(%)
1. Energy	375.89	328.44	269.36	224.96	190.56	167.76	164.47	166.62	155.77	167.57	177.46	181.11	185.96	191.33	203.84	210.55	217.20	229.29	233.11	222.84	252.07	267.64	283.18	295.55	280.94	270.25	279.85	-25.6
A. Fuel combustion	132.45	111.35	88.89	74.02	59.88	54.07	50.36	48.68	43.80	46.82	50.34	52.37	56.76	58.71	58.11	62.46	63.79	65.53	67.15	66.48	70.63	73.74	74.56	81.53	85.06	89.59	92.51	-30.2
1. Energy industries	0.46	0.49	0.51	0.54	0.59	0.63	0.70	0.81	0.78	0.82	0.87	0.91	0.93	0.97	1.08	1.11	1.31	1.40	1.54	1.59	1.70	1.73	1.76	1.92	2.23	2.35	2.55	454.3
2. Manufacturing industries and construction	5.90	6.91	8.35	9.48	9.94	10.46	11.37	12.14	12.19	12.85	14.09	14.83	15.55	16.11	16.97	16.94	17.40	18.67	19.58	18.68	21.88	24.37	25.50	25.86	28.78	29.58	28.85	389.0
3. Transportation	6.82	7.50	8.63	10.22	11.39	12.74	13.90	14.78	13.03	14.75	17.03	18.32	19.47	19.99	20.32	20.92	21.62	22.83	23.05	23.96	24.51	24.06	23.88	23.95	23.33	23.78	23.80	249.0
4. Other sectors	119.24	95.81	70.99	53.36	37.57	29.86	23.96	20.54	17.45	18.03	18.03	17.88	20.42	21.18	19.31	23.05	23.06	22.22	22.62	21.84	22.14	23.18	23.02	29.39	30.33	33.46	36.89	-69.1
5. Other	0.02	0.64	0.40	0.43	0.39	0.39	0.42	0.40	0.36	0.38	0.33	0.43	0.39	0.46	0.44	0.45	0.39	0.40	0.36	0.39	0.40	0.40	0.40	0.41	0.39	0.42	0.42	2000.0
B. Fugitive emission from fuels	243.44	217.08	180.48	150.94	130.68	113.69	114.11	117.94	111.97	120.75	127.12	128.74	129.20	132.63	145.73	148.08	153.41	163.76	165.96	156.36	181.44	193.90	208.62	214.02	195.88	180.65	187.34	-23.0
1. Solid fuels	230.13	201.27	160.00	126.22	99.42	76.46	66.18	60.34	58.29	56.10	55.47	51.02	44.35	44.10	42.65	37.85	37.75	38.58	37.07	33.67	27.86	27.86	27.99	24.26	23.36	23.58	23.07	-90.0
2. Oil and natural gas	13.31	15.81	20.48	24.72	31.26	37.23	47.93	57.60	53.68	64.65	71.65	77.72	84.85	88.53	103.08	110.23	115.66	125.19	128.90	122.69	153.58	166.05	180.63	189.76	172.51	157.07	164.27	1134.2
2. Industrial processes	5.31	7.40	10.51	11.72	12.53	12.87	14.59	17.82	18.60	19.77	20.66	19.80	21.54	21.42	21.98	22.42	23.34	24.48	23.73	23.95	24.54	24.62	25.83	25.57	26.83	26.15	27.45	416.9
A. Mineral industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
B. Chemical industry	5.31	7.40	10.51	11.72	12.53	12.87	14.59	17.82	18.60	19.77	20.66	19.80	21.54	21.42	21.98	22.42	23.34	24.48	23.73	23.95	24.54	24.62	25.83	25.57	26.83	26.15	27.45	416.9
C. Metal industry	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	
D. Other industry																												
E. Production of Halocarbons and SF_6																												
F. Consumption of Halocarbons and SF_6																												
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO								
3. Solvent and Other Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4. Agriculture	680.11	681.75	680.29	685.22	682.62	677.46	681.58	676.70	670.01	642.45	628.20	617.65	614.13	605.88	599.95	594.97	595.43	598.22	600.14	606.33	613.43	589.44	588.95	576.09	561.53	551.88	547.62	-19.5
A. Enteric fermentation	140.96	148.80	160.08	178.02	188.95	196.01	210.74	212.38	204.39	176.85	160.80	149.43	147.73	147.13	152.87	157.38	165.00	172.92	181.82	190.24	202.97	201.03	209.05	207.77	199.66	193.76	192.74	36.7
B. Manure management	38.28	40.24	42.24	44.71	46.33	48.04	49.58	50.44	52.42	52.17	54.22	55.61	56.99	57.01	55.78	56.45	57.17	58.08	56.76	58.71	60.86	53.14	59.24	61.06	60.81	62.25	62.53	63.3
C. Rice cultivation	499.73	491.70	477.04	461.63	446.51	432.53	420.29	412.85	412.21	412.44	412.18	411.55	408.39	400.79	390.39	380.21	372.31	366.29	360.65	356.49	348.75	334.50	319.93	306.53	300.32	295.14	291.66	-41.6
D. Agricultural soils																												
E. Prescribed burning of savannas																												
F. Field burning of agricultural residues	1.14	1.01	0.94	0.86	0.84	0.88	0.97	1.03	0.99	0.99	1.00	1.06	1.03	0.95	0.91	0.93	0.95	0.93	0.90	0.90	0.84	0.77	0.73	0.73	0.74	0.73	0.70	-38.6
G. Other																												

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change in 2016 to 1990
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	(%)
5. Land Use, Land-Use Change and forestry	9.99	9.29	9.76	9.41	9.63	9.64	9.74	10.68	11.10	10.80	11.44	11.79	12.32	12.35	12.12	11.45	12.25	12.51	13.13	12.69	12.32	13.07	12.36	12.65	13.25	14.94	14.07	40.8
A. Forest land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
B. Cropland	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
D. Wetlands	9.99	9.29	9.76	9.41	9.63	9.64	9.74	10.68	11.10	10.80	11.44	11.79	12.32	12.35	12.12	11.45	12.25	12.51	13.13	12.69	12.32	13.07	12.36	12.65	13.25	14.94	14.07	40.8
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
G. Other	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
6. Waste	381.61	420.76	449.20	460.55	496.01	505.31	518.84	527.80	484.65	483.20	485.06	506.98	510.33	512.03	460.60	455.06	444.10	411.76	404.09	407.93	391.05	384.10	366.16	365.05	370.35	389.28	382.87	0.3
A. Waste landfill	356.75	390.64	416.45	436.18	454.88	466.47	480.92	496.94	454.65	453.34	454.43	475.49	475.34	479.59	429.21	422.67	410.20	379.63	374.14	377.79	369.27	362.37	345.25	342.11	349.30	367.97	361.82	1.4
B. Sewage and wastewater treatment	24.85	30.12	32.76	24.37	40.77	38.80	37.79	30.47	29.62	28.49	27.95	28.84	31.01	28.46	27.25	26.38	26.65	24.42	22.01	21.66	20.75	20.21	19.78	19.16	18.33	17.72	17.76	−28.5
C. Waste incineration	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
D. Other	0.00	0.00	0.00	0.00	0.36	0.04	0.13	0.40	0.38	1.37	2.69	2.65	3.98	3.99	4.14	6.01	7.25	7.71	7.94	8.48	1.03	1.52	1.13	3.77	2.72	3.58	3.28	811.1
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total CH_4 emissions including CH_4 from LULUCF	1,452.91	1,447.63	1,419.13	1,391.86	1,391.35	1,373.05	1,389.22	1,399.62	1,340.14	1,323.79	1,322.82	1,337.34	1,344.29	1,343.02	1,298.49	1,294.44	1,292.32	1,276.26	1,274.20	1,273.74	1,293.41	1,278.87	1,276.49	1,274.89	1,252.90	1,252.49	1,251.85	−13.8
Total CH_4 emissions excluding CH_4 from LULUCF	1,442.92	1,438.34	1,409.37	1,382.45	1,381.72	1,363.41	1,379.48	1,388.94	1,329.04	1,312.99	1,311.38	1,325.54	1,331.97	1,330.67	1,286.37	1,282.99	1,280.07	1,263.75	1,261.07	1,261.05	1,281.09	1,265.80	1,264.12	1,262.25	1,239.65	1,237.56	1,237.78	−14.2
International bunkers	0.55	0.85	1.06	1.11	1.29	1.50	1.83	2.01	2.07	2.26	2.09	2.01	1.96	2.10	2.18	2.19	2.18	2.04	1.94	1.75	1.85	1.83	1.78	1.74	1.78	1.96	2.21	301.8
International aviation	0.04	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.06	0.08	0.08	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.10	150.0
International marine	0.51	0.82	1.03	1.07	1.25	1.45	1.78	1.95	2.02	2.21	2.04	1.96	1.89	2.04	2.11	2.11	2.12	1.95	1.86	1.68	1.77	1.74	1.70	1.66	1.69	1.87	2.11	313.7
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO_2 emissions from biomass																												

CHAPTER 1 National Circumstances
CHAPTER 2 National Greenhouse Gas Inventory
CHAPTER 3 Mitigation Policies and Actions
CHAPTER 4 International Support and Awareness of Climate Change
Appendix

〈Table 1-1〉 GHG Emissions Trends – N_2O

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change in 2016 to 1990
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	(%)
1. Energy	2.96	3.18	3.51	3.85	4.18	4.50	4.94	5.33	4.62	4.99	5.54	5.83	6.17	6.33	6.60	6.71	6.91	7.29	7.52	7.76	8.66	9.12	9.33	9.61	9.79	10.06	10.12	241.9
A. Fuel combustion	2.96	3.18	3.51	3.85	4.18	4.50	4.94	5.33	4.62	4.99	5.54	5.83	6.17	6.33	6.60	6.71	6.91	7.29	7.52	7.76	8.66	9.12	9.33	9.61	9.79	10.06	10.12	241.9
1. Energy industries	0.78	0.92	1.07	1.19	1.46	1.63	1.91	2.15	1.76	1.93	2.32	2.53	2.69	2.76	2.97	3.07	3.26	3.46	3.64	4.01	4.49	4.60	4.67	4.81	4.56	4.59	4.64	494.9
2. Manufacturing industries and construction	0.98	1.14	1.38	1.55	1.64	1.71	1.84	1.95	1.92	2.02	2.17	2.24	2.35	2.43	2.54	2.53	2.58	2.77	2.85	2.73	3.11	3.45	3.59	3.63	4.04	4.18	4.09	317.3
3. Transportation	0.30	0.33	0.37	0.47	0.49	0.55	0.58	0.63	0.49	0.52	0.57	0.59	0.63	0.65	0.64	0.64	0.64	0.65	0.63	0.64	0.65	0.66	0.66	0.68	0.69	0.74	0.78	160.0
4. Other sectors	0.90	0.76	0.65	0.61	0.57	0.59	0.58	0.58	0.44	0.50	0.46	0.44	0.48	0.47	0.43	0.45	0.40	0.39	0.38	0.37	0.38	0.39	0.38	0.46	0.47	0.52	0.58	-35.6
5. Other	0.001	0.04	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	1900.0
B. Fugitive emission from fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2. Oil and natural gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
2. Industrial processes	0.83	1.62	8.20	8.36	9.15	10.86	12.32	14.74	16.84	19.97	22.82	24.10	23.41	34.53	41.76	35.83	33.38	3.06	0.87	0.72	0.66	1.01	1.39	1.27	1.06	0.83	1.06	27.7
A. Mineral industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
B. Chemical industry	0.83	1.62	8.20	8.36	9.15	10.86	12.32	14.74	16.84	19.97	22.82	24.10	23.41	34.53	41.76	35.83	33.38	3.06	0.87	0.72	0.66	1.01	1.39	1.27	1.06	0.83	1.06	27.7
C. Metal industry																												
D. Other industry																												
E. Production of Halocarbons and SF_6																												
F. Consumption of Halocarbons and SF_6																												
G. Other																												
3. Solvent and Other Product Use																												
4. Agriculture																												
A. Enteric fermentation																												
B. Manure management	6.70	7.27	8.00	8.84	9.43	9.98	10.72	10.91	10.60	9.57	9.01	8.61	8.64	8.64	8.94	9.40	9.83	10.23	10.46	10.98	11.65	11.24	11.22	11.28	10.67	11.86	13.18	96.7
C. Rice cultivation																												
D. Agricultural soils	15.79	16.04	16.77	17.11	18.13	18.79	19.43	19.55	19.33	18.39	17.94	17.32	17.02	16.69	17.05	17.49	17.38	17.52	17.34	18.07	18.32	17.05	18.21	18.55	18.23	18.22	18.24	15.5
E. Prescribed burning of savannas																												
F. Field burning of agricultural residues	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	-33.3
G. Other																												

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change in 2016 to 1990
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	(%)
5. Land Use, Land-Use Change and forestry	0.90	0.77	0.60	0.45	0.24	0.24	0.19	0.19	0.21	0.22	0.22	0.20	0.22	0.20	0.19	0.18	0.17	0.19	0.20	0.21	0.21	0.20	0.17	0.15	0.11	0.08	0.12	-86.7
A. Forest land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
B. Cropland	0.90	0.77	0.60	0.45	0.24	0.24	0.19	0.19	0.21	0.22	0.22	0.20	0.22	0.20	0.19	0.18	0.17	0.19	0.20	0.21	0.21	0.20	0.17	0.15	0.11	0.08	0.12	-86.7
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	
G. Other	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	
6. Waste	3.22	3.06	3.17	3.18	3.21	3.36	3.43	3.51	3.51	3.64	3.84	3.87	3.94	3.97	3.96	4.29	3.97	4.08	4.16	4.20	4.62	4.68	4.81	4.92	5.01	5.21	5.23	62.4
A. Waste landfill																												
B. Sewage and wastewater treatment	3.10	2.90	2.98	2.94	2.95	3.03	3.06	3.08	3.09	3.08	3.06	3.05	3.03	3.02	3.00	3.32	2.96	2.94	3.00	3.05	3.38	3.37	3.34	3.29	3.33	3.43	3.38	9.0
C. Waste incineration	0.12	0.16	0.19	0.23	0.24	0.33	0.37	0.41	0.39	0.48	0.62	0.66	0.67	0.71	0.71	0.61	0.57	0.67	0.68	0.64	0.80	0.80	0.95	0.98	0.96	1.00	0.92	666.7
D. Other	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.02	0.02	0.08	0.16	0.16	0.24	0.24	0.25	0.36	0.44	0.46	0.48	0.51	0.44	0.52	0.53	0.65	0.72	0.78	0.93	4550.0
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total N_2O emissions including N_2O from LULUCF	30.43	31.96	40.27	41.81	44.36	47.75	51.06	54.26	55.13	56.81	59.40	59.95	59.42	70.38	78.52	73.94	71.67	42.39	40.57	41.95	44.14	43.33	45.15	45.80	44.88	46.27	47.96	57.6
Total N_2O emissions excluding N_2O from LULUCF	29.53	31.19	39.67	41.36	44.12	47.51	50.87	54.07	54.91	56.59	59.18	59.75	59.20	70.18	78.34	73.75	71.50	42.19	40.37	41.75	43.93	43.13	44.98	45.65	44.77	46.19	47.84	62.0
International bunkers	0.24	0.22	0.27	0.29	0.33	0.37	0.43	0.47	0.44	0.47	0.46	0.46	0.48	0.51	0.54	0.55	0.49	0.57	0.53	0.50	0.54	0.54	0.53	0.55	0.55	0.58	0.65	170.8
International aviation	0.17	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.20	0.20	0.22	0.23	0.25	0.27	0.29	0.30	0.24	0.34	0.31	0.29	0.33	0.33	0.33	0.35	0.35	0.36	0.40	135.3
International marine	0.06	0.10	0.12	0.13	0.15	0.17	0.21	0.23	0.24	0.26	0.24	0.23	0.23	0.24	0.25	0.25	0.25	0.23	0.22	0.20	0.21	0.21	0.20	0.20	0.20	0.22	0.25	316.7
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
CO_2 emissions from biomass																												

CHAPTER 1 National Circumstances
CHAPTER 2 National Greenhouse Gas Inventory
CHAPTER 3 Mitigation Policies and Actions
CHAPTER 4 International Support and Awareness of Climate Change
Appendix

〈Table 1-1〉 GHG Emissions Trends – HFCs, PFCs, SF_6

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999년	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change in 2016 to 1990
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	(%)
Emissions of HFCs – ($kt\ CO_2eq$)	982.80	798.88	1,877.22	2,117.21	3,837.90	5,084.87	5,779.02	7,160.07	4,911.10	8,061.49	8,443.31	5,851.64	8,652.61	6,442.92	6,590.97	6,651.18	6,097.96	7,362.99	6,881.07	5,846.15	8,087.59	7,907.00	8,694.42	8,094.74	8,537.55	7,931.23	7,365.92	649.5
HFC-23	0.08	0.07	0.16	0.18	0.19	0.22	0.24	0.29	0.17	0.32	0.29	0.05	0.18	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	-75.0
HFC-32	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-125	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-134a	NO, NE	NO ,NE	NO, NE	NO, NE	1.21	1.90	2.25	2.92	2.21	3.32	3.90	4.00	5.01	4.83	4.94	4.97	4.51	5.45	5.11	4.33	6.03	5.88	6.44	5.96	6.19	5.86	5.41	347.1
HFC-152a	NO, NE	NO, NE	0.04	0.08	0.00	0.00	0.00	0.01	NO, NE	0.03	0.22	0.11	0.36	0.33	0.12	0.16	0.22	0.24	0.07	0.05	0.07	0.07	0.06	0.09	0.65	0.77	1.04	2500.0
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-143a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
기타	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Emissions of PFCs – ($kt\ CO_2eq$)	NO, NE	NO, NE	0.28	1.62	NO, NE	63.21	587.40	1,682.59	1,649.15	1,890.01	2,249.73	1,989.49	1,973.16	2,266.90	2,774.07	2,796.76	2,925.12	2,978.31	2,792.80	2,047.14	2,264.59	2,071.79	2,267.88	2,320.56	2,426.90	1,521.49	1,489.26	531778.6
CF_4	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	0.09	0.09	0.10	0.09	0.07	0.08	0.10	0.13	0.14	0.19	0.22	0.21	0.17	0.19	0.17	0.22	0.23	0.26	0.14	0.14	55.6
C_2F_6	NO, NE	NO, NE	0.00	0.00	NO, NE	0.00	0.06	0.12	0.11	0.14	0.17	0.14	0.11	0.11	0.12	0.11	0.11	0.12	0.11	0.07	0.08	0.07	0.06	0.06	0.06	0.03	0.02	
C_3F_8	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	0.00	NO, NE	0.00	0.01	0.03	0.06	0.09	0.12	0.11	0.08	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.01	0.02	0.02	
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
$c-C_4F_8$	NO, NE	NO, NE	NO, NE	NO, NE	NO,NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
기타	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Emissions of SF_6 – ($kt\ CO_2eq$)	173.58	332.61	373.15	385.85	923.62	3,599.31	2,263.70	2,443.48	1,375.85	3,604.76	3,219.79	3,439.56	3,254.83	3,753.55	4,310.53	5,428.23	5,280.79	6,779.12	7,612.64	8,849.74	11,856.90	8,756.46	8,455.25	9,277.43	10,354.07	8,676.04	6,787.92	3810.5
SF_6	0.01	0.01	0.02	0.02	0.04	0.15	0.09	0.10	0.06	0.15	0.13	0.14	0.14	0.16	0.18	0.23	0.22	0.28	0.32	0.37	0.50	0.37	0.35	0.39	0.43	0.36	0.28	2700.0

〈Table 1-2〉 2016 Greenhouse Gas Emissions by Sector – Energy Sector

GHG Source and Sink Categories	CO_2	CH_4	N_2O
	(Gg)		
Energy	595,830.85	279.85	10.12
A. Fuel combustion	595,830.85	92.51	10.12
1. Energy industries	261,306.19	2.55	4.64
a. Public electricity and heat generation	241,782.22	2.01	4.55
b. Oil refining	17,827.97	0.44	0.07
c. Solid fuel manufacturing and other energy industry	1,696.00	0.10	0.02
2. Manufacturing industries and construction	182,385.00	28.85	4.09
a. Steel	92,717.62	10.16	1.38
b. Non-ferrous metals	2,693.81	0.26	0.03
c. Chemicals	38,886.03	5.15	0.99
d. Pulp, paper and printing	643.59	0.05	0.00
e. Food and beverage processing and tobacco manufacturing	1,840.03	0.15	0.01
f. Other	45,603.92	13.08	1.68
Non-metal	13,426.07	1.29	0.17
Fabricated metal	4,587.55	0.37	0.01
Wood and timber	74.93	0.01	0.00
Construction	2,616.17	0.18	0.02
Textile and leather	1,289.52	0.11	0.01
Other manufacturing	23,609.68	11.13	1.46
3. Transportation	97,972.42	23.80	0.78
a. Civil aviation	1,639.14	0.02	0.06
b. Road transport	93,855.85	23.48	0.71
c. Railways	297.84	0.02	0.00
d. Shipping	1,401.26	0.10	0.01
e. Other transport	778.33	0.18	0.01
4. Other	51,117.10	36.89	0.58
a. Commerce/Public	15,016.20	25.94	0.38
b. Residential	32,110.45	10.63	0.16
c. Agriculture/Forestry/Fishery	3,990.44	0.31	0.03
5. Other	3,050.14	0.42	0.02
a. Fixed	3,050.14	0.42	0.02
b. Movable	IE	IE	IE
B. Fugitive emission from fuels	NE, NO	187.34	NO
1. Solid fuels	NE, NO	23.07	NO
2. Oil and natural gas	NE, NO	164.27	NO
a. Oil	NE	9.97	NO
b. Natural gas	NE	154.31	
Memo items			
International bunkers	45,842.15	2.21	0.65
International aviation	14,354.34	0.10	0.40
International marine	31,487.81	2.11	0.25
Multilateral operations	NO	NO	NO
CO_2 emissions from biomass	47,147.77		

※ Reporting table according to the 1996 IPCC Guidelines Annex

〈Table 1-2〉 2016 Greenhouse Gas Emissions by Sector – Industrial Processes Sector

GHG Source and Sink Categories	CO_2	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6	
				P[3]	A[4]	P	A	P	A
	(Gg)			CO_2eq.(Gg)				(Gg)	
Industrial processes	34,908.70	27.45	1.06	9,322.23	191.76	874.14	1,489.26	0.39	0.28
A. Mineral industry	34,756.33	NO	NO						
1. Cement production	25,543.43								
2. Lime production	3,482.50								
3. Lime and dolomite consumption	5,490.89								
4. Soda ash production and consumption of	239.51								
5. Asphalt roofing	NE								
6. Asphalt road paving	NE								
B. Chemical industry	1.56	27.45	1.06	NA	NA	NA	NA	NA	NA
C. Metal industry	150.81	IE, NA, NO	NO				NO		0.00
1. Steel production	150.81	NA, IE, NO							
2. Ferroalloy production	IE	IE							
3. Aluminum production	NO	NO					NO		
4. SF_6 consumption in magnesium production									0.00
D. Other industry	NA								
E. Production of Halocarbons and SF_6					NO		NO		NE, NO
1. By-product emissions					NO		NO		NO
2. Fugitive emissions					NO		NO		NE
F. Consumption of Halocarbons and SF_6				9,322.23	191.76	874.14	1,489.26	0.39	0.28
1. Refrigeration and cooling				NO,NE,IE	NO,NE	NO,NE,IE	NO	NO	NO
2. Blowing agent				NO,NE,IE	NO,NE	NO,NE,IE	NO	NO	NO
3. Fire extinguisher				NO,NE,IE	NO,NE	NO,NE,IE	NO	NO	NO
4. Aerosol				NO,NE,IE	NO,NE	NO,NE,IE	NO	NO	NO
5. Solvent				NO,NE,IE	NO,NE	NO,NE,IE	NO	NO	NO
6. Use of ODS[2] alternatives for other uses				NO,NE,IE	NO	NO,NE,IE	NO	NO	NO
7. Semiconductor manufacturing				NO,NE,IE	191.76	NO,NE,IE	1,489.26	IE	0.14
8. Heavy electric equipment								IE	0.14
9. Other (provisional emissions)				9,322.23	NO	874.14	NO	0.39	NO

※ Reporting table according to the 1996 IPCC Guidelines Annex

1) HFCs and PFCs emissions are expressed in CO_2 equivalent

2) ODS: ozone-depleting substances

3) P: Potential emissions based on the IPCC Guidelines (Tier 1 method)

4) A: Actual emissions based on the IPCC Guidelines (Tier 2 method)

〈Table 1-2〉 2016 Greenhouse Gas Emissions by Sector – Agriculture Sector

GHG Source and Sink Categories	CH_4	N_2O
	(Gg)	
Agriculture	547.62	31.44
A. Enteric fermentation	192.74	
1. Cattle	175.02	
2. Buffalo	NO	
3. Sheep	0.01	
4. Goat	1.47	
5. Camel and llama	NO	
6. Horse	0.42	
7. Mule and donkey	NO	
8. Pig	15.64	
9. Poultry	NE	
10. Other livestock (deer)	0.17	
B. Manure management	62.53	13.18
1. Cattle	17.31	6.48
2. Buffalo	NO	NO
3. Sheep	0.00	0.00
4. Goat	0.03	0.37
5. Camel and llama	NO	NO
6. Horse	0.03	0.03
7. Mule and donkey	NO	NO
8. Pig	31.28	3.70
9. Poultry	13.88	2.55
10. Other livestock (deer)	0.00	0.04
C. Rice cultivation	291.66	
1. Irrigation	290.32	
2. Rain-fed paddy	1.33	
D. Agricultural soils	NA	18.24
1. Direct emissions	NA	10.84
2. Ranch, grazing and manure		NE
3. Indirect emissions	NA	7.40
E. Prescribed burning of savannas	NO	NO
F. Field burning of agricultural residues	0.70	0.02
1. Cereals	0.18	0.00
2. Pulses (beans)	0.09	0.00
3. Root vegetables	NO	NO
4. Other	0.42	0.01

※ Reporting table according to the 1996 IPCC Guidelines Annex

〈Table 1-2〉 2016 Greenhouse Gas Emissions by Sector – LULUCF Sector

GHG Source and Sink Categories	Net CO_2 Emissions/Removal[1]	CH_4	N_2O
	(Gg)		
LULUCF	-44,785.35	14.07	0.12
A. Forest land	-48,506.97	NE, NO	NE, NO
1. Forest land maintained	-48,506.97	NE, NO	NE, NO
2. Forest land converted from other land	IE	NE, NO	NE, NO
B. Cropland	3,711.02	NE, NO	0.12
1. Cropland converted from other land	-341.16	NE, NO	
2. Cropland converted to other land	3,937.53	NE, NO	NE, NO
3. N_2O emissions due to conversion to cropland			0.12
4. CO_2 emission due to use of agricultural lime	114.66		
C. Grassland	-54.58	NE, NO	NE, NO
1. Grassland maintained	0.00	NE, NO	NE, NO
2. Grassland converted from other land	-54.58	NE, NO	NE, NO
D. Wetlands	65.17	14.07	NE, NO
1. Wetlands maintained	NE	14.07	NE, NO
2. Wetlands converted from other land	65.17	IE	NE, NO
E. Settlements	NE	NE	NE
F. Others	NE	NE	NE
1. Others maintained	NE	NE	NE
2. Others converted from other land	NE	NE	NE

※ Reporting table according to the 1996 IPCC Guidelines Annex

〈Table 1-2〉 2016 Greenhouse Gas Emissions by Sector – Waste Sector

GHG Source and Sink Categories	CO_2	CH_4	N_2O
	(Gg)		
Waste	6,860.01	382.87	5.23
A. Waste landfill	NA, NO	361.82	
1. Managed landfill	NA	323.37	
2. Non-managed landfill	NA	38.45	
B. Sewage and wastewater treatment		17.76	3.38
1. Wastewater treatment		3.18	NE
2. Sewage treatment		14.58	3.38
C. Waste incineration	6,860.01	NE	0.92
D. Other	NA	3.28	0.93

※ Reporting table according to the 1996 IPCC Guidelines Annex

1) For reporting purposes, removal is always expressed as a negative number (–) and emissions are expressed as a positive number (+) in accordance with the 1996 IPCC Guideline

〈Table 1-3〉 Country-specific Emission/Removal Factors with National Greenhouse Gas Inventory – Energy Sector (prepared by the Ministry of Trade, Industry and Energy)

Sectors	Name of Factor	Unit	Factor	
			2007-2011	2012-2016
Energy sector (Fuel combustion)	Gasoline	ton C/TJ	19.7	20.0
	Jet oil	ton C/TJ	19.6	19.8
	Kerosene	ton C/TJ	19.5	19.6
	Diesel	ton C/TJ	20.0	20.2
	Bunker-A (B-A)	ton C/TJ	20.2	20.4
	Bunker-B (B-B)	ton C/TJ	20.6	20.5
	Bunker-C (B-C)	ton C/TJ	20.8	20.6
	By-product fuel oil No.1	ton C/TJ	-	19.7
	By-product fuel oil No.2	ton C/TJ	-	21.0
	Propane	ton C/TJ	17.6	17.6
	Butane	ton C/TJ	18.1	18.1
	Naphtha	ton C/TJ	18.6	19.2
	Asphalt	ton C/TJ	21.5	21.6
	Lubricants	ton C/TJ	19.7	19.9
	Petroleum coke	ton C/TJ	27.2	27.2
	Domestic anthracite	ton C/TJ	29.7	30.5
	Imported anthracite (fuel)	ton C/TJ	-	28.6
	Imported anthracite (coking coal)	ton C/TJ	-	29.2
	Bituminous (coking coal)	ton C/TJ	-	26.2
	Bituminous (fuel)	ton C/TJ	25.9	26.0
	Liquid Natural Gas (LNG)	ton C/TJ	15.4	15.3
	City gas (LNG)	ton C/TJ	15.4	15.3
	City gas (LPG)	ton C/TJ	17.6	17.6
	City gas (LPG)	ton C/TJ	17.6	17.6

Sectors	Name of Factor	Unit	Factor
			1990-2016
Energy sector (Public electricity and heat generation)	CH_4 emission factor for coal	kg CH_4/TJ	0.25
	CH_4 emission factor for oil	kg CH_4/TJ	0.15
	CH_4 emission factor for Natural Gas and City gas (LNG)	kg CH_4/TJ	0.41
	N_2O emission factor for coal	kg N_2O/TJ	1.66
	N_2O emission factor for oil	kg N_2O/TJ	1.75
	N_2O emission factor for Natural Gas and City gas (LNG)	kg N_2O/TJ	1.06
Energy sector (Fugitive emission from LNG)	Emission factor for transport venting of LNG	Gg $CH_4/10^6m^3$	2.028×10^{-5}
	Emission factor for transport leaks of LNG	Gg $CH_4/10^6m^3$	8.567×10^{-6}
	Emission factor for storage venting of LNG	Gg $CH_4/10^6m^3$	3.756×10^{-6}
	Emission factor for storage leaks of LNG	Gg $CH_4/10^6m^3$	6.835×10^{-6}

※ Due to the unavailability of a country-specific emission factor for petroleum coke calculated based on official calorific value for the year 2011 (Notification of the Ministry of Trade, Industry & Energy), the country-specific emission factor in accordance with the calorific value notified in 2006 was used to measure the emissions for the period of 2012-2015

〈Table 1-3〉 Country-specific Emission/Removal Factors with National Greenhouse Gas Inventory – Agriculture and LULUCF Sectors (prepared by the Ministry of Agriculture, Food and Rural Affairs)

Sectors	Name of Factor	Unit	Factor
			1990-2016
Agriculture sector (Rice cultivation sub-sector)	Methane baseline emission factor for rice cultivation (EFc)	kg $CH_4 ha^{-1} day^{-1}$	2.32
	Scaling factor for organic amendment applied (SFO) for rice straw	–	2.5
	When applying rice straw (dry matter) of 5-7 mg/ha	–	1.00
	Scaling factor for water management (SFW): Continuously flooded	–	0.83
	Scaling factor for water management (SFW): Intermittently flooded - 1 week	–	0.66
	Scaling factor for water management (SFW): Intermittently flooded - 2 weeks	–	0.49
Agriculture sector (Agricultural soils sub-sector)	Direct N_2O emission factor from synthetic fertilizer for potato (EF_{1i})	kg N_2O-N/kgN	0.0049
	Direct N_2O emission factor from synthetic fertilizer for pepper (EF_{1i})	kg N_2O-N/kgN	0.0086
	Direct N_2O emission factor from synthetic fertilizer for soybeans (EF_{1i})	kg N_2O-N/kgN	0.0119
	Direct N_2O emission factor from synthetic fertilizer for spring cabbage (EF_1i)	kg N_2O-N/kgN	0.0056
	Direct N_2O emission factor from synthetic fertilizer for autumn cabbage (EF_1i)	kg N_2O-N/kgN	0.0058
	Integrated direct N_2O emission factor from synthetic fertilizer for field crops (EF_{1FC})	kg N_2O-N/kgN	0.00596
	Indirect N_2O emission factor from N leaching and runoff (EF_5)	kg N_2O-N/kgN	0.0135
LULUCF sector (Forest land sub-sector)	Basic wood density (D) for coniferous forest	t d.m./m^3	0.46
	Basic wood density (D) for broadleaf forest	t d.m./m^3	0.68
	Biomass Expansion Factor (BEF) for coniferous forest	–	1.43
	Biomass Expansion Factor (BEF) for broadleaf forest	–	1.51
	Ratio of below-ground biomass to above-ground biomass (R) for coniferous forest	–	0.27
	Ratio of below-ground biomass to above-ground biomass (R) for broadleaf forest	–	0.36

〈Table 1–3〉 Country–specific Emission/Removal Factors with National Greenhouse Gas Inventory – Waste Sector (prepared by the Ministry of Environment)

Sectors	Name of Factor	Unit	Factor
			1990–2016
Waste sector (Waste landfill)	Fraction by volume of CH_4 in landfill gas (F)	-	0.5629
	Methane generation rate constant (k)	–	0.05
Waste sector (Wastewater treatment sub–sector)	CH_4 factor by physical treatment	ton CH_4/ton BOD	0.01532
	CH_4 factor by biological treatment	ton CH_4/ton BOD	0.018
	CH_4 factor by advanced treatment	ton CH_4/ton BOD	0.0071
	CH_4 factor for chemical industry	ton CH_4/ton BOD	0.0012
	CH_4 factor for electric and electronic industry	ton CH_4/ton BOD	0.0016
	CH_4 factor for food and beverage industry	ton CH_4/ton BOD	0.010
	CH_4 factor for tobacco, paper, and wood industry	ton CH_4/ton BOD	0.0034
	CH_4 factor for leather and shoes industry	ton CH_4/ton BOD	0.0036
	CH_4 factor for textile industry	ton CH_4/ton BOD	0.00032
	CH_4 for nonmetal industry	ton CH_4/ton BOD	0.00018
	CH_4 factor for power and water supply industry	ton CH_4/ton BOD	0.00308
	CH_4 factor for wastewater treatment business	ton CH_4/ton BOD	0.00074
	CH_4 factor for metal in total	ton CH_4/ton BOD	0.0033
Waste sector (Waste incineration sub–sector)	Municipal solid waste	g N_2O/ton	52.1
	Industrial solid waste	g N_2O/ton	129.7
	Sewage sludge	g N_2O/ton	595.0

〈Table 1-4〉 Measurement Guidelines and Emission Factors

Sectors	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor
1. Energy												
A. Fuel combustion												
1. Energy industries	96 D	90-06:96 D 07-16:CS	96 D	96 D[1)]	96 D	96 D[1)]						
2. Manufacturing industries and construction	96 D	90-06: 96 D 07-16:CS	96 D	96 D[3)]	96 D	96 D[2)]						
3. Transportation												
a. Civil aviation	General aviation GPG T1 Civil aviation GPG T2	96 D	General aviation GPG T1 Civil aviation GPG T2	96 D	General aviation GPG T1 Civil aviation GPG T2	96 D						
b. Road transport, railway, Shipping, and other transport	96 D	96 D[3)]	96 D	96 D[3)]	96 D	96 D[3)]						
4. Other sectors	96 D	96 D[3)]	96 D	96 D[4)]	96 D	96 D[4)]						
5. Other	96 D	96 D[3)]	96 D	96 D[4)]	96 D	96 D[4)]						
B. Fugitive emission from fuels	96 D	96 D	96 D	96 D	96 D	96 D						
2. Industrial processes												
A. Mineral industry	96 D, GPG T1	96 D, GPG D	NA	NA	NA	NA						
1. Cement production	96 D	96 D	NA	NA	NA	NA						
2. Lime production	GPG T1	GPG D	NA	NA	NA	NA						
3. Lime and dolomite consumption	96 D	96 D	NA	NA	NA	NA						
4. Soda ash production and consumption of	96 D	96 D	NA	NA	NA	NA						
B. Chemical industry	96 D	96 D	NE	NE	06 T2, 96 T1	06 D, 96 D						
1. Ammonia production	NO	NO	NE	NE	NA	NA						
2. Nitric acid production					06 T2	06 D						
3. Adipic acid production					96 T1	96 D						
4. Carbide production	96 D	96 D	NO	NO								
5. Other chemical production			96 T1	96 D								
C. Metal industry	96 T1b	96 D	NA	NA	NA	NA					96 T1	
1. Steel production	96 T1b	96 D	NA	NA	NA	NA						
2. Ferroalloy production	IE	IE	NA	NA	NA	NA						

Sectors	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor
3. Aluminum production	96 T1b	96 D	NA	NA	NA	NA						
4. SF_6 consumption in magnesium production											96 T1	
D. Other industry	NA	NA										
E. Production of Halocarbons and SF_6							96 T1	NO	NO	NO	NE	NE
1. By-product emissions							96 T1	NO				
2. Fugitive emissions							NO	NO	NO	NO	NE	NE
Sectors	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
F. Consumption of Halocarbons and SF_6							96 T1a, 06 T2a, 06 T2b	06 D(T2a), 06 D(T2b)	96 T1a, 06 T2a	06 D T2a), 06 D(T2b)	96 T1a, 6 T2a, 06 T2b, 06 T1	06 D T2a), 06 D(T2b), 06 D
1. Potential emissions							96 T1a		96 T1a		96 T1a	
2. Semiconductor							06 T2a	06 D(T2a)	06 T2a	06 D(T2a)	06 T2a	06 D(T2a)
3. Display							06 T2b	06 D(T2b)	06 T2b	06 D(T2b)	06 T2b	06 D(T2b)
4. Heavy electric equipment											06 T1	06 D
G. Other	NA	NA	NA	NA	NA	NA						
4. Agriculture												
A. Enteric fermentation			96 T1	96 D								
B. Manure management			96 T1	96 D	GPG T1	96 D						
C. Rice cultivation			06 T2	CS								
D. Agricultural soils			NE	NE	GPG T1, 06 T2	CS, 96D, 06D						
E. Prescribed burning of savannas			NO	NO	NO	NO						
F. Field burning of agricultural residues			96 T1	RA, D	96 T1	RA, D						
G. Other			NO	NO	NO	NO						
5. LULUCF												
A. Forest land	06 T2	CS										
B. Cropland	GPGL T1	GPGL D			GPGL T1	GPGL D						
C. Grassland	GPGL T1	GPGL D										
D. Wetlands	06 OTH[b]	06 D	06 OTH[b]	06 D								
E. Settlements												
F. Other lands												
G. Other												

Sectors	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor
6. Waste												
A. Waste landfill	NA/NO	NA/NO	GPG T2	CS/96 D/ GPG D[7]								
B. Sewage and wastewater treatment			GPG D[8]	CS/GPG D/06 D[9]	96 D	96 D						
C. Waste incineration	GPG D	GPG D	NE	NE	GPG D	CS						
D. Other	NA	NA	06 D	06 D	06 D	06 D						

1) Exception : 06GL D(refinery gas, LPG), CS(city gas)
2) Exception : 06GL D(refinery gas, LPG), CS(diesel, gasoline, propane, butane)
3) Exception : 06GL D(LPG)
4) Exception : CS(city gas)
5) 2006 IPCC GL, Appendix 3
6) 2006 IPCC GL, Appendix 2
7) CS – k, F / 1996 IPCC GL – DOC / IPCC GPG 2000 – MCF, DOCf, OX
8) IPCC GPG 2000 – Industrial, Domestic, Uncollected, Untreated Wastewater
9) CS – Industrial, Domestic Wastewater / / IPCC GPG 2000 – Uncollected, Untreated Wastewater, B0 / IPCC 2006 GL – Uncollected, Untreated Wastewater, MCF

〈Table 1-5〉 List of Activity Data

Sectors	Sub-sectors	Name of Activity Data	Sources
Energy	Fuel combustion and fugitive	Yearbook of Energy Statistics	Ministry of Trade, Industry and Energy
	Oil refining, transportation, etc.	Petroleum Products Supply and Demand Statistics	Korea National Oil Corporation
	Transportation	Consumption and Number of Landings and Takeoffs (LTOs) by Fuel Type of Air Carrier	Korea Transportation Safety Authority
Industrial processes	Mineral industry	Yearbook of Cement Statistics and Emissions Trading Scheme Report	Korean Cement Association and Ministry of Environment
		Exports and Imports Statistics (Consumption of soda ash)	Korea International Trade Association
		Lime and Dolomite Consumptions Survey and Emissions Trading Scheme Report	Korea Steel Framing Alliance and Ministry of Environment
	Chemical industry	Korea Petrochemical Statistics	Korea Petrochemical Industry Association
		Emissions Trading Scheme Report	Ministry of Environment
		Carbide Productions and Consumptions Survey	Korea Energy Agency
	Metal industry	Exports and Imports Statistics (Carbon electrode)	Korea International Trade Association
		Emissions Trading Scheme Report	Ministry of Environment
	Production and Consumption of Halocarbons and SF_6	Emissions Trading Scheme Report	Ministry of Environment
		Exports and Imports Statistics	Korea International Trade Association
		SF_6 consumptions survey during production, consumption and processing	Korea Energy Agency
Agriculture	Livestock	Livestock Survey Report	Statistics Korea
		Agriculture, Food and Rural Affairs Statistics Yearbook	Ministry of Agriculture, Food and Rural Affairs
	Plowing and sowing	Agriculture, Food and Rural Affairs Statistics Yearbook	Ministry of Agriculture, Food and Rural Affairs
		Crop Production Survey	Statistics Korea
LULUCF	Forest land	Statistical Yearbook of Forestry	Korea Forest Service
	Cropland	Cultivated Area Survey	Statistics Korea
	Grassland and Wetlands	Cadastral Statistics Yearbook	Ministry of Land, Infrastructure and Transport
Waste	landfill	Status of Generation and Treatment of Wastes of Korea	Ministry of Environment
		Status of Generation and Treatment of Designated Wastes of Korea	Ministry of Environment
		Landfill Gas Recovery Survey	Ministry of Environment
	Sewage and wastewater	Sewer Statistics	Ministry of Environment
		Generation and Treatment of Industrial Wastewater	Ministry of Environment
	Incineration	Status of Generation and Treatment of Wastes of Korea	Ministry of Environment
		Status of Generation and Treatment of Designated Wastes of Korea	Ministry of Environment
	Other	Status of Generation and Treatment of Wastes of Korea	Ministry of Environment

〈Table 1-6〉 IPCC Good Practice Guidance for LULUCF Annex 3A.2

and Use	Annual Carbon Storage Change ($GgCO_2$)				CH_4 (Gg)	N_2O (Gg)
	Growing tree biomass A	Dead organic matter B	Soil C	CO_2 Emissions/Removal D=A+B+C		
Forest land	-48,506.97	NE	NE	-48,506.97	NE	NE
Cropland	NE	NE	3,596.37	3,596.37	NE	0.12
Grassland	NE	NE	-54.58	-54.58	NE	NE
Wetlands	NE	NE	65.17	65.17	14.07	NE
Settlements	NE	NE	NE	NE	NE	NE
Others	NE	NE	NE	NE	NE	NE
Total	-48,506.97	NE	3,606.96	-44,900.01	14.07	0.12

〈Table 1-7〉 Comparison between Reference Approach (RA) and Sectoral Approach (SA)

(Unit: Thousand tons CO_2eq.)

Descriptions	Reference Approach	Sectoral Approach	Difference (%)
Liquid fuel	196,533.33	192,258.66	2.22
Solid fuel	306,626.84	307,327.04	-0.23
Gaseous fuel	96,051.22	96,245.16	-0.20
Other	NO	NO	NO
Total	599,211.40	595,830.85	0.57

※ The difference in CO_2 emissions using the reference and sectoral approach was 0.57% (less than 1%)

〈Table 1-8〉 Not Estimated Emission Source of National Greenhouse Gas Inventory (1990-2016)

GHGs	Sectors	Sub-sectors	Reasons for not estimated
CO_2	1. Energy	1.B.2.a. iii. Oil transport	IPCC/No national emission factor
	1. Energy	1.B.2.a. iv. Oil refining and storage	IPCC/No national emission factor
	1. Energy	1.B.2.a. v. Distribution of petroleum products	IPCC/No national emission factor
	2. Industrial processes	2.A.5. Asphalt roofing	IPCC/No national emission factor
	2. Industrial processes	2.A.6 Asphalt road paving	IPCC/No national emission factor
	2. Industrial processes	2.A.7 Other mineral production (glass production)	IPCC/No national emission factor
	5. LULUCF	5A1. Forest land maintained (dead organic matter and soil carbon)	No activity data
	5. LULUCF	5.A.2. Forest land converted to other lands (dead organic matter and soil carbon)	No activity data
	5. LULUCF	5.D.8. Wetlands converted to other lands	No activity data
	5. LULUCF	5.E.9. Settlement maintained	No activity data
	5. LULUCF	5.E.10. Settlement converted to other lands	No activity data
	5. LULUCF	5.F.11. Others maintained	No activity data
	5. LULUCF	5.F.12. Other converted to other lands	No activity data
	5. LULUCF	5.V. Biomass incineration	No activity data
	6. Waste	6.C.a. Biological origin waste	No activity data
CH_4	1. Energy	1.B.2.a. v. Distribution of petroleum products	IPCC/No national emission factor
	2. Industrial processes	2.B.1. Ammonia production	IPCC/No national emission factor
	4. Agriculture	4.A.9. Enteric fermentation (poultry)	IPCC/No national emission factor
	5. LULUCF	5.A.1. Forest land maintained	No activity data
	5. LULUCF	5.A.2. Forest land converted to other lands	No activity data
	5. LULUCF	5.V. Biomass incineration	No activity data
	6. Waste	6.B.1.b. Industrial wastewater sludge	IPCC/No national emission factor
	6. Waste	6.C.a. Incineration (biological origin waste)	IPCC/No national emission factor
	6. Waste	6.C.b. Incineration (waste)	IPCC/No national emission factor
N_2O	5. LULUCF	5.A.1. Forest land maintained	No activity data
	5. LULUCF	5.A.2. Forest land converted to other lands	No activity data
	5. LULUCF	5.V. Biomass incineration	No activity data
	6. Waste	6.B.1.a. Industrial wastewater	IPCC GL No methodology
	6. Waste	6.B.1.b. Industrial wastewater sludge	IPCC GL No methodology
	6. Waste	6.B.2.a. Sewage	IPCC GL No methodology
	6. Waste	6.B.2.b. Sewage sludge	IPCC GL No methodology
HFCs, SF_6 (Actual emissions)	2. Industrial processes	2.E.2. Production (fugitive) of Halocarbons and SF_6	No activity data
	2. Industrial processes	2.F.1. Consumption (cooling and refrigerant) of Halocarbons and SF_6	No activity data
	2. Industrial processes	2.F.2. Consumption (blowing agent) of Halocarbons and SF_6	No activity data
	2. Industrial processes	2.F.3.Consumption (fire extinguisher) of Halocarbons and SF_6	No activity data
	2. Industrial processes	2.F.4. Consumption (aerosol) of Halocarbons and SF_6	No activity data
	2. Industrial processes	2.F.5. Consumption (solvent) of Halocarbons and SF_6	No activity data

〈Table 1-9〉 Major Emission Sources according to the National GHG Inventory Level Assessment (including LULUCF)

Rank-ing	IIPCC GHG Emission and Sinks (including LULUCF)		GHGs	2016 Emissions (Gg CO_2eq.)	Tier 1 Level Assessment (Total = 1)	Tier 1 Level Assessment Accumulated Share
1	1A1	Energy industry Solid fuel	CO_2	184,186	0.246	0.246
2	1A2	Manufacturing industries and construction: Solid fuel	CO_2	120,580	0.161	0.408
3	1A3b	Road transport	CO_2	93,856	0.126	0.533
4	5A1	Forest land maintained	CO_2	-48,507	0.065	0.598
5	1A1	Energy industry Gaseous fuel	CO_2	48,327	0.065	0.663
6	1A2	Manufacturing industries and construction: Liquid fuel	CO_2	44,832	0.060	0.723
7	1A1	Energy industry Liquid fuel	CO_2	28,793	0.039	0.761
8	1A4	Other sectors: Gaseous fuel	CO_2	28,263	0.038	0.799
9	2A1	Cement production	CO_2	25,543	0.034	0.833
10	1A4	Other sectors: Liquid fuel	CO_2	20,293	0.027	0.861
11	1A2	Manufacturing industries and construction: Gaseous fuel	CO_2	16,973	0.023	0.883
12	6A	Waste landfill	CH_4	7,598	0.010	0.893
13	2F9	Consumption, etc. of Halocarbons and SF_6	HFCs	7,174	0.010	0.903
14	6C	Waste incineration	CO_2	6,860	0.009	0.912
15	4C	Rice cultivation	CH_4	6,125	0.008	0.920
16	4D	Agricultural soils	N_2O	5,655	0.008	0.928
17	2A3	Lime and dolomite consumption	CO_2	5,491	0.007	0.935
18	2F7	Semiconductor production (LCD production)	HFCs, PFCs, SF_6	4,947	0.007	0.942
19	4B	Manure management	N_2O	4,085	0.005	0.947
20	4A	Enteric Fermentation	CH_4	4,048	0.005	0.953

〈Table 1-9〉 Major Emission Sources according to the National GHG Inventory Level Assessment (including LULUCF)

Rank-ing	IPCC GHG Emission and Sinks (including LULUCF)		Green house Gas	Emissions (Gg CO_2eq.)		Tier1 Trend Assessment	Tier1 Trend Assessment Share (Total = 1)	Tier1 Trend Assessment Accumu-lated Share
				1990	2016			
1	1A1	Energy industry Solid fuel	CO_2	17,048	184,186	0.416	0.202	0.202
2	1A4	Other sectors: Solid fuel	CO_2	36,062	2,561	0.264	0.128	0.330
3	1A4	Other sectors: Liquid fuel	CO_2	35,736	20,293	0.210	0.102	0.432
4	5A1	Forest land maintained	CO_2	-38,687	-48,507	0.206	0.100	0.532
5	1A2	Manufacturing industries and construction: Liquid fuel	CO_2	36,985	44,832	0.146	0.071	0.603
6	1A1	Energy industry Liquid fuel	CO_2	25,762	28,793	0.109	0.053	0.656
7	1A1	Energy industry Gaseous fuel	CO_2	4,802	48,327	0.107	0.052	0.708
8	1A4	Other sectors: Gaseous fuel	CO_2	1,708	28,263	0.071	0.034	0.742
9	1A2	Manufacturing industries and construction: Solid fuel	CO_2	39,146	120,580	0.061	0.030	0.772
10	4C	Rice cultivation	CH_4	10,494	6,125	0.061	0.030	0.802
11	1A2	Manufacturing industries and construction: Gaseous fuel	CO_2	0	16,973	0.050	0.024	0.826
12	1A3b	Road transport	CO_2	30,690	93,856	0.046	0.022	0.848
13	2A1	Cement production	CO_2	15,202	25,543	0.039	0.019	0.867
14	1B1	Solid fuel	CH_4	4,833	484	0.035	0.017	0.884
15	6A	Waste landfill	CH_4	7,492	7,598	0.034	0.017	0.901
16	2F9	Halocarbons and SF_6 Consumption, etc.	HFCs	NO	7,174	0.021	0.010	0.911
17	4D	Agricultural soils	N_2O	4,895	5,655	0.020	0.010	0.921
18	1A4	Other sectors: Solid fuel	CH_4	2,234	106	0.017	0.008	0.929
19	2F7	Semiconductor production(LCD production)	HFCs, PFCs, SF_6	NO	6	0.015	0.007	0.936
20	1A3d	Shipping	CO_2	2,432	1,401	0.014	0.007	0.943
21	4A	Enteric fermentation	CH_4	2,960	4,048	0.010	0.005	0.948
22	5B2	Cropland converted from other lands	CO_2	2,843	3,938	0.010	0.005	0.953

2. Climate-related[1] Financial Support Details

〈Table 2-1〉 Financial Support Provided via Multilateral Institutions (2014)

(Exchange rate[2]: KRW 1,053.064/USD)

Multilateral institutions	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	38,657	36,709					
CGIAR (Consultative Group on International Agricultural Research)	334	317	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
FAO (Food and Agriculture Organization of the United Nations)	300	285	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
GCF (Green Climate Fund)	11,584	11,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GGGI (Global Green Growth Institute)	10,531	10,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IBRD (International Bank for Reconstruction and Development)	11,096	10,537	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IFAD (International Fund for Agricultural Development)	2,106	2,000	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
IPCC (Intergovernmental Panel on Climate Change)	147	140	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
ITTO (International Tropical Timber Organization)	395	375	Completed	ODA	Contribution	Mitigation	Forestry
UNCCD (United Nations Convention to Combat Desertification)	2,000	1,899	Completed	ODA	Contribution	Mitigation	Forestry
Montreal Protocol Secretariat	104	99	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	60	57	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of the 〈Table 2-2〉

〈Table 2-1〉 Financial Support Provided via Multilateral Institutions (2015)

(Exchange rate[2]: KRW 1,131.309/USD)

Multilateral institutions	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	68,909	60,912					
UN ESCAP (United Nations Economic and social Commission for Asia and the Pacific)	111	98	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
FAO (Food and Agriculture Organization of the United Nations)	10,342	9,142	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
GCF (Green Climate Fund)	11,770	10,404	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GGGI (Global Green Growth Institute)	11,313	10,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IBRD (International Bank for Reconstruction and Development)	26,722	23,621	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IFAD (International Fund for Agricultural Development)	3,281	2,900	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
IPCC (Intergovernmental Panel on Climate Change)	147	130	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
ITTO (International Tropical Timber Organization)	346	306	Completed	ODA	Contribution	Mitigation	Forestry
UNCCD (United Nations Convention to Combat Desertification)	2,076	1,835	Completed	ODA	Contribution	Mitigation	Forestry
UNEP (United Nations Environment Programme)	1,744	1,542	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNFCCC (United Nations Framework Convention on Climate Change)	879	777	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WFP (World Food Programme)	113	100	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	65	58	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of the 〈Table 2-2〉

〈Table 2-1〉 Financial Support Provided via Multilateral Institutions (2016)

(Exchange rate[2]: KRW 1,160.589/USD)

Multilateral institutions	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	101,438	87,657					
CGIAR (Consultative Group on International Agricultural Research)	297	256	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
GCF (Green Climate Fund)	12,472	11,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNESCAP (United Nations Economic and social Commission for Asia and the Pacific)	116	100	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
FAO (Food and Agriculture Organization of the United Nations)	11,355	9,784	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
GGGI (Global Green Growth Institute)	11,606	10,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IFAD (International Fund for Agricultural Development)	2,635	2,270	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
IOC (Intergovernmental Oceanographic Commission)	1	1	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
ITTO (International Tropical Timber Organization)	308	265	Completed	ODA	Contribution	Adaptation	All sectors
UN (United Nations)	1,585	1,366	Completed	ODA	Contribution	Mitigation	Forestry
UNCCD (United Nations Convention to Combat Desertification)	193	166	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNEP (United Nations Environment Programme)	1,891	1,629	Completed	ODA	Contribution	Mitigation	Designation None
UNFCCC (United Nations Framework Convention on Climate Change)	116	100	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WFP (World Food Programme)	64	64	Ongoing	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	57,913	49,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNFCCC (United Nations Framework Convention on Climate Change)	886	763	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of the 〈Table 2-2〉

〈Table 2-1〉 Financial Support Provided via Multilateral Institutions (2017)

(Exchange rate[2]: 1,130.635/USD)

Multilateral institutions	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	103,675	91,696					
CGIAR (Consultative Group on International Agricultural Research)	290	256	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
GCF (Green Climate Fund)	13,002	11,500	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GEF (Global Environmental Facility)	2,205	1,950	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
ESCAP (United Nations Economic and social Commission for Asia and the Pacific)	348	308	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
FAO (Food and Agriculture Organization of the United Nations)	5,534	4,894	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
GGGI (Global Green Growth Institute)	11,306	10,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IFAD (International Fund for Agricultural Development)	3,019	2,670	Ongoing	ODA	Contribution	Mitigation and Adaptation	All sectors
ITTO (International Tropical Timber Organization)	240	211	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
UN (United Nations)	10,467	9,257	Completed	ODA	Contribution	Mitigation	Forestry
UNCCD (United Nations Convention to Combat Desertification)	193	170	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNEP (United Nations Environment Programme)	782	691	Completed	ODA	Contribution	Mitigation	Designation None
UNFCCC (United Nations Framework Convention on Climate Change)	68	60	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	55,763	49,320	Ongoing	ODA	Contribution	Mitigation and Adaptation	All sectors
UNFCCC (United Nations Framework Convention on Climate Change)	458	404	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of the 〈Table 2-2〉

〈Table 2–2〉 Financial Support Provided through Bilateral, Regional, and Other Channels (2014)

(Exchange rate[2]: KRW 1,053.064/USD)

Nation/Region	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	72,978	69,303					
Grenada	122	116	Completed	ODA	Grant aid	Mitigation and Adaptation	Energy
Nigeria	418	397	Completed	ODA	Grant aid	Cross-cutting	All sectors
Dominican Republic	172	164	Completed	ODA	Grant aid	Cross-cutting	All sectors
Madagascar	388	369	Completed	ODA	Grant aid	Mitigation	Other social infrastructure
Bangladesh	1,176	1,117	Completed	ODA	Grant aid	Adaptation	Forestry
Sudan	228	217	Completed	ODA	Grant aid	Adaptation	Reconstruction
Oceania	527	500	Completed	ODA	Grant aid	Adaptation	General environmental protection
Jordan	317	301	Completed	ODA	Grant aid	Mitigation	All sectors
Uganda	136	129	Completed	ODA	Grant aid	Cross-cutting	All sectors
Peru	223	212	Completed	ODA	Grant aid	Cross-cutting	All sectors
Other regions or multiple nations	6,097	5,790	Completed	ODA	Grant aid	Mitigation and Adaptation	Unclassified
Ghana	356	338	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Laos	501	476	Ongoing	ODA	Grant aid	Cross-cutting	Energy
Mongolia	5,452	5,177	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Vietnam	17,250	16,381	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Bolivia	309	294	Ongoing	ODA	Grant aid	Cross-cutting	Drinking water and sanitation
Solomon Islands	5,265	5,000	Ongoing	ODA	Grant aid	Cross-cutting	Educational
Sri Lanka	361	343	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ecuador	201	191	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ethiopia	4,342	4,123	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Indonesia	6,439	6,114	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
China	250	237	Ongoing	ODA	Grant aid	Cross-cutting	Forestry
Cameroon	2,106	2,000	Ongoing	ODA	Grant aid	Mitigation	Energy
Cambodia	1,470	1,396	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kenya	5,289	5,022	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Colombia	5,432	5,158	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Tanzania	1,472	1,398	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Tunisia	2,106	2,000	Ongoing	ODA	Grant aid	Mitigation	Forestry
Philippines	3,914	3,717	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Other regions	659	626	Ongoing	ODA	Grant aid	Cross-cutting	All sectors

※ The footnote description is at the bottom of the 〈Table 2–2〉

〈Table 2-2〉 Financial Support Provided through Bilateral, Regional, and Other Channels (2015)

(Exchange rate[2]: KRW 1,131.309/USD)

Nation/Region	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	339,564	301,156					
Nigeria	149	132	Completed	ODA	Grant aid	Cross-cutting	All sectors
Dominican Republic	130	115	Completed	ODA	Grant aid	Cross-cutting	All sectors
Mali	526	465	Completed	ODA	Grant aid	Cross-cutting	Forestry
Saint Lucia	223	197	Completed	ODA	Grant aid	Adaptation	General environmental protection
Algeria	284	251	Completed	ODA	Grant aid	Cross-cutting	All sectors
Jordan	246	217	Completed	ODA	Grant aid	Cross-cutting	All sectors
China	250	221	Completed	ODA	Grant aid	Cross-cutting	Forestry
Cuba	527	466	Completed	ODA	Grant aid	Cross-cutting	General environmental protection
Turkmenistan	121	107	Completed	ODA	Grant aid	Mitigation	Energy
Fiji	181	160	Completed	ODA	Grant aid	Cross-cutting	All sectors
Ghana	3,280	2,900	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Guatemala	239	212	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Nepal	880	778	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Laos	116	102	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	60,025	53,058	Ongoing	ODA	Concessional loan	Adaptation	Drinking water and sanitation
Rwanda	3,126	2,763	Ongoing	ODA	Grant aid	Cross-cutting	Forestry
Morocco	4,525	4,000	Ongoing	ODA	Grant aid	Cross-cutting	General environmental protection
Mozambique	5,677	5,018	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Mongolia	4,052	3,582	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Myanmar	3,983	3,521	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	69,349	61,300	Ongoing	ODA	Concessional loan	Adaptation	Drinking water and sanitation
Bangladesh	1,517	1,341	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Vietnam	9,101	8,045	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	87,036	76,934	Ongoing	ODA	Concessional loan	Adaptation	Drinking water and sanitation
Bolivia	329	291	Ongoing	ODA	Grant aid	Adaptation	All sectors
Senegal	5,835	5,158	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Solomon Islands	131	116	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Sri Lanka	542	479	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Sierra Leone	1,131	1,000	Ongoing	ODA	Grant aid	Adaptation	Drinking water and sanitation
Afghanistan	13,123	11,600	Ongoing	ODA	Grant aid	Adaptation	All sectors
Ecuador	284	251	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ethiopia	825	730	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uganda	320	283	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uzbekistan	926	818	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Iraq	119	105	Ongoing	ODA	Grant aid	Cross-cutting	General environmental protection
Indonesia	13,401	11,846	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Cambodia	1,344	1,188	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Colombia	645	570	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Democratic Republic of the Congo	117	104	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Tanzania	3,384	2,991	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Paraguay	7,955	7,032	Ongoing	ODA	Grant aid	Cross-cutting	Forestry
Pakistan	265	234	Ongoing	ODA	Grant aid	Adaptation	All sectors
Peru	4,681	4,138	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Philippines	17,887	15,811	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Other regions or multiple nations	9,426	8,332	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Other regions	1,351	1,194	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
South Sudan	1,131	1,000	Planned	ODA	Grant aid	Adaptation	General environmental protection

※ The footnote description is at the bottom of the 〈Table 2-2〉

〈Table 2–2〉 Financial Support Provided through Bilateral, Regional, and Other Channels (2016)

(Exchange rate[2]: KRW 1,160.589/USD)

Nation/Region	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	272,889	235,130					
Nigeria	284	244	Completed	ODA	Grant aid	Cross-cutting	All sectors
Madagascar	228	197	Completed	ODA	Grant aid	Cross-cutting	All sectors
Mali	1,710	1,473	Completed	ODA	Grant aid	Adaptation	Food aid
Algeria	303	261	Completed	ODA	Grant aid	Cross-cutting	All sectors
Jordan	133	115	Completed	ODA	Grant aid	Cross-cutting	All sectors
Egypt	367	316	Completed	ODA	Grant aid	Cross-cutting	All sectors
China	250	215	Completed	ODA	Grant aid	Mitigation and Adaptation	Forestry
Zimbabwe	278	239	Completed	ODA	Grant aid	Cross-cutting	All sectors
Kazakhstan	1,550	1,335	Completed	ODA	Grant aid	Cross-cutting	All sectors
Cuba	1,710	1,473	Completed	ODA	Grant aid	Adaptation	Food aid
Kyrgyzstan	1,410	1,215	Completed	ODA	Grant aid	Cross-cutting	All sectors
Tanzania	283	244	Completed	ODA	Grant aid	Cross-cutting	All sectors
Fiji	451	389	Completed	ODA	Grant aid	Cross-cutting	All sectors
Asia (not allocated)	4,300	3,705	Completed	ODA	Grant aid	Mitigation and Adaptation	General environmental protection
Ghana	429	370	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Guatemala	331	285	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Nepal	2,838	2,445	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Laos	5,036	4,339	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	66,856	57,605	Planned	ODA	Concessional loan	Adaptation	Drinking water and sanitation
Rwanda	3,649	3,144	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Mongolia	2,152	1,854	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Myanmar	942	812	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Bangladesh	9,255	7,975	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Vietnam	865	746	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Bolivia	299	258	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Senegal	184	158	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Solomon Islands	535	461	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Sri Lanka	1,819	1,567	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Afghanistan	447	385	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ecuador	1,220	1,051	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ethiopia	769	663	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uganda	390	336	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uzbekistan	349	301	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Iraq	248	214	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Indonesia	1,676	1,444	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Cambodia	902	778	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	98,760	85,095	Planned	ODA	Concessional loan	Adaptation	General environmental protection
Kenya	234	202	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Democratic Republic of the Congo	683	588	Ongoing	ODA	Grant aid	Adaptation	All sectors
Thailand	1,027	885	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Paraguay	129	111	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Pakistan	182	157	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Peru	8,492	7,317	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Philippines	2,965	2,555	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Other regions or multiple nations	5,578	4,806	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Other regions	1,651	1,422	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Nicaragua	38,740	33,380	Planned	ODA	Concessional loan	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of the 〈Table 2–2〉

〈Table 2-2〉 Financial Support Provided through Bilateral, Regional, and Other Channels (2017)

(Exchange rate[2]: KRW 1,130.635/USD)

Nation/Region	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Total[6]	235,541	208,328					
Grenada	92	81	Completed	ODA	Grant aid	Mitigation	Energy
Nauru	87	77	Completed	ODA	Grant aid	Cross-cutting	All sectors
Nicaragua	10	9	Completed	ODA	Grant aid	Adaptation	Disaster prevention
	25,906	22,913	Ongoing	ODA	Concessional loan	Cross-cutting	All sectors
Dominican Republic	68	60	Completed	ODA	Grant aid	Cross-cutting	All sectors
East Timor	88	78	Completed	ODA	Grant aid	Cross-cutting	All sectors
Laos	1,026	907	Completed	ODA	Grant aid	Cross-cutting	All sectors
Mali	1,150	1,017	Completed	ODA	Grant aid	Adaptation	Food aid
Mexico	8	7	Completed	ODA	Grant aid	Adaptation	Transportation and warehouse
Montenegro	8	7	Completed	ODA	Grant aid	Adaptation	Transportation and warehouse
Maldives	32	28	Completed	ODA	Grant aid	Mitigation	All sectors
Belarus	26	23	Completed	ODA	Grant aid	Adaptation	Disaster prevention
Belize	10	9	Completed	ODA	Grant aid	Adaptation	Disaster prevention
Bhutan	64	57	Completed	ODA	Grant aid	Cross-cutting	All sectors
Brazil	8	7	Completed	ODA	Grant aid	Adaptation	Transportation and warehouse
Samoa	27	24	Completed	ODA	Grant aid	Adaptation	Drinking water and sanitation
Suriname	8	7	Completed	ODA	Grant aid	Adaptation	Transportation and warehouse
Swaziland	8	7	Completed	ODA	Grant aid	Adaptation	Agriculture
Sierra Leone	19	17	Completed	ODA	Grant aid	Mitigation and Adaptation	Fishery
Asia (not allocated)	7,020	6,209	Completed	ODA	Grant aid	Cross-cutting	General environmental protection
Angola	17	15	Completed	ODA	Grant aid	Mitigation	Mineral resources
Honduras	52	46	Completed	ODA	Grant aid	Adaptation	All sectors
Ukraine	26	23	Completed	ODA	Grant aid	Adaptation	Disaster prevention
Zambia	53	47	Completed	ODA	Grant aid	Mitigation	Educational
Georgia	8	7	Completed	ODA	Grant aid	Adaptation	Transportation and warehouse
China	503	445	Completed	ODA	Grant aid	Mitigation and Adaptation	Forestry
Zimbabwe	53	47	Completed	ODA	Grant aid	Mitigation	Educational
Kazakhstan	862	762	Completed	ODA	Grant aid	Mitigation and Adaptation	Forestry
Cambodia	1,240	1,097	Completed	ODA	Grant aid	Cross-cutting	All sectors
	338	299	Ongoing	ODA	Concessional loan	Mitigation and Adaptation	Drinking water and sanitation
Costa Rica	96	85	Completed	ODA	Grant aid	Adaptation	All sectors
Democratic Republic of the Congo	853	754	Completed	ODA	Grant aid	Cross-cutting	All sectors
Cuba	1,150	1,017	Completed	ODA	Grant aid	Adaptation	Food aid
Kyrgyzstan	1,863	1,647	Completed	ODA	Grant aid	Cross-cutting	All sectors
Kiribati	154	136	Completed	ODA	Grant aid	Cross-cutting	All sectors
Tajikistan	38	34	Completed	ODA	Grant aid	Mitigation and Adaptation	Disaster prevention
Thailand	38	33	Completed	ODA	Grant aid	Cross-cutting	All sectors
Togo	35	31	Completed	ODA	Grant aid	Cross-cutting	All sectors
Tuvalu	27	24	Completed	ODA	Grant aid	Adaptation	Drinking water and sanitation
Tonga	98	87	Completed	ODA	Grant aid	Cross-cutting	All sectors
Panama	29	26	Completed	ODA	Grant aid	Adaptation	Disaster prevention
Papua New Guinea	176	156	Completed	ODA	Grant aid	Cross-cutting	All sectors
Palau	15	13	Completed	ODA	Grant aid	Mitigation and Adaptation	Environmental protection
Fiji	1,203	1,064	Completed	ODA	Grant aid	Cross-cutting	All sectors
Other regions or multiple nations	3,847	3,403	Completed	ODA	Grant aid	Cross-cutting	All sectors
Other regions	859	760	Completed	ODA	Grant aid	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of the 〈Table 2-2〉

Nation/Region	Total amount[3]		Status	Funding sources	Financial instruments	Support type[4]	Sectors[5]
	million KRW	thousand USD					
Ghana	922	815	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Guatemala	735	650	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Nigeria	121	107	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Nepal	2,643	2,337	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Rwanda	4,225	3,737	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Morocco	10,534	9,316	Ongoing	ODA	Grant aid	Adaptation	All sectors
Mozambique	2,616	2,314	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Mongolia	2,784	2,462	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Myanmar	2,979	2,635	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Bangladesh	1,010	894	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Vietnam	5,480	4,847	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	12,331	10,906	Ongoing	ODA	Concessional loan	Adaptation	Drinking water and sanitation
Bolivia	140	124	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	Bolivia	25,000	Planned	ODA	Concessional loan	Adaptation	Drinking water and sanitation
Senegal	2,038	1,803	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Solomon Islands	3,018	2,669	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	35,728	31,600	Planned	ODA	Concessional loan	Mitigation and Adaptation	Energy
Sudan	54	48	Ongoing	ODA	Grant aid	Mitigation and Adaptation	Environmental protection
Sri Lanka	2,316	2,049	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Azerbaijan	104	92	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Afghanistan	1,695	1,499	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Algeria	94	84	Ongoing	ODA	Grant aid	Adaptation	All sectors
Ecuador	1,653	1,462	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ethiopia	3,399	3,007	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
El Salvador	2,731	2,415	Ongoing	ODA	Grant aid	Mitigation and Adaptation	All sectors
Honduras	24,959	22,075	Ongoing	ODA	Concessional loan	Mitigation and Adaptation	Energy
Jordan	252	223	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uganda	312	276	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uzbekistan	474	419	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Iraq	363	321	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Egypt	286	253	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Indonesia	4,397	3,889	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	12,908	11,417	Ongoing	ODA	Concessional loan	Adaptation	Drinking water and sanitation
Cameroon	539	477	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kenya	1,600	1,415	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Colombia	1,120	991	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Tanzania	118	105	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Tunisia	942	833	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Paraguay	1,568	1,387	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Pakistan	741	655	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Peru	775	685	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Philippines	5,592	4,946	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	1,681	1,487	Ongoing	ODA	Concessional loan	Adaptation	Drinking water and sanitation

※ (Source) Export-Import Bank of Korea

1) Climate-related: Financial contribution related to GHG emission reduction and response to climate change
2) Exchange rate: OECD/DAC exchange rate for 20XX
3) Total amount: If the status is "completed" or "ongoing," it refers to an amount spent, and if the status is "planned," it refers to an amount approved
4) Among support types, "cross-cutting" refers to support provided in all areas of mitigation, adaptation, and mitigation and adaptation
5) Sectors: Categorized by applying the OECD classifications including all sectors, energy, environment, drinking water and sanitation, and agriculture and livestock
6) Totals : Total amount spent except for the approved one

3. Capacity Building Support Provided

〈Table 3-1〉 Capacity Building Support Provided (2014)

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted area	Additional Information
28 countries including Azerbaijan, Bhutan, Egypt, UAE and Paraguay	Greenhouse Gas Inventory & Research Center (GIR)	International GHG Expert Training Program	Mitigation	• GHG inventory: Base of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, agriculture, waste, and LULUCF) • GHG mitigation modeling: Basic modeling data, basic statistics and econometrics, projection and mitigation by sector (construction, transport, power generation, industry and agriculture), LEAP model (usage, emissions projection and mitigation scenario analysis) – Small group sessions: Measurement by sector (agriculture, LULUCF, waste and industrial processes), projection and mitigation by sector (building, transport, power generation, and industry)
12 countries including Argentina, Azerbaijan, Cambodia, Congo DR, and Thailand	Greenhouse Gas Inventory & Research Center (GIR)	Cooperative Green Growth Modeling Forum 7th Steering Committee Meeting & 2nd Technical Working Group	Mitigation	• Steering Committee: Present each nation's GHG policy, inventory status, and related issues • Technical Working Group: Present progress report and discuss building and waste sectors
9 countries including Azerbaijan, Bangladesh, Egypt, Peru and Thailand	Greenhouse Gas Inventory & Research Center (GIR)	2014 Cooperative Green Growth Modeling Forum 8th Steering Committee Meeting	Mitigation	• Selected best reports (Nepal and Cambodia) and held discussion for improving the forum
Ghana, Nigeria, East Timor, Laos, Mongolia, Myanmar, Bangladesh, Vietnam, Bolivia, Bulgaria, Yemen, Jordan, Uzbekistan, Egypt, Indonesia, Kyrgyzstan, Cambodia	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 10th International Training Course on Environmental Policy Realizing a Resource Circulating Society through Advanced Waste Management	Mitigation	• Lectures on advanced waste management and field trip to help participating nations establish and announce action plan compatible with their circumstances to pursue system improvement and solutions
South Africa, Libya, Senegal, Sri Lanka, Algeria, Egypt, Indonesia, China, Colombia, Paraguay, Philippines	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 13th & 14th International Specialized Course on Environmental Technology/Water and Sewage Management, Waste Management and Energy Recovery	Mitigation Adaptation	• Capacity building in the areas of waste-to-energy for developing nations' sustainable development, the supply of clean and safe drinking water, wastewater management for sustainable water use
Nepal, Maldives, Mongolia, Bangladesh, Vietnam, Sri Lanka, Indonesia, Cambodia, Thailand, Fiji, Philippines	Korea Adaptation Center for Climate Change (KACCC)/ United Nations Environment Programme (UNEP)	International Training Workshop on Climate Change Adaptation and Evaluation	Adaptation	• Enhancing adaptation capacity with training on the socioeconomic damages suffered by Asia Pacific nations due to climate change, related assessment, and decision-making
Indonesia, Cambodia, Myanmar, Laos	Forest Training Institute of the Korea Forest Service	4th and 5th REDD+ Capacity Building Program	Mitigation Adaptation	• Support training on REDD+ governance and safety system to public officials of countries selected as targets of REDD+ pilot project for capacity building

〈Table 3-1〉 Capacity Building Support Provided (2015)

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted area	Additional Information
26 countries including Bangladesh, Ecuador, Ghana, Jordan and Iran	Greenhouse Gas Inventory & Research Center (GIR)	International GHG Expert Training Program	Mitigation	• GHG inventory: Base of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, agriculture, waste, and LULUCF) • GHG mitigation modeling: Basic modeling data, basic statistics and econometrics, projection and mitigation by sector (construction, transport, power generation, industry and agriculture), LEAP model (usage, emissions projection and mitigation scenario analysis)
8 countries including Argentina, Jordan, Ghana, Kenya, and Nepal	Greenhouse Gas Inventory & Research Center (GIR)	2015 Cooperative Green Growth Modeling Forum 9th Steering Committee Meeting	Mitigation	• Discuss climate damages suffered by each nation, and introduce the related project and ways to use the financial funds of the Green Climate Fund
Laos, Romania, Malaysia, Mongolia, Bangladesh, Vietnam, Bulgaria, Jordan, Ukraine, Egypt, Indonesia, Cambodia, Colombia, Kyrgyzstan, Pakistan, Peru	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 11th International Training Course on Environmental Policy/ Climate Change and Adaptation Policy	Mitigation and Adaptation	• Contribute to the establishment of environmental policies for the sustainable development of participating nations through field trips and lectures on climate change adaptation policy, GHG mitigation status and related policies
Mongolia, Indonesia, Kazakhstan, Colombia, Turkey	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 15th International Specialized Course on Environmental Technology/Korea's Policy and Technology of Natural Gas Vehicle	Mitigation	• Introduce the ROK's natural gas vehicle policy and transfer technology for capacity building aimed at establishing sustainable environmental policies.
Laos, Malaysia, Vietnam, Sri Lanka, Thailand, Philippines	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 16h International Specialized Course on Environmental Technology/Water and Sewage Treatment and Waste Management	Mitigation	• Introduce the ROK's waste, wastewater and waste-to-energy policies, and transfer technology for developing countries' capacity building aimed at establishing sustainable environmental policies
Mongolia, Bangladesh, Vietnam, Sri Lanka, Algeria, Indonesia, China, Kazakhstan, Cambodia, Costa Rica, Colombia, Thailand, Philippines	Korea Environmental Industry & Technology Institute (KEITI) of the Ministry of Environment	Global Environment Scholarship Program (GESP) Master's Program for capacity building in environmental	Various sectors	• The ROK's environmental policy and management, sustainable development and planning, forest resources and ecological restoration, etc.
Guinea, Nepal, Burkina Faso, Cambodia, Comoros, Tuvalu	Korea Adaptation Center for Climate Change (KACCC)/ United Nations Environment Programme (UNEP)	National Training Workshop/Poorest Countries' Adaptation Planning Good Practice for Climate Change	Adaptation	• Introduce theory and tools for establishing the national climate change adaptation plan and share best practices for capacity building
Indonesia, Cambodia, Myanmar, Laos	Forest Training Institute of the Korea Forest Service	6th and 7th REDD+ Capacity Building Program	Mitigation and Adaptation	• Support training on REDD+ governance and safety system to public officials of countries selected as targets of REDD+ pilot project for capacity building

〈Table 3-1〉 Capacity Building Support Provided (2016)

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted area	Additional Information
23 countries including Algeria, Cambodia, Nicaragua, and Uzbekistan	Greenhouse Gas Inventory & Research Center (GIR)	International GHG Expert Training Program	Mitigation	• GHG inventory: Base of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, agriculture, waste, and LULUCF)
8 countries including Cambodia, Malaysia, Mongolia, Pakistan, Thailand	Greenhouse Gas Inventory & Research Center (GIR)	The 10th Cooperative Green Growth Modeling Forum	Mitigation	• Launch of Capacity Building Initiative and joint research on four sectors (power generation, transport, residential and forestry)
39 Non-Annex I nations in Asia-Pacific and Eastern European Regions	Ministry of Environment/ UNFCCC secretariat	The Workshop on the Building Capacity for the Asia-Pacific and Eastern European Regions	Mitigation	• Theory and practical training and introduction of best practices for the establishment of GHG inventory management system and use of the 2006 IPCC Guidelines
South Africa, Mexico, Myanmar, Bangladesh, Vietnam, Algeria, Ethiopia, Indonesia, China, Cambodia, Colombia, Thailand, Philippines	Korea Environmental Industry & Technology Institute (KEITI) of the Ministry of Environment	Global Environment Scholarship Program (GESP) Master's Program for capacity building in environmental	Various sectors	• The ROK's environmental policy and management, sustainable development and planning, forest resources and ecological restoration, etc.
South Africa, East Timor, Laos, Malaysia, Bangladesh, Bulgaria, Jordan, Ukraine, Iran, Indonesia, Chile, Cambodia, Kyrgyzstan, Turkey, Pakistan	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 12th International Training Course on Environmental Policy Resource Recirculation Policy for Sustainable Development	Mitigation	• Share the ROK's experience and knowhow on resource circulating policies to contribute to the participating nations' establishment of environmental policies for sustainable development
Nauru, Nepal, Niue, Marshall Islands, Malaysia, Maldives, Mongolia, Vietnam, Samoa, Sri Lanka, Iran, China, Cook Islands, Tonga, Pakistan, Papua New Guinea, Palau, Fiji, Philippines	Korea Adaptation Center for Climate Change (KACCC)/ United Nations Environment Programme (UNEP)/United Nations Development Programme (UNDP)	Asia-Pacific National Adaptation Plans Training Workshop	Adaptation	• Discuss the success and difficulties of each nation's NAP establishment process and share experience to enhance capacity for NAP establishment
Dominican Republic, Paraguay, Chile, Cambodia, Myanmar, Nepal, Bhutan, India, Trinidad and Tobago	Forest Training Institute of the Korea Forest Service	8th and 9th REDD+ Capacity Building Program	Mitigation and Adaptation	• Support capacity building program to public officials of countries selected as targets of REDD+ pilot project for cooperation and assistance in the area of forestry

〈Table 3-1〉 Capacity Building Support Provided (2017)

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted area	Additional Information
28 countries including Armenia, Bhutan, Chile, Ethiopia, and Papua New Guinea	Greenhouse Gas Inventory & Research Center (GIR)	International GHG Expert Training Program	Mitigation	• GHG inventory: Basics of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, AFOLU, and waste)
8 countries including Jordan, Malaysia, and Azerbaijan	Greenhouse Gas Inventory & Research Center (GIR)	The 11th Cooperative Green Growth Modeling Forum	Mitigation	• Discuss the progress of joint research by sector (power generation, transportation, home, forest) to analyze the necessary areas for capacity building related to GHG inventory and model analysis
6 countries including Bolivia, Ecuador, Egypt, Ghana, Kenya, and South Africa	Greenhouse Gas Inventory & Research Center (GIR)	The 12th Cooperative Green Growth Modeling Forum	Mitigation	• Presentation and discussion of each country's trends and joint research initiatives in the joint research development sectors of countries in Africa and Latin America

4. Abbreviations

BAU	Business-As-Usual
BEMS	Building Energy Management System
BM	Benchmark
BRT	Bus Rapid Transit
CCS	Carbon Capture and Storage
CDM	Clean Development Mechanism
CO_2eq.	Carbon dioxide equivalent
DAC	Development Assistance Committee
EnMS	Energy Management System
EPR	Extended Producer Responsibility
GDP	Gross Domestic Product
GF	Grandfathering
GGGI	Global Green Growth Institute
GNI	Gross National Income
GWP	Global Warming Potential
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
KAU	Korean Allowance Unit
KCU	Korean Credit Unit
KOC	Korean Offset Credit
LULUCF	Land Use, Land-Use Change and Forestry
NDC	Nationally Determined Contributions
NDE	National Designated Entity
ODA	Official Development Assistance
REDD+	Reducing Emissions from Deforestation and forest Degradation
RFS	Renewable Fuel Standard
RPS	Renewable Energy Portfolio Standard
SRF	Solid Refuse Fuel
TOE	Ton of Oil Equivalent
UNEP	United Nations Environment Programme
WMO	World Meteorological Organization

5. Publication Information

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