

Fourth Biennial Update Report of the Republic of Korea

under the United Nations Framework
Convention on Climate Change



Contents

Fourth Biennial Update Report of the Republic of Korea under the United Nations Framework Convention on Climate Change

Executive Summary 06

CHAPTER 1 National Circumstances 08

1. Geography	10
2. Climate	11
3. Population	13
4. Economy	14
5. Institutional and Legal Frameworks	16

CHAPTER 2 National Greenhouse Gas Inventory 20

1. National Greenhouse Gas Inventory System	22
2. Measurement Scope and Method	24
3. Greenhouse Gas Emissions and Trends	26
4. National GHG Inventory Development and System Improvement	32

Chapter 3 Reduction Policies and Measures 36

1. Reduction Target	38
2. Reduction Progress by Sector	39
3. Verification and Assessment of GHG Reduction	41

CHAPTER 4 International Cooperation and Public Awareness of Climate Change 88

1. Financial Support	90
2. Technology Development and Transfer	94
3. Capacity Building	97
4. Enhancement of Public Awareness and Private–Government Cooperation	99

Appendix 102

1. GHG Inventory Details	104
2. Climate-related Financial Support Details	132
3. Capacity Building Support Provided	148
4. Abbreviations	157
5. Publication Information	160





LIST OF TABLES

〈Table 1–1〉	Monthly Mean Temperature and Precipitation (1991–2018)	11
〈Table 1–2〉	No. of Typhoons per year (2016–2018)	12
〈Table 1–3〉	Calculated Potential of New and Renewable Energy	12
〈Table 1–4〉	Gross Domestic Product (GDP) and Economic Growth Rate	15
〈Table 1–5〉	Dependence on Exports and Share of the Manufacturing Sector in the National Economy	15
〈Table 1–6〉	Volume of Exports and Imports and Ratio of Exports and Imports to Gross National Income (GNI)	15
〈Table 1–7〉	ROK's Major Plans on Climate Change	16
〈Table 1–8〉	Five Major Pillars of Carbon Neutrality of LEDS (December 2020)	17
〈Table 2–1〉	Greenhouse Gas Emissions by Sector	27
〈Table 2–2〉	Emissions and Percentage by GHG	30
〈Table 2–3〉	Comparison between National GHG Inventory Management Plans (1 st and 2 nd)	32
〈Table 3–1〉	Progress of 2030 Reduction Target Updates	39
〈Table 3–2〉	Basic Strategy of the Second Basic Plan (Jan 2017)	42
〈Table 3–3〉	Strategy of Operation of Phase III (2021–2025)	43
〈Table 3–4〉	Criteria for Selection of Controlled Entities under GHG & Energy Target Management System	46
〈Table 3–5〉	Key Reduction Policies in the Energy Transition Sector	47
〈Table 3–6〉	Assessment of RPS Target and Achieved Supply of Renewable Energy	48
〈Table 3–7〉	Yearly Generation of New and Renewable Energy and Cumulative Total Supply by Facility	48
〈Table 3–8〉	Direction of Major Reduction Policies for the Industrial Sector	49
〈Table 3–9〉	Direction of Major Reduction Policies for the Buildings Sector	52
〈Table 3–10〉	Details of Criteria for Zero Energy Building Certification	53
〈Table 3–11〉	Performance of Subsidizing Interest Payment for Green Remodeling	54
〈Table 3–12〉	Scope of Participation in Carbon Point Program and Incentive Payment Criteria	55
〈Table 3–13〉	Direction of Major Reduction Policies for the Transportation Sector	56
〈Table 3–14〉	Improvement of Average Automobile Fuel Efficiency in 2018	57
〈Table 3–15〉	Targeted Replacement of Government Runner Ships with Green Ships	59
〈Table 3–16〉	Target for AMP Installation	59
〈Table 3–17〉	2018 Performance, e.g. Development of Public Transportation Network	60
〈Table 3–18〉	Direction of Major Reduction Policies in Waste Sector	61
〈Table 3–19〉	Progress of Delivery of Recycling Obligation	62
〈Table 3–20〉	Direction of Major Reduction Policies in Public and Other Sectors	63
〈Table 3–21〉	Direction of Major Reduction Policies for Agriculture, Stockbreeding and Fisheries Sector	64
〈Table 3–22〉	Progress of Voluntary GHG Reduction Projects in Agriculture and Stockbreeding Sector	65
〈Table 3–23〉	Progress of GHG Reduction Projects by Year	66
〈Table 3–24〉	Direction of Major Reduction Policies for Forest Carbon Sink Sector	67
〈Table 3–25〉	Potential Volume of Forest Carbon Absorption	68
〈Table 3–26〉	Reduction Actions and Performance Index Status	70

〈Table 4-1〉	ROK's ODA Financial Support (2010–2020)	92
〈Table 4-2〉	Climate-Related ODA Financial Support	93
〈Table 4-3〉	EDCF Green Index Components	94
〈Table 4-4〉	Climate Technology and National R&D Investments in 2019	95
〈Table 4-5〉	Climate Technology Cooperation Programs (UNITAR Jeju International Training Center-GTC)	97
〈Table 4-6〉	KEITI Projects for Climate Change Response (approved by International Organizations)	98
〈Table 4-7〉	Comprehensive Environmental Education Plan Areas and Tasks	99

LIST OF TABLES OF APPENDIX

〈Table 1-1〉	GHG Emissions Trends	104
〈Table 1-2〉	2018 Greenhouse Gas Emissions by Sector	114
〈Table 1-3〉	Country-specific Emission and Removal Factors by Sector of National Greenhouse Gas Inventory Application (1990–2018)	119
〈Table 1-4〉	Measurement Guidelines and Emission Factors	122
〈Table 1-5〉	List of Activity Data	126
〈Table 1-6〉	IPCC Good Practice Guidance for LULUCF Annex 3A,2	127
〈Table 1-7〉	Comparison between Reference Approach (RA) and Sectoral Approach (SA)	128
〈Table 1-8〉	Not Estimated Emission Source of National Greenhouse Gas Inventory (1990–2018)	128
〈Table 1-9〉	Major Emission Sources according to the National GHG Inventory Level Assessment	130
〈Table 2-1〉	Financial Support Provided via Multilateral Institutions	132
〈Table 2-2〉	Financial Support Provided through Bilateral, Regional and Other Channels	138
〈Table 3-1〉	Capacity Building Support Provided	148

LIST OF FIGURES

[Figure 1-1]	Geographic Location	10
[Figure 1-2]	Frequency and Intensity of Heat Wave by Year	13
[Figure 1-3]	Total Population and Population Growth Rate	14
[Figure 1-4]	Organization Chart of the 2050 Carbon Neutrality Commission	18
[Figure 2-1]	Organization Chart for National GHG Inventory Development	23
[Figure 2-2]	Trends in National Greenhouse Gas Emissions and Removals (1990–2018)	26
[Figure 2-3]	Greenhouse Gas Emissions per Capita and Estimated Population (1990–2018)	31
[Figure 2-4]	Total GHG Emissions per Real GDP (1990–2018)	31
[Figure 3-1]	2030 National GHG Reduction Target	39
[Figure 3-2]	Progress Tracking and Assessment Mechanism	40
[Figure 3-3]	Trend of Total Volume and Price of Allowances	45
[Figure 4-1]	ROK's ODA Implementation Process	91
[Figure 4-2]	Investment per sub-level area of Climate Technology R&D (2018–2019)	95

Preface



It is a great pleasure to share with the global community the Fourth Biennial Update Report of the Republic of Korea which lays out Korea's efforts and commitments against the threat of ever-intensifying climate crisis.

Under the United Nations Framework Convention on Climate Change (UNFCCC), all parties are requested to submit their national plans that include policies and strategies to reduce greenhouse gas (GHG) emissions. Accordingly, these biennial reports containing efforts and success stories of each party would strengthen our collective response for a sustainable future. The Republic of Korea, as a non-Annex I country, has so far submitted three biennial update reports since 2014. The fourth and latest report embodies Korea's efforts and progress in addressing climate change that encompass updated national GHG inventories and sectoral policies for GHG emissions reduction as well as financial, technical, and capacity-building supports for developing countries.

Looking back on our journey, Korea first declared to go carbon neutral by 2050 in October 2020 and adopted 2050 Carbon Neutral Strategy in December of the same year to materialize its goal. To create a solid foundation toward green transition, the Presidential Committee on Carbon Neutrality was launched in May 2021 and the Framework Act on Carbon Neutrality and Green Growth was enacted in September 2021, becoming the 14th in the world to turn the 2050 net zero commitment into law. Taking a step further, on the occasion of the 26th UNFCCC Conference of the Parties (COP26) held in October at Glasgow, Korea announced its enhanced — and challenging — ambition for 2030 Nationally Determined Contributions (NDC) to reduce our 2030 GHG emissions by 40% compared to 2018 levels, a 14 percentage points increase from the previous commitment.

Korea will spare no efforts in implementing concrete plans to tackle climate crises sector by sector: Coal-fired power plants will be phased out, the use of renewables will be significantly expanded, zero-emission vehicles will be widely disseminated, and green lifestyles will become our ordinary ways of life. Korea will also work with the international community to reduce methane emissions as a signatory to the Global Methane Pledge at COP26, and will increase financial and technical support for developing countries to help turn toward a de-carbonized economy. To fully achieve our NDC, Korea will further enhance carbon sinks through sustainable forest and ecosystem management, develop Carbon Capture, Utilization and Storage (CCUS) technologies, and seek overseas cooperative mitigation projects in accordance with the Article 6 of the Paris Agreement.

Limiting global temperature increase under 1.5°C and achieving carbon neutrality by 2050 is a global pledge that we must keep for our planet through global solidarity and actions. With the submission of the Fourth Biennial Update Report, Korea reaffirms its commitments to join the global coalition in our collective response against the climate crisis to ensure a sustainable future for all.

December 2021

Minister of Environment **Han, Jeoung Ae**





Executive Summary

1. National Circumstances

The terrain of the Republic of Korea (ROK) is mostly mountainous and there are four distinct seasons. The ROK has a population of approximately 52 million (as of 2018), and is 35.6% dependent on exports (as of 2018), with the manufacturing sector accounting for 29% of the nominal Gross Domestic Product (GDP) (as of 2018).

While ROK's social and economic structure is heavily dependent on manufacturing and export, the ROK ratified the Paris Agreement in November 2016 to join the efforts of the international society to respond to climate change, and is endeavoring to address the climate crisis and the great transition to carbon neutrality in a proactive manner.

2. National Greenhouse Gas Inventory

The ROK developed the National GHG Inventory, in accordance with the Intergovernmental Panel on Climate Change (IPCC) Guidelines, for the period extending from 1990 to 2018, covering the areas of Energy, Industrial Processes, Agriculture, Land Use, Land-Use Change and Forestry (LULUCF), and Waste. The Inventory includes the statistics pertaining to carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbon (PFCs) and sulphur hexafluoride (SF₆) as specified by the Kyoto Protocol; the CO₂ equivalent (CO₂eq.) of the substances was calculated using the Global Warming Potential (GWP) of the IPCC Second Assessment Report (SAR).

In 2018, the ROK emitted total 727.6 million tCO₂eq. of GHG, and the net emissions considering the GHG absorbed was 686.3 million tCO₂eq.. Total emissions in 2018 was 2.5% higher than in 2017, driven mainly by production of electricity and heat in the public sector and the increased emissions in the chemicals sector. The increased production of oil raw materials was the cause of the escalated emissions in the chemicals sector. Nevertheless, according to the latest provisional figures released by Ministry of Environment, GHG emissions are expected to have decreased over 2019~2020.

3. Reduction Policy and Measures

In July 2018, the ROK announced the Revised Basic Roadmap to Achieve the National GHG Reduction Target for 2030 (July 2018) for the purpose of facilitating the delivery of the national



GHG reduction target. And the Nationally Determined Contributions (NDC) was updated in December 2020, to reflect the revised absolute reduction target of reducing GHG emissions 24.4% from the total national GHG emissions in 2017, which replaces the original target of reducing GHG emissions 37% below the BAU levels by 2030. In August 2021, the Framework Act on Carbon Neutrality was enacted aiming to reduce GHG emissions by at least 35% from the 2018 level, and accordingly in October 2021, the NDC was updated again with the target of reducing the emissions 40% below the emissions level in 2018 (727.6 MtCO₂eq.).


Separate basic plans are being developed for the respective sectors to set the mid- to long-term goals and directions, and specific systems and measures are utilized to reduce GHG emissions. At the same time, various other policies are being developed: the Renewable Portfolio Standard (RPS) aims to increase the share of new and renewable energy and promote energy transition; Mandatory Energy Efficiency Improvement System and Zero-energy Building Certification are introduced in the industry and the buildings sector; and policies to increase the supply of eco-friendly vehicles and improve the transport system are being developed to support the transportation sector.

4. International Support and Awareness of Climate Change

As a responsible member of the international society, the ROK is striving to meet the Sustainable Development Goals (SDGs), and is aiming to continuously expand the scale of official development assistance (ODA), considering the international standards and the domestic circumstances. The ROK plans to take part in the new climate regime, lead the international discussions on climate change, and pursue quantitative increase and qualitative improvement of ODA in the field of climate and environment. Also, the Seoul Declaration was adopted at the 2021 P4G Seoul Summit, which was hosted by the ROK in 2021, to highlight the importance of global partnerships to achieve the vision of carbon neutrality.

Government agencies including the Greenhouse Gas Inventory and Research Center (GIR) and Ministry of Environment are also operating their respective programs designed for capacity building, so as to support the development of experts in the developing countries in such areas as: developing the GHG inventory, emissions reduction activities to counter deforestation and forest degradation in the developing countries, and adjusting to climate change. Various other stakeholders are also proactively engaging in activities to raise awareness of climate change and to achieve the target of the new climate regime.



An aerial photograph of a coastal facility, likely a port or a large-scale construction site. A prominent feature is a tall, white, cylindrical observation tower with a circular viewing platform at the top. The tower is situated on a rocky, curved peninsula. To the left of the tower, there is a modern, multi-story building with a grey facade and large windows. The building has some Korean text on its side. The surrounding area includes a parking lot, a paved walkway, and some landscaping. The water is a deep blue, and the sky is clear. The overall scene suggests a well-developed and modern coastal infrastructure.

CHAPTER 1

National Circumstances



1. Geography

The Republic of Korea (ROK) is a peninsular state that is located in the northeast end of the Asian Continent. In terms of longitude and latitude, the ROK is located at 33–43 degrees north latitude and 124–132 degrees east longitude. Its gross area is 222,000 km² and is 950 km long from north to south and 540 km long from west to east. The peninsula is divided into north and south with the Military Demarcation Line as the boundary with the ROK accounting for 45% of the gross area at 100,364 km².¹

[Figure 1–1] Geographic Location



Forest land accounts for 63.2%² of the ROK's total area. High mountains are concentrated in the east and north, and are thus dispersed asymmetrically. The topography features slope to the Yellow Sea starting from the mountain ranges in the east of the country which gradually decreases approaching the Yellow Sea. The slope to the East Sea is steep, making tilted topography (tilted block) that leads to the development and distribution of mountainous areas and plain terrains and the distinct flow of rivers.³

The ROK's average altitude above sea level is around 448 m which is considerably lower compared to the overall average of countries in East Asia (910 m) that include Japan, China, Vietnam and some regions of Myanmar. The ROK's mean slope is 5.7° which is around 2° steeper compared to the overall average of the East Asian countries (3.9°).⁴ In summary,

¹ National Land Statistics (Korea Research Institute for Human Settlements, 2021)

² 2015 Basic Forest Statistics (Korea Forest Service, 2016)

³ National Land Statistics (Korea Research Institute for Human Settlements, 2021)

⁴ The National Atlas of Korea (National Geographic Information Institute, 2020)

the Korean Peninsula's altitude above sea level is not high compared to the overall average of the East Asian region, and the higher-than-average slope is contributed by many steep forests.⁵

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 last 28 years (1991–2018), the annual mean⁶ temperature is 12.5°C; the hottest month is August with a mean temperature of 25.1°C, and the coldest month is January with a mean temperature of -1.1°C.

〈Table 1-1〉 Monthly Mean Temperature and Precipitation (1991–2018)

Temp. and Prec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mean Temperature (°C)	-1.1	1.1	6.0	12.1	17.3	21.4	24.7	25.1	20.5	14.2	7.5	1.1
Highest Temperature (°C)	4.2	6.9	12.1	18.6	23.5	26.7	29.0	29.7	25.9	20.7	13.5	6.5
Lowest Temperature (°C)	-5.8	-4.0	0.5	6.0	11.6	16.8	21.3	21.5	16.1	8.9	2.5	-3.6
Precipitation (mm)	24.9	35.1	58.1	91.8	103.7	146.9	294.2	282.9	150.3	61.5	48.0	28.8

※ Source: National Climate Data Center of the Korea Meteorological Administration

In addition, the ROK has seasonally distinctive wind systems with strong northwesterly and southwesterly wind strong in winter and summer respectively, and also distinct sea breeze effects in coastal areas. Humidity ranges from 60% to 75% throughout the country. It is humid in July and August at 70–85%, and relatively dry in March and April at 50–70%. Around 26 typhoons are observed per year in the northwest Pacific that move northward from May to October with 90% of them affecting the ROK from July to September.⁷

⁵ The National Atlas of Korea (National Geographic Information Institute, 2020)

⁶ Based on 62 major regions of mainland excluding island areas

⁷ Korea's Climate Characteristics (National Weather Service of the Korea Meteorological Administration, 2021)



A total 82 typhoons occurred in the northwest Pacific from 2016 to 2018 of which ten typhoons had both direct and indirect impact on the peninsula.⁸ In 2016, Typhoon Chaba, the 18th typhoon of the year in the Pacific, caused damages including flooding of around 3,500 houses. In 2017, Typhoon Noru resulted in sharp water changes in water temperature which ultimately led to a loss in the fishing industry. In 2018, Typhoon Kong-rey led to flooding of the eastern coastal areas in Gyeongsang Province causing two casualties and property damages amounting to KRW 54.9 billion.

〈Table 1–2〉 No. of Typhoons per year (2016–2018)

	2016	2017	2018	Total
Typhoons observed	26	27	29	82
Typhoons that impacted the ROK	2	3	5	10

※ Source: Abnormal Climate Report (Relevant government ministries, 2016–2018)

Considering the ROK’s climate characteristics, photovoltaic has the highest potential among renewable energy sources. Theoretically, solar energy efficiency is high in spring and summer while it is relatively low in autumn and winter.⁹ An analysis of the horizontal global radiation¹⁰ by season indicates that solar radiation in spring and summer is 20% and 25% higher than the annual average respectively while that in autumn and winter is 12% and 33% lower respectively.

〈Table 1–3〉 Calculated Potential of New and Renewable Energy

New and Renewable Energy Sources	Theoretical Potential (GW)	Technical Potential (GW)
Photovoltaic	106,831	1,807
Solar Heat	106,831	4,778
Wind Power (Onshore)	499	352
Wind Power (Offshore)	462	387
Water Power	28	12
Geothermal Heat (Shallow)	22,236	1,256
Geothermal Heat (Deep)	350	3
Ocean Energy	651	147

※ Source: New and Renewable Energy White Paper (Korea Energy Agency, 2018)

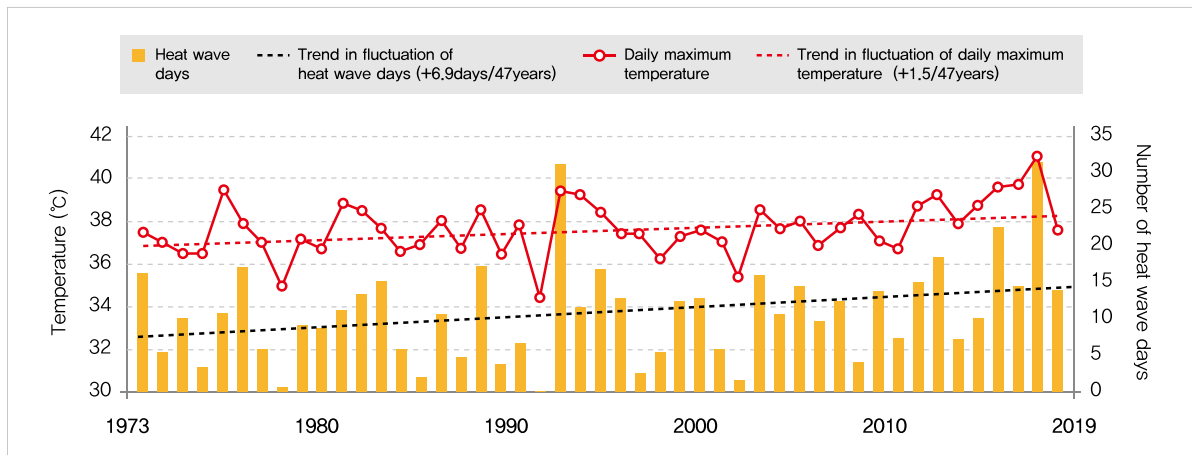
⁸ Abnormal Climate Report (Relevant government ministries, 2016–2018)

⁹ New and Renewable Energy White Paper (Korea Energy Agency, 2018)

¹⁰ Horizontal global radiation: A value resulting from adding the diffuse horizontal irradiance to the horizontal beam irradiance. (Beam radiation: Radiation that directly reaches the horizontal plane from the sun without being absorbed and scattered in vapor or small dust in the air, Diffuse radiation: Radiation that arrives from all directions, except radiation that reaches the Earth directly from the sun)

Due to global warming and increased climate variability over the last decade, the ROK experienced unprecedented abnormal weather. Heat wave grows in intensity as well as frequency every year. As a result, peak power demand in summer set a new record at 85,183 MW in 2016 and broke the record only two years later in 2018 at 92,478 MW. Moreover, heavy rain that falls locally in a short period of time has become frequent while droughts continued for a long term from 2015 to 2017.¹¹

[Figure 1–2] Frequency and Intensity of Heat Wave by Year



※ Source: Heat Wave Impact Report (Korea Environment Institute, 2020)

3. Population

As of 2018, the ROK’s population was approximately 52,000,000. This accounts for around 0.7% of the world’s population, making the ROK the 28th largest country in terms of population. Population density is about 515 people/km² which is the third highest in the world, except city states and small countries, following Bangladesh and Taiwan.¹²

The average annual population growth rate in the ROK was around 3% in the 1960s. However the rate gradually decreased as a result of policies to suppress population growth, leading to a sharp drop to less than 0.5% in 2005. Given these trends, the ROK’s population was 51,781,000 in 2020 and is expected to be 51,927,000 in 2030.¹³

¹¹ Abnormal Climate Report (Relevant government ministries, 2018)

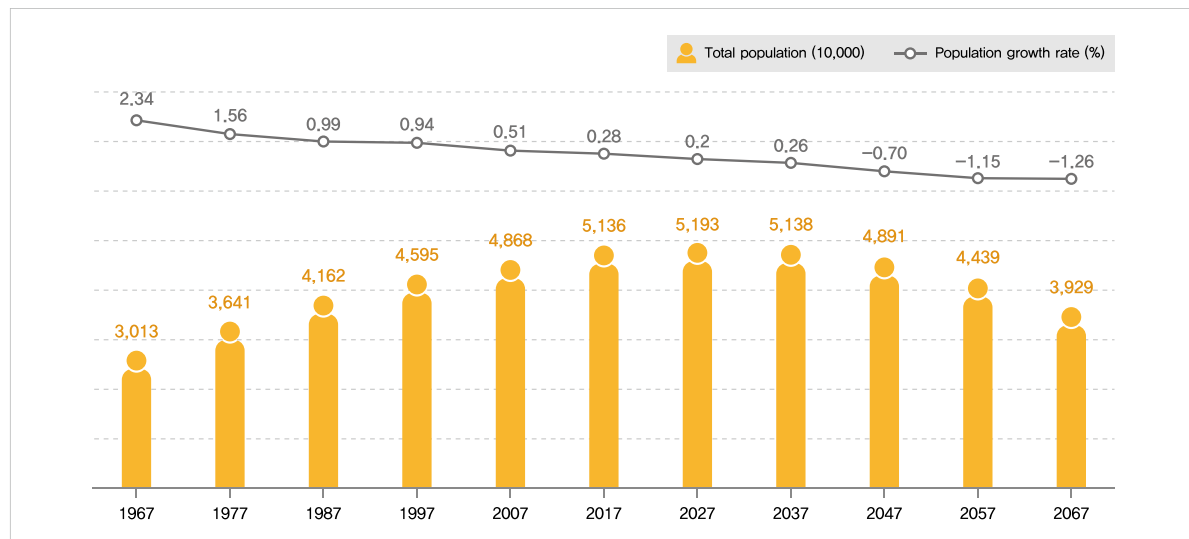
¹² World Population Prospects 2018 Revision, p46 (United Nations, 2018)

¹³ e-Country Indexes (Total population, Population growth rate) (www.index.go.kr)



In terms of age characteristics, the median age increased from 31.8 in 2000 to 42.6 in 2018 while life expectancy increased from 75.6 years (71.7 years for male and 79.2 years for female) in 1999 to 82.7 years (79.7 years for male and 85.7 for female) in 2018. The proportion of the population aged 65 years or over also rose from 7.2% in 2000 to 14.3% in 2018. As such, the ROK is witnessing rapid population aging. As changes in the social and economic structures are forecast such as aging population, an increased number of single-person households and income polarization, there are concerns over more risks to health mainly of population groups with a lack of capacity to adapt to climate change such as the elderly and single-person households.¹⁴

[Figure 1–3] Total Population and Population Growth Rate



※ Source: Korea's Population (Statistics Korea)

4. Economy

The ROK's economy achieved high growth after the 1970s with a swift transition from a primary industry-centered industrial structure to a secondary and tertiary industry-centered structure. Real GDP remained high at an annual average of 8% in the 1980s and more than 7% until the 1998 foreign exchange crisis hit Korea in 1998. Since 2008, the growth rate has fallen to around 3% due to the global economic recession caused by the global financial crisis and European fiscal crisis. In 2018, despite an increase in real GDP contributed by expansion of consumption and exports, it recorded a growth rate of 2.9% which is lower than that in 2017 (3.2%) as investments underwent adjustment. The manufacturing sector grew by 0.9% compared to the previous period that was mainly led by transportation equipment such as automobiles while the construction sector grew by 1.0% led by construction of buildings for non-residential

14 Korea Climate Change Assessment Report (Ministry of Environment, 2020)

use and engineering construction. The service sector grew by 0.6% contributed by the growth of health and social welfare service areas.¹⁵ The ROK posted a nominal GDP of around KRW 1,898 quadrillion in 2018 and was ranked the 12th among 205 countries across the globe.¹⁶

〈Table 1–4〉 Gross Domestic Product (GDP) and Economic Growth Rate

	2014	2015	2016	2017	2018
GDP (KRW 1 trillion) (Nominal GDP)	1,562.9	1,658.0	1,740.8	1,835.7	1,898.2
Economic Growth Rate (%) (Real GDP Growth Rate)	3.2	2.8	2.9	3.2	2.9

※ Source : National Income (Bank of Korea)

While the economy's dependence on the manufacturing sector and exports recently decreased after a steady increase from 1990 to 2011, they still play a significant role in the national economy. As of 2018, the manufacturing sector accounted for 29% of the nominal GDP and the ROK's dependence on exports reached 35.06%.¹⁷

〈Table 1–5〉 Dependence on Exports and Share of the Manufacturing Sector in the National Economy

	1990	2010	2012	2013	2014	2015	2016	2017	2018
Export Dependence (%)	22.95	40.77	42.87	40.83	38.59	35.95	33.03	35.34	35.06
Share of Manufacturing (%)	27.7	30.2	30.5	30.3	29.5	29.0	28.8	29.5	29.1

※ Source: GDP per Economic Activity (Statistics Korea)

The ROK has promoted export-led economic growth since its initial development. As a result, both exports and imports have expanded rapidly with its need for raw materials and capital goods. The ROK's ratio of imports and exports to Gross National Income (GNI) was 82.5% in 2018 which is relatively high compared to other countries.^{18 19}

〈Table 1–6〉 Volume of Exports and Imports and Ratio of Exports and Imports to Gross National Income (GNI)

	1997	1998	2000	2010	2015	2017	2018
Exports (KRW 100 billion)	1,954.2	5,289.9	5,975.0	6,506.9	6,860.8	6,149.6	5,812.8
Imports (KRW 100 billion)	1,820.4	4,822.6	4,950.8	5,427.1	6,070.2	5,708.4	5,303.5
Per capita real GNI (KRW 10 thousand)	1,853	1,699	1,972	2,808	3,260	3,493	3,531
Ratio of exports and imports to GNI (%)	59.8	72.8	69.8	95.4	82.0	80.2	82.5

* USD exchange rate of KRW 1,134.20

※ Source: Exports and Imports (Ministry of Trade, Industry and Energy)

15 Annual Gross National Income and 4th Quarter of 2018 (Bank of Korea, 2019)

16 World Bank (WB)

17 Trade Dependence (Statistics Korea)

18 Export- and Import-to-GDP Ratio (National Index System)

19 The ratio of exports and imports to GNI of major countries is 36.5%(US), 43.8%(Japan), and 75.9%(France).



5. Institutional and Legal Frameworks

The ROK enacted the Framework Act on Low Carbon, Green Growth in January 2010 to build a foundation needed for green growth using green technologies with green industries as new growth drivers with the goal of realizing a low carbon society. Every five years, Korea establishes the Energy Master Plan (August 2008), the Five Year Plan on Green Growth (July 2009), and the Climate Change Response Master Plan (December 2016) as well as plans in line with the national GHG reduction goal that is stipulated in the aforementioned Act that form the basis of climate and energy policies.

(Table 1–7) ROK’s Major Plans on Climate Change

	Overview	Establishment Cycle
Energy Master Plan (August 2008)	<ul style="list-style-type: none">– Presents the philosophy, vision, goals and implementation strategies of the mid- to long-term energy policy– Presents the principles and direction of an energy plan by source and by sub-sector to make adjustments from a macroscopic perspective	Established and implemented every five years with a plan period of the next 20 years
Five Year Plan on Green Growth (July 2009)	<ul style="list-style-type: none">– Aims to efficiently and systematically implement the National Strategy for Green Growth with the initial plan started in 2009	Established and implemented every five years
Climate Change Response Master Plan (December 2016)	<ul style="list-style-type: none">– Aims to achieve GHG reduction goal with regulations, markets and technologies to actively take part in global efforts to respond to climate change	Established and implemented every five years

In accordance with reform of the climate change response system in 2016, the Office for Government Policy Coordination sets a reduction target by sub-sector based on the national GHG reduction goal in collaboration with relevant government ministries. The Office also develops necessary policies and reduction measures as well as an implementation plan after collecting stakeholder opinions. In accordance with the United Nations Framework Convention on Climate Change (UNFCCC), the National Communication and Biennial Update Report are prepared by the Greenhouse Gas Inventory and Research Center (GIR) under the Ministry of Environment with relevant government ministries. Reports are submitted to the international community after an evaluation by the Presidential Committee on Green Growth²⁰ affiliated with the Prime Minister (Office for Government Policy Coordination).

To actively participate in the international community’s efforts to respond to climate change under the Paris Agreement, the ROK submitted Intended Nationally Determined Contributions (INDCs) in June 2015 that included the GHG reduction target of 37% below

²⁰ Affiliated with the Prime Minister, the Committee evaluates major policies, plans and implementation related to low-carbon and green growth. In May 2021, it was integrated with the National Council on Climate Change and Air Quality and Special Commission on Fine Dust to become the 2050 Carbon Neutrality Commission.

BAU level by 2030 before the conclusion of the Agreement. In 2018, it announced the Amendment to the Roadmap to Achieve National GHG Reduction Target for 2030 in July, 2018 (2030 Roadmap Amendment) that states strengthened reduction responsibilities of the ROK and less use of overseas reduction.

In December 2019, the ROK partially amended the Enforcement Decree of the Framework Act on Low Carbon, Green Growth to change the GHG reduction target-setting method from the previous BAU method to an absolute quantity method, and finalized its national GHG reduction target for 2030 which is a reduction of 24.4% from the 2017 level.

The ROK established the 2050 Carbon Neutral Strategy in December 2020 jointly by relevant government ministries as well as the 2030 Nationally Determined Contribution (NDC) and 2050 Long-term low greenhouse gas Emission Development Strategy (LEDS) to actively respond to the climate crisis and to the era of great transition to carbon neutrality.

〈Table 1-8〉 Five Major Pillars of Carbon Neutrality of LEDS (December 2020)

	Details
① Increase use of clean electric power and hydrogen	<ul style="list-style-type: none"> – (Industry) Fossil fuel → Electric power and Hydrogen²¹ – (Transportation) Internal combustion engine → Eco-friendly vehicles and vessels – (Building) City gas → Electrification
② Improve innovative energy efficiency in connection with digital technologies	<ul style="list-style-type: none"> – (Industry) Increased supply of highly efficient equipment, factory energy management systems, and build smart green industrial complexes – (Transportation) Intelligent transportation system (C-ITS), autonomous driving vehicles (car accidents ↓, efficiency ↑), drone cabs – (Building) Existing buildings → Green remodeling, new buildings → zero energy buildings, LED lighting, highly efficient appliances
③ Facilitate the development and commercialization of carbon-free future technologies	<ul style="list-style-type: none"> – (Future technologies) Steel → hydrogen direct reduction steelmaking / petrochemicals → innovative materials, bioplastics / electric power → CCUS
④ Promote sustainable industrial innovation and circular economy (Input of raw material and fuel ↓)	<ul style="list-style-type: none"> – Maximized recycling, reuse of raw materials (scrap metals, plastic wastes, used concretes) and minimized energy input
⑤ Strengthen carbon sink functions of Nature and ecology including forests, mud flats and wetlands	<ul style="list-style-type: none"> – Increased afforestation of idle land (mud flats, wetlands, urban forests), facilitate forest management (forest age ↓, lumber use ↑)

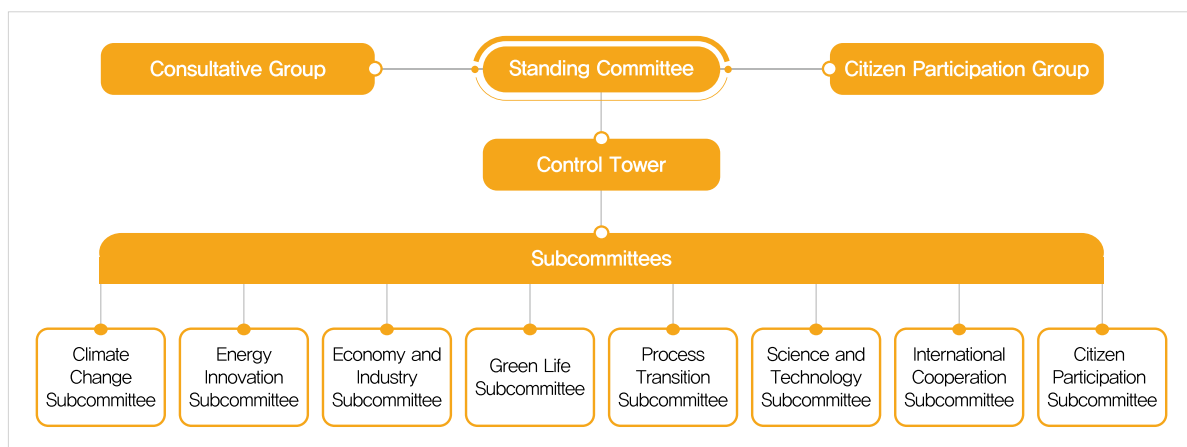
※ Source: ROK's NDC and LEDS (Ministry of Foreign Affairs, 2020)

²¹ The Hydrogen Economy Roadmap (January 2019) recognizes the hydrogen economy as the new growth engine of innovative growth and a driver of eco-friendly energy. It contains policy directions and goals as well as implementation strategies to promote the hydrogen economy by 2040. The Roadmap mainly covers ① production of 6.2 million hydrogen vehicles and construction of 1,200 hydrogen charging stations, ② supply of 15GW fuel cells for power generation, and 2.1GW for household and building use, ③ supply of green hydrogen of 5.26 million ton/year and price of KRW 3,000/kg, ④ stable and economically-feasible hydrogen distribution system, and ⑤ a full-cycle safety management system and a hydrogen industry ecosystem.



The 2050 Carbon Neutrality Commission was created in May 2021 as an executive body to facilitate the shift to a carbon neutral society in all areas of industry, economy and society. It is a presidential organization that serves as a control tower of the ROK's carbon neutrality policies. Eight joint private–government committees (Climate Change, Energy Innovation, Economy and Industry, Green Life, Process Transition, Science and Technology, International Cooperation, Citizen Participation) that consist of 18 leaders from central administrative agencies, industrial sector and civil society performing the pivotal role of evaluation and coordination of policies for carbon neutrality.

[Figure 1–4] Organization Chart of the 2050 Carbon Neutrality Commission

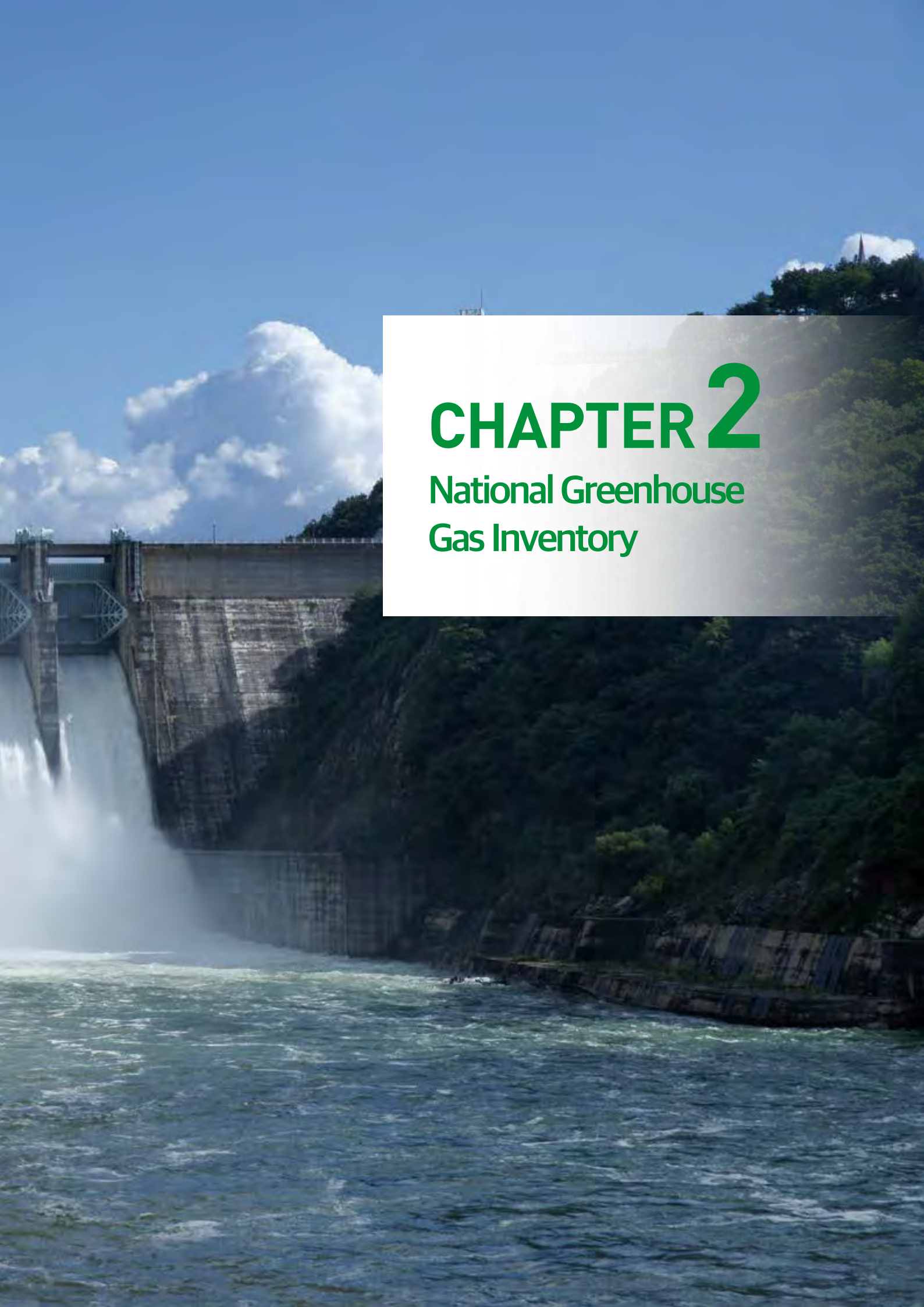


In addition, the Framework Act on Carbon Neutrality, Green Growth to Counter the Climate Crisis (Framework Act on Carbon Neutrality) was enacted in August 2021 as a legal foundation to respond to the climate crisis and to achieve carbon neutrality by 2050²². The Act stipulates 2050 carbon neutrality as the nation's vision, and in order to achieve its vision, has systematized legal processes that includes development of national strategies, mid- to long-term GHG reduction goals, basic plan and examination of implementation progress. By doing so, the ROK has become the 14th country that has legislated the 2050 carbon neutrality vision and implementation system. It also has stipulated in the law that the reduction target for 2030 in social discussions shall be at least 35% which is 9%p higher than the previously set goal²³.

²² The previous Framework Act on Low Carbon, Green Growth was abolished and replaced with the Framework Act on Carbon Neutrality.

²³ Considering that the 2030 target becomes 37.5% based on the assumption that a linear reduction is made from 2018 to 2050, 35% reduction target indicates that the ROK practically aims to achieve 2050 carbon neutrality.





CHAPTER 2

National Greenhouse Gas Inventory



1. National Greenhouse Gas Inventory System

1.1 Organizational System

The ROK government has launched the GIR under the Ministry of Environment to build and manage a comprehensive management system of GHG data that includes the volume and factors of national GHG emissions and removal as well as statistics²⁴. GIR plays the role of (1) establishing the Regulations on the Management of the National GHG Inventory (March 2018); (2) providing Guidelines for Measurement (Monitoring), Reporting, and Verification (MRV Guidelines) for calculation of the inventory; (3) reviewing 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) aggregating and preparing the national inventory; and (6) developing and operating the IT system for data management.

Government ministries²⁵ from five sectors subject to GHG inventory measurement oversee the management of the GHG inventory. A measurement agency²⁶ with expertise in the field of GHG inventory of the relevant sector to which a ministry delegates measurement of emissions in that particular sector as well as development of emissions and removal factors prepares the draft inventory which is then reviewed by the ministry and submitted to GIR.

The Technical Group is a technical advisor in relation to the Measurement (Monitoring), Reporting, and Verification (MRV) of the national GHG inventory and country-specific emission and removal factors which consists of external experts from academia and research institutes. The Working Group facilitates discussions with responsible ministries and relevant organizations with respect to the MRV of the national GHG inventory, development and verification of emission and removal factors and enactment as well as revision of relevant guidelines. The Working Group is chaired by the president of GIR and consists of director-level government officials from relevant ministries and organizations per sector such as Statistics Korea (KOSTAT) and the Korea Forest Service (KFS).

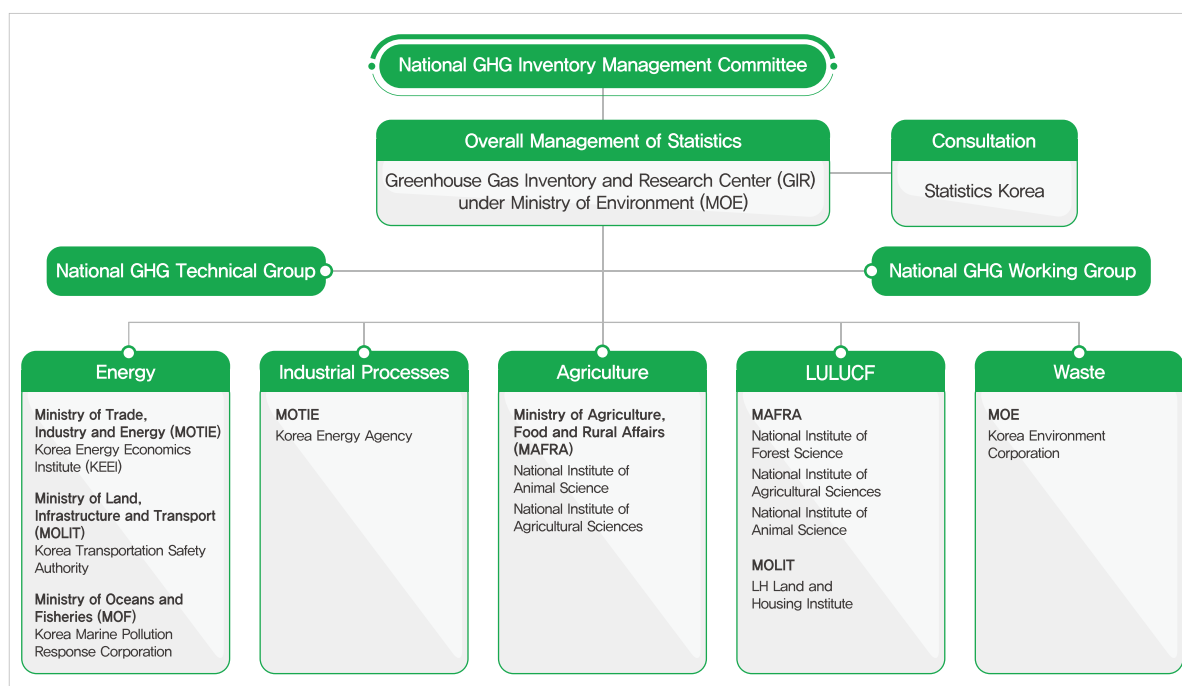
²⁴ Article 45 of the Framework Act on Low Carbon, Green Growth and Article 36 of the Enforcement Decree of the Act

²⁵ Ministries responsible for each sector 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), Ministry of Land, Infrastructure and Transport (settlements, other land); and (5) Waste: Ministry of Environment

²⁶ (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 a decision-making body that finalizes the national GHG inventory and country-specific emission and removal factors submitted after consultation of the Working Group. The Management Committee is chaired by a Vice Minister of Environment and consists of no more than 15 members which include director general-level officials from ministries and Statistics Korea, and for appointed members, experts from academia and the public sector.

[Figure 2-1] Organization Chart for National GHG Inventory Development



1.2 Preparation Process

To enhance transparency and accuracy of the national GHG inventory, the measurement and verification process of the inventory has been segregated. Review and evaluation are performed in phases by the Working Group and Management Committee respectively in order to finalize emissions volume.

– Measurement and Reporting

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



– Verification

After collecting draft reports on the inventory submitted by ministries, GIR reviews and verifies measurement methodology, activity data and the appropriateness of emission and removal factors to identify any errors in the emission calculations of subcategories. GIR requests ministries to revise and correct their drafts for improvement identified during the verification process. GIR prepares a final draft after confirmation of the inventory drafts revised by the ministries.

– Final Confirmation and Publication

GIR hosts Working Group meetings for the review of the final draft of the inventory revised for each sector. The national GHG inventory is confirmed through the final evaluation of the Management Committee by December. Afterwards, GIR publishes the approved national GHG inventory through several platforms including its website (www.gir.go.kr).

2. Measurement Scope and Method

2.1 Scope of Greenhouse Gases

The ROK's national GHG inventory includes anthropogenic emissions and removals of GHGs defined by the Kyoto Protocol, namely carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆). Since greenhouse gases have different levels of heat dissipation for the residency period in the atmosphere, the national total emissions are expressed with Carbon Dioxide Equivalent (CO₂eq.) calculated using the Global Warming Potential (GWP)²⁷ for the purpose of understanding and comparing the emissions level between gases. The ROK calculated CO₂eq. of CH₄, N₂O, HFCs, PFCs and SF₆ 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 prepares GHG statistics for Energy, Industrial Processes, Agriculture, Land Use, Land–Use Change and Forestry (LULUCF) and Waste sectors in accordance with the IPCC Guidelines. The report of the national GHG inventory published so far covers 29 years from 1990 to 2018.

²⁷ Based on CO₂ influence on global warming, the level of influence of each greenhouse gas is indicated in figures. In other words, this index is of warming effects per unit mass. It applies the 100–year GWPs presented in the IPCC Second Assessment Report.

2.3 Measurement Methodology

The national GHG inventory was primarily prepared based on the 1996 IPCC Guidelines. However the ROK applied the 2000 IPCC Good Practice Guidance (IPCC GPG 2000), 2003 IPCC Good Practice Guidance for LULUCF (IPCC GPG LULUCF) and 2006 IPCC Guidelines to some categories. The IPCC GPG 2000 was applied to ① Civil Aviation in the Energy sector and ② Landfills, Wastewater Treatment and Waste Incineration in the Waste sector while the IPCC GPG LULUCF and 2006 IPCC Guidelines were applied to the LULUCF sector. The 2006 Guidelines were also applied to the sub-sectors of ① fugitive emissions from natural gas in the Energy sector, ② semiconductor and LCD manufacturing and heavy electric equipment in the Industrial Processes sector, ③ rice cultivation and agricultural soil management in the Agriculture sector, ④ above-ground biomass of forest land and wetlands in the LULUCF sector and ⑤ others in the Waste sector.

The ROK continues to develop country-specific emission and removal factors to ensure the accuracy of the inventory. The use of country-specific emission factors is determined through MRV processes similar to the processes for the national GHG inventory. Emission factors surveyed and analyzed by research institutes are submitted to GIR through respective ministries which are then reviewed by GIR's verification team consisting of experts in the Technical Group and internal experts for the appropriateness of development method, representativeness of factors and accuracy of measurement and analysis. The country-specific emission factors are confirmed after verification by the Working Group and evaluation by the Management Committee.

Measurements are based on 71 country-specific emission factors. Emissions measured by applying such factors accounted for approximately 88.8% of national total emissions. Country-specific emission factors are applied to the sub-sectors of ① fuel combustion and fugitive emissions in Energy (33 factors), ② cement production in Industrial Processes (1 factor), ③ rice cultivation and agriculture soil in Agriculture (13 factors), ④ forest land in LULUCF (6 factors) and ⑤ landfills, wastewater treatment and waste incineration in Waste (18 factors).

Emissions of sub-sectors not estimated with country-specific emission factors are mostly calculated through default emission factors in the 1996 IPCC Guidelines whereas factors in the 2006 IPCC Guidelines are applied to a number of sub-sectors. Default factors of the 2006 IPCC Guidelines are applied to the categories of ① refinery gas of fuel combustion, LPG fuel and fugitive emissions from oil and natural gas in the Energy sector, ② nitric acid production, semiconductor and LCD manufacturing and heavy electric equipment in the



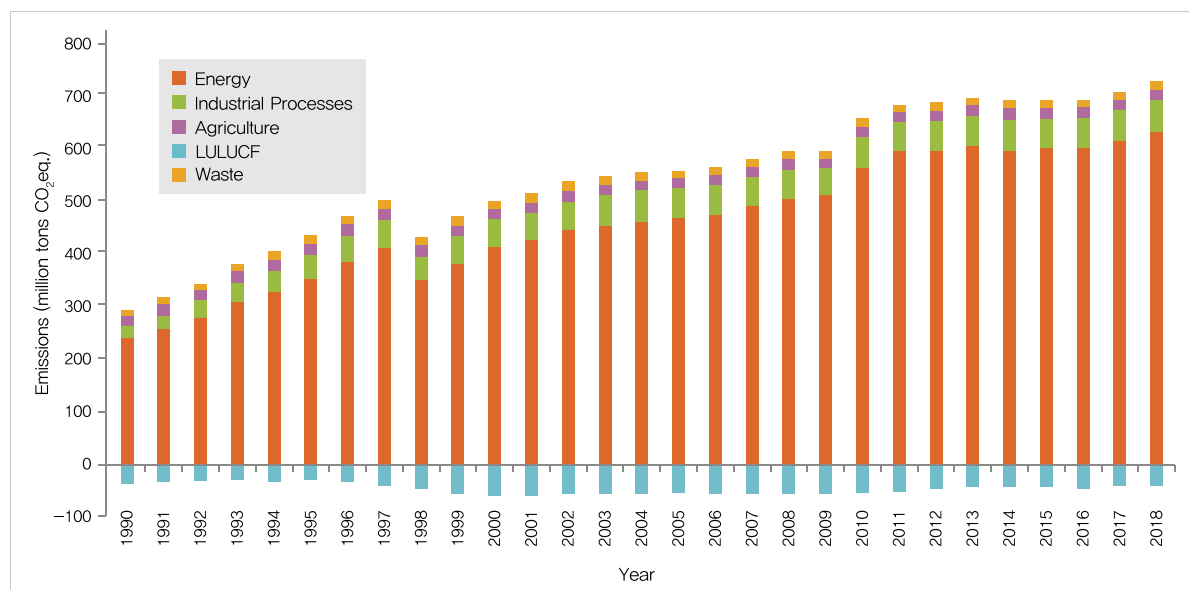
Industrial Processes sector, ③ agriculture soil in the Agriculture sector, ④ forest land and wetlands in the LULUCF sector and ⑤ others in the Waste sector.

Activity data used when measuring the national GHG inventory are from diverse sources including official national statistics announced by government agencies and public organizations, materials provided by relevant associations, statistics of target management system and emissions trading system business sites as well as materials released by Statistics Korea. In case of use of materials as activity data that are not from official sources, the ROK enhances inventory accuracy by verifying its original source.

3. Greenhouse Gas Emissions and Trends

In 2018, total GHG emissions in the ROK were 727.6 million tCO₂eq. and net emissions including sinks were 686.3 million tCO₂eq. Total emissions in 2018 increased by 2.5% compared with 2017. The biggest contributor to emissions growth in 2018 was the energy sector²⁸ which accounted for the largest share of national emissions. Emissions in the energy sector increased by 16.7 million tCO₂eq. compared to 2017 which is attributable to increased emissions from public electric power and heat production as well as the chemical industry. Increased emissions in the public electric power and heat production field were triggered by a rise in natural gas power generation that resulted from greater electric power demand. Increased emissions in the chemical industry are attributable to a rise in production of basic oil products (ethylene, propylene, butadiene, benzene, toluene and xylene).

[Figure 2–2] Trends in National Greenhouse Gas Emissions and Removals (1990–2018)



²⁸ Energy sector accounts for around 86.9% of national total emissions in 2018.

Looking at the trend of total GHG emissions of the ROK in recent years, emissions increased by an annual average of 1.3% from 2010 to 2018. Total GHG emissions dropped by 0.8% in 2014 from 2013 which is the first reduction that the ROK observed except for a foreign exchange crisis year in 1998. Increased emissions in the energy sector resulted in a 2.5% rise in 2018 from 2017 in total emissions.

According to the latest tentative emissions released by the Ministry of Environment (GIR), GHG emissions are expected to peak in 2018 and decline for two consecutive years in 2019 and 2020. It is assumed that emissions will drop as a result of reduced coal thermal power generation that is attributable to fine dust and climate change response policies, increased new and renewable energy power generation, refrained traveling and transport due to COVID-19 and effects of reduction policies including expanded supply of low-emission vehicles.

〈Table 2-1〉 Greenhouse Gas Emissions by Sector

(Unit: Million tCO₂eq.)

Sectors	2010	2014	2015	2016	2017	2018	Emissions Proportion by Sector in 2018 (%)	Compared to 2017 (%)
Total Emissions (excluding LULUCF)	656.3	691.9	692.5	693.5	709.7	727.6	100	2.5
Net Emissions (including LULUCF)	602.5	648.7	648.2	648.0	668.3	686.3	—	2.7
Energy	566.1	597.4	600.7	602.7	615.7	632.4	86.9	2.7
Industrial Processes	53.0	57.5	54.3	53.2	55.9	57.0	7.8	1.9
Agriculture	22.1	21.4	21.0	20.8	21.0	21.2	2.9	1.1
LULUCF	-53.8	-43.3	-44.4	-45.6	-41.5	-41.3	-5.7	-0.5
Waste	15.2	15.6	16.6	16.8	17.2	17.1	2.4	-0.7

3.1 Emission and Removal by Sector

From 2016 to 2018, total GHG emissions in the energy sector recorded 602.7 million tCO₂eq., 615.7 million tCO₂eq. and 632.4 million tCO₂eq. respectively, accounting for 86.9% of total national GHG emissions in 2018. The trend of emissions indicates that total emissions in the energy sector shrank for the first time in 2014 after the 1998 foreign exchange crisis to post a year-on-year decrease of 1.3%. However GHG emissions in the energy sector recorded year-on-year growth of 0.3%, 2.2% and 2.7% respectively from 2016 to 2018.



Total GHG emissions in the industrial processes sector were 53.2 million tCO₂eq. in 2016, 55.9 million tCO₂eq. in 2017 and 57.0 million tCO₂eq. in 2018 which account for 7.8% of total national emissions in 2018. Emissions mainly increased in fluorinated greenhouse gas consumption that indicated a rise of 16.9% in 2017 from 2016 to record 2.6 million tCO₂eq., and an increase of 14.1% in 2018 from 2017, recording 2.6 million tCO₂eq. The year-on-year change from 2016 to 2018 in the industrial processes sector was -1.9%, 5.1%, and 1.9% respectively.

Total GHG emissions in the agriculture sector were 20.8 million tCO₂eq. in 2016, 21.0 million tCO₂eq. in 2017 and 21.2 million tCO₂eq. in 2018 which account for 2.9% of total national emissions in 2018. The plowing and sowing sub-sector recorded lower emissions owing to reduced rice cultivation area while the livestock sub-sector posted greater emissions which was attributable to a rise in the number of livestock as an outcome of increased meat consumption. The year-on-year GHG change in the agriculture sector was -0.8%, 0.7% and 1.1% respectively in 2016, 2017 and 2018.

The net GHG removal in the LULUCF sector was -45.6 million tCO₂eq. in 2016, -41.5 million tCO₂eq. in 2017 and -41.3 million tCO₂eq. in 2018. Net removal of the LULUCF sector dropped by 8.9% in 2017 from 2016 and 0.5% in 2018 from 2017. This is attributable to reduced forest area that accounts for 99.2% of net removal and a decrease in growth of forest trees of biomass caused by sluggish growth of forest trees.

Total GHG emissions in the waste sector were 16.8 million tCO₂eq. in 2016, 17.2 million tCO₂eq. in 2017 and 17.1 million tCO₂eq. in 2018 to take up 2.4% of total national emissions in 2018. In 2017, emissions increased by 2.2% over the previous year due to reduced methane collection in the landfill sub-sector. Total emissions in the waste sector decreased in 2018 as a result of a reduction in construction waste incineration and industrial wastewater treatment. The year-on-year GHG change in the waste sector was 1.7%, 2.2% and -0.7% respectively in 2016, 2017 and 2018.

3.2 Trends of Emission and Removal by GHG

Total emissions of CO₂ (excluding LULUCF) reached 637.4 million tCO₂eq. in 2016, 650.2 million tCO₂eq. in 2017 and 664.7 million tCO₂eq. in 2018 which account for 91% of total national GHG emissions in 2018. The year-on-year change in CO₂ emissions was 0.5%, 2.0% and 2.2% respectively in 2016, 2017 and 2018. Most of CO₂ emissions were observed in the energy sector.

Total emissions of CH₄ (excluding LULUCF) were 27.0 million tCO₂eq. in 2016, 27.4 million tCO₂eq. in 2017 and 27.7 million tCO₂eq. in 2018 which account for 3.8% of total national GHG emissions in 2018. The year-on-year change in CH₄ emissions was 0.3%, 1.5% and 1.1% respectively in 2016, 2017 and 2018. CH₄ emissions in the agriculture sector take up 44% of total CH₄ emissions.

Total emissions of N₂O (excluding LULUCF) were 13.5 million tCO₂eq. in 2016, 13.9 million tCO₂eq. in 2017 and 14.4 million tCO₂eq. in 2018 which account for 2% of total national GHG emissions in 2018. The year-on-year change in N₂O emissions was -0.1%, 2.8% and 3.5% respectively in 2016, 2017 and 2018. N₂O emissions in the agriculture sector take up around 63% of total N₂O emissions.

Emissions of HFCs, PFCs and SF₆, which are fluorinated greenhouse gases, are produced in the industrial processes sector. Total emissions of HFCs were 7.4 million tCO₂eq. in 2016, 9.6 million tCO₂eq. in 2017 and 9.3 million tCO₂eq. in 2018 which account for 1.3% of total national emissions in 2018. The year-on-year change in HFCs emissions was -7.1%, 31.0% and -3.6% respectively in 2016, 2017 and 2018. Total emissions of PFCs were 1.5 million tCO₂eq. in 2016, 2.1 million tCO₂eq. in 2017 and 3.2 million tCO₂eq. in 2018 to take up 0.4% of total national emissions in 2018. The year-on-year change in PFCs emissions was -2.1%, 42.5% and 49.8% respectively in 2016, 2017 and 2018. Total emissions of SF₆ were 6.8 million tCO₂eq. in 2016, 6.5 million tCO₂eq. in 2017 and 8.4 million tCO₂eq. in 2018 which account for 1.2% of total national emissions in 2018. The year-on-year change in SF₆ emissions was -17.7%, -4.3% and 28.1% respectively in 2016, 2017 and 2018.



<Table 2–2> Emissions and Percentage by GHG

(Unit: Million tCO₂eq.)

GHGs		2010	2014	2015	2016	2017	2018	Compared to 2017 (%)
Total Emissions (excluding LULUCF)		656.3	691.9	692.5	693.5	709.7	727.6	2.5
CO ₂	Total Emissions	595.3	629.9	634.3	637.4	650.2	664.7	2.2
	Share (%)	90.7	91.0	91.6	91.9	91.6	91.4	
CH ₄	Total Emissions	27.6	27.1	26.9	27.0	27.4	27.7	1.0
	Share (%)	4.2	3.9	3.9	3.9	3.9	3.8	
N ₂ O	Total Emissions	13.0	13.6	13.5	13.5	13.9	14.4	3.5
	Share (%)	2.0	2.0	2.0	1.9	2.0	2.0	
HFCs	Total Emissions	8.1	8.5	7.9	7.4	9.6	9.3	-3.6
	Share (%)	1.2	1.2	1.1	1.1	1.4	1.3	
PFCs	Total Emissions	2.3	2.4	1.5	1.5	2.1	3.2	49.8
	Share (%)	0.3	0.4	0.2	0.2	0.3	0.4	
SF ₆	Total Emissions	10.1	10.4	8.3	6.8	6.5	8.4	28.1
	Share (%)	1.5	1.5	1.2	1.0	0.9	1.2	

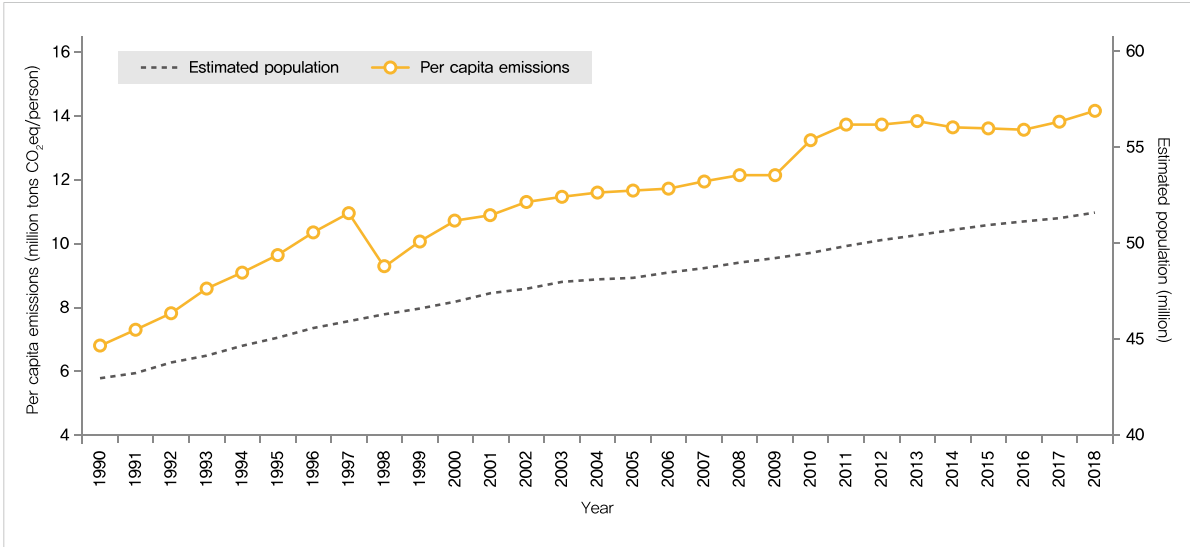
3.3 Trends of Emissions per Capita and GDP

– Greenhouse Gas Emissions per Capita

In 2018, the ROK's total greenhouse gas emissions per capita amounted to 14.1 tCO₂eq., indicating an increase of 106.9% from 1990. Such increase was caused by a more rapid increase in GHG emissions than population growth due to industrial development. The rate of increase in GHG emissions from 1990 to 2018 was 149.0% which is significantly higher than the population growth of 20.4% in the same period.

Per capita GHG emissions were 13.7 tCO₂eq. in 2012 and declined for the first time over the previous year except for the foreign exchange crisis year in 1998. The figure maintained a downward trend afterwards through 2016 but went up in 2017 and onwards.

[Figure 2–3] Greenhouse Gas Emissions per Capita and Estimated Population (1990–2018)

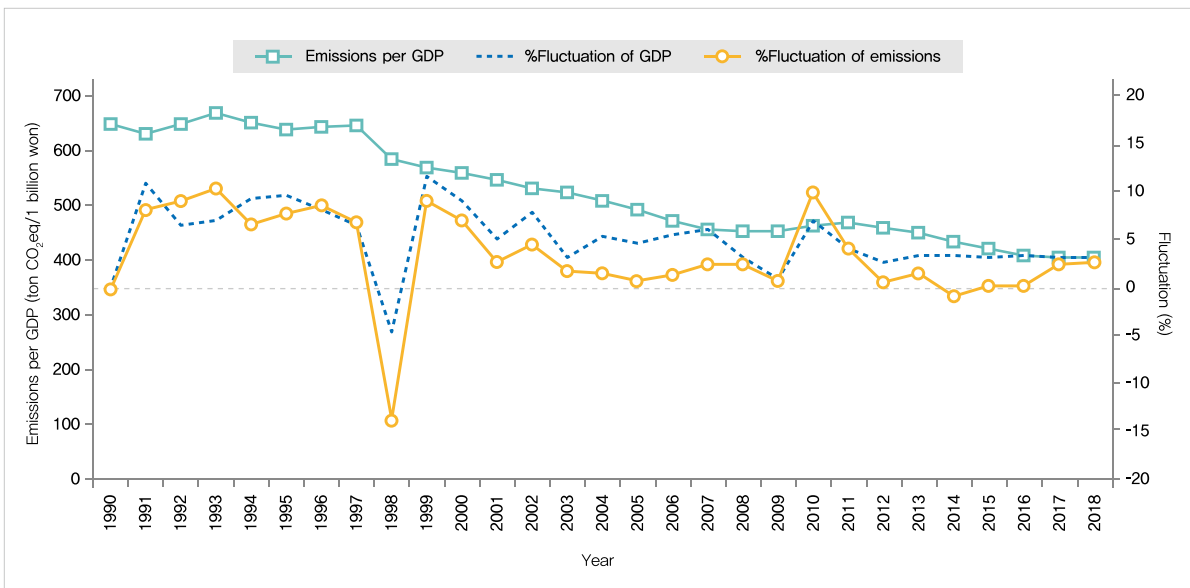


※ Source: Population Projections for the ROK (Statistics Korea, 2018)

– Emissions per Real GDP

Total GHG emissions per GDP in 2018 based on the Bank of Korea’s GDP data were 401.6 tCO₂eq./billion won, representing a drop of 37.6% from 643.4 tCO₂eq./billion won in 1990 and 0.4% from 403.1 tCO₂eq./billion won in 2017. Both total emissions and GDP showed a decline from 1990 to 2018 after the 1998 foreign exchange crisis hit Korea. Both figures witnessed an increase afterwards but total GHG emissions per GDP indicated a decreasing trend in general. Due to the economic crisis in 2009, GHG emissions per GDP sharply increased in 2010 but continuously dropped since 2012.

[Figure 2–4] Total GHG Emissions per Real GDP (1990–2018)



※ Source: National Inventory Report (NIR) (GIR, 2020)



4. National GHG Inventory Development and System Improvement

The ROK’s government ministries jointly established the 2nd National GHG Inventory Management Plan for 2020–2024 in February 2020 to respond to the enhanced transparency framework of the Paris Agreement. The plan consists of three strategies and detailed implementation plans as follows: ① Expand the scope of emission statistics including calculation of indirect GHG emissions; ② Improve development method of emission statistics and system by, for instance, applying the 2006 IPCC Guidelines, expanding country-specific emission and removal factors, and verifying uncertainty; and ③ Improve information service foundation and strengthen both domestic and overseas cooperation by building MRV system of emission statistics. Detailed implementation plan is monitored every year to identify areas that require improvement and new challenges in order to make smooth progress.

(Table 2–3) Comparison between National GHG Inventory Management Plans (1st and 2nd)

	1 st Plan(July 2015)	2 nd Plan(February 2020)
Plan Period	2015–2019	2020–2024
Goal	To establish MRV system	To advance MRV system
GHG	6 major GHGs	6 major GHGs + NF3 + Indirect GHG
Measurement Method	Pilot Measurement based on the 2006 IPCC Guidelines	Development of Statistics by Applying the 2006 IPCC Guidelines
Emission Factors	Develop new country factors by sector	Develop new country factors by sector + Renew existing factors + Develop business site factor-based country factors

※ The 1st National GHG Inventory Management Plan (2015–2019) (July 2015) focused on building a national GHG inventory preparation system. The goal of the 2nd plan is to advance the system such as expanding the scope of statistics and improving the method. The ROK built a foundation for applying the 2006 IPCC Guidelines in order to comply with the Paris Agreement based on the 1st plan. The ROK is segmenting and advancing relevant systems through the 2nd plan such as measuring indirect emissions, measuring uncertainty, advancing the 2006 IPCC IT system and promoting domestic and overseas network

4.1 Implementation Plan on Measurement of Indirect GHG Emissions

The enhanced transparency framework of the Paris Agreement requires parties to report indirect GHG (CO, NO_x, NMVOCs, SO_x) emissions from 2024. Accordingly, discussions are being held on building a foundation for cooperation regarding the method and procedures for the use of statistics with National Air Emission Inventory and Research Center that manages air pollutant statistics including indirect greenhouse gases. Technical matters such as incorporation of categorization systems of statistics and measurement methodologies are being jointly reviewed. Future plans will include surveys on the domestic and overseas current progress of indirect GHG emissions measurement, establishment and review of measurement methodology, incorporation of categorization systems and establishment of MRV guidelines for statistics of indirect GHG.

4.2 Applying the 2006 IPCC Guidelines

The UNFCCC requires parties to measure and report national GHG inventory to which the 2006 IPCC Guidelines are applied from 2024 in accordance with the enhanced transparency framework of the Paris Agreement. The ROK has so far developed 1996 IPCC Guidelines-based inventory and submitted National Communication to the international community. In order to facilitate application of the 2006 IPCC Guidelines, the ROK has established a plan on improving activity data and developing measures to secure new activity data.

A decision was made on early application of the 2006 IPCC Guidelines at the Management Committee jointly by relevant authorities from 2017 to 2019 to establish a foundation for 2006 IPCC Guidelines-applied measurement and pilot measurement. The ROK plans to complete application of the said Guidelines to all sectors of the national GHG inventory through additional sectoral activity data and emission factor improvements and advancement of reporting system.

4.3 Increased Development and Application of Country-Specific Emission and Removal Factors

The IPCC emphasized the accuracy of emission factors as a key factor of GHG emissions measurement to improve the accuracy of national GHG inventory. The ROK plans to develop, verify and publicly announce national factors by sector to ensure the accuracy of its inventory, and take preemptive responses for application of the 2006 IPCC Guidelines.

4.4 Improvement of Uncertainty Measurement

Uncertainty shows the credibility of the GHG inventory which is identified from omission of basic materials of activity data and emission factors, lack of representativeness and measurement error. All parties are required to report uncertainty evaluation-related information from 2024 in accordance with the enhanced transparency framework of the Paris Agreement. Uncertainty of the ROK's GHG sources and sinks either applies the IPCC Guidelines' default values or is not provided at all, meaning that uncertainty measurement and reporting for all sub-sectors are needed. The measurement foundation currently consists of surveys of domestic and overseas uncertainty measurement cases as well as research and development of measurement algorithm through analyses of emission factor and activity data uncertainty of some sub-sectors. The ROK plans to establish MRV guidelines for GHG statistics and carry out pilot as well as official uncertainty measurements by sector.



4.5 Improvement of Information Service Foundation and Strengthened Domestic and Overseas Cooperation

– IT System Improvements

The ROK operates the National GHG Inventory Reporting System (NIRS) to improve the quality of the national GHG inventory and to ensure systematic data management. NIRS manages information regarding measurement results that are in accordance with the national inventory 1996 IPCC Guidelines (emissions common reporting format, national inventory report), verification details and relevant base data.

Currently, the ROK is enhancing NIRS to build a comprehensive national GHG inventory management system and, at the same time, developing inventory preparation support tools such as activity data, calculation formulas and emission factors that can be applied to the ROK's inventory development system based on the 2006 IPCC Guidelines. The ROK plans to advance the function of statistics analysis of 2006 IPCC Guidelines-based national GHG inventory which also includes reinforced national GHG statistics database management and automatic review and verification function.

– Strengthening Professional Competencies by Expanding Domestic and Overseas

The ROK is committed to continuously sharing information on international trends in the field of GHG inventory and facilitating discussions for improved quality of the national inventory in order to strengthen competencies of national GHG inventory experts. As part of its efforts, the ROK regularly holds workshops on a national GHG inventory management during which information on international GHG agenda such as the Paris rulebook and IPCC report are exchanged, and discussions on preparation of statistics according to international standards and quality management take place.

The ROK has also been providing GHG measurement training to public officials and researchers in developing countries who are in charge of the development of GHG inventory since 2011 with the goal of supporting developing countries with regard to the implementation of the transparency framework and enhancing capacity to respond to climate change. The ROK signed an MOU with the UNFCCC secretariat to jointly deliver the training program since 2017.





CHAPTER 3

Reduction Policies and Measures



1. Reduction Target

According to the Paris Agreement, all parties must establish the national GHG reduction target periodically. Most of the parties submitted the INDC in 2015 as per the Lima decision. As parties ratified the Paris Agreement in 2016, the INDC was converted to NDC which was required to be updated or re-submitted by 2020 in accordance with the respective Agreement.

The ROK submitted the INDC in 2015 and shared its 2030 GHG reduction target with the international community. In order to deliver the target by 2030, ROK established the Basic Roadmap to Achieve the National GHG Reduction Target for 2030 in December 2016 (2030 Roadmap).

After the Moon Jae-In administration took office, government tasks such as reinforcing management of fine dust and energy transition were reflected in the 2030 Roadmap, and the Revised 2030 Roadmap was released in July 2018 to facilitate the delivery of the national GHG reduction target as a committed member of the international community. While the first NDC aimed to reduce GHG emissions by 37% from the BAU levels by 2030, the updated NDC submitted to the UNFCCC in December 2020 adopts an absolute reduction target which is to cut emissions by 24.4% from the total national GHG emissions in 2017. In August 2021, the Framework Act on Carbon Neutrality that defines the minimum NDC target for 2030 of at least 35% reduction from the 2018 level was enacted, and accordingly in October 2021, the NDC was updated again with the target of reducing emissions by 40% from the 2018 level which amounts to 727.6 MtCO₂eq.

Basic plans are developed for each sector to set mid- to long-term goals and strategies to reach the target through specific systems and measures. At the same time, the establishment of various policies are currently in progress to increase the share of new and renewable energy and promote energy transition through Renewable Portfolio Standard (RPS). For industry and building sector, Energy Efficiency Resource Standards (EERS) and Zero-energy Building Certification are introduced while policies to increase the supply of eco-friendly vehicles and improve the transport as well as logistics systems are promoted to support the transportation sector. Together with the sectoral reduction, additional means including forest carbon sinks and overseas reduction will also be used to achieve the reduction target.

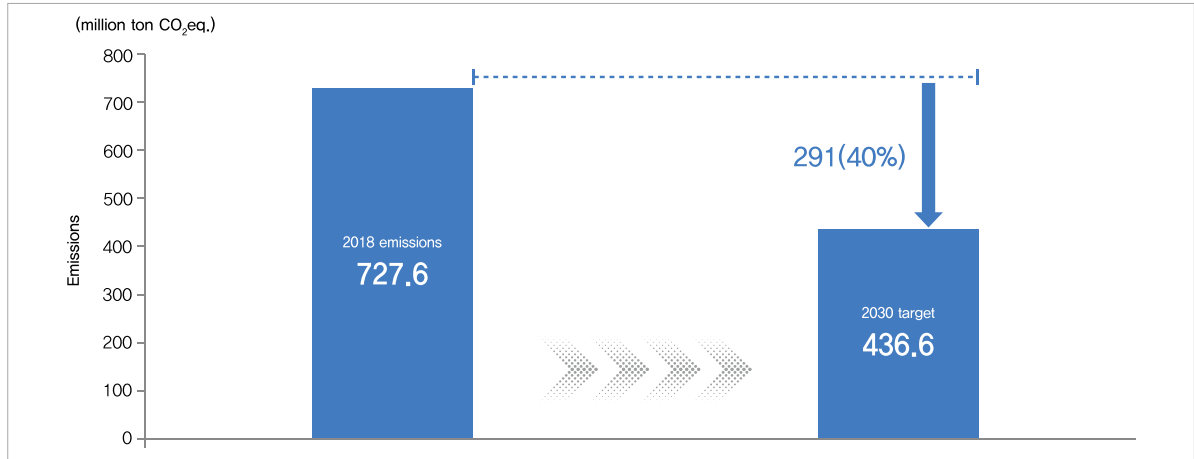
<Table 3-1> Progress of 2030 Reduction Target Updates

Category	「Basic Roadmap to Achieve the National GHG Reduction Target for 2030」(Dec 2016)	「Revised Basic Roadmap to Achieve the National GHG Reduction Target for 2030」(Jul 2018)	「Updated National GHG Reduction Target for 2030 (NDC)」(Dec 2020)	「Revised GHG Reduction Target for 2030」(Oct 2021)
Scope of Analysis	31 sub-sectors in 8 sectors	8 sectors		
Reduction Target	37% ↓ from 2030 BAU level (domestic 25.7%, overseas 11.3%)	37% ↓ from 2030 BAU level (domestic 32.5%, others 4.5%)	24.4% ↓ from 2017 level (709.1MtCO ₂ eq.) by 2030	40% ↓ from 2018 level (727.6MtCO ₂ eq.) by 2030
Mitigation Pathway	Amount of emissions to be reduced in 2030	Amount of emissions to be reduced every 3 years from 2013 to 2030		Amount of emissions to be reduced in 2030 ²⁹

Remark: Domestic reduction target of 32.5% as per the Revised 2030 Roadmap reflects potential reduction that can be additionally achieved by energy transition while others of 4.5% include the potential reduction to be achieved using forest carbon sinks and overseas reduction

※ Source : 2018-2019 Evaluation of Progress of GHG Reduction (Greenhouse Gas Inventory and Research Center, 2020)

[Figure 3-1] 2030 National GHG Reduction Target



2. Tracking and Assessment of GHG Reduction Progress

– Principles and Mechanism of Progress Tracking and Assessment

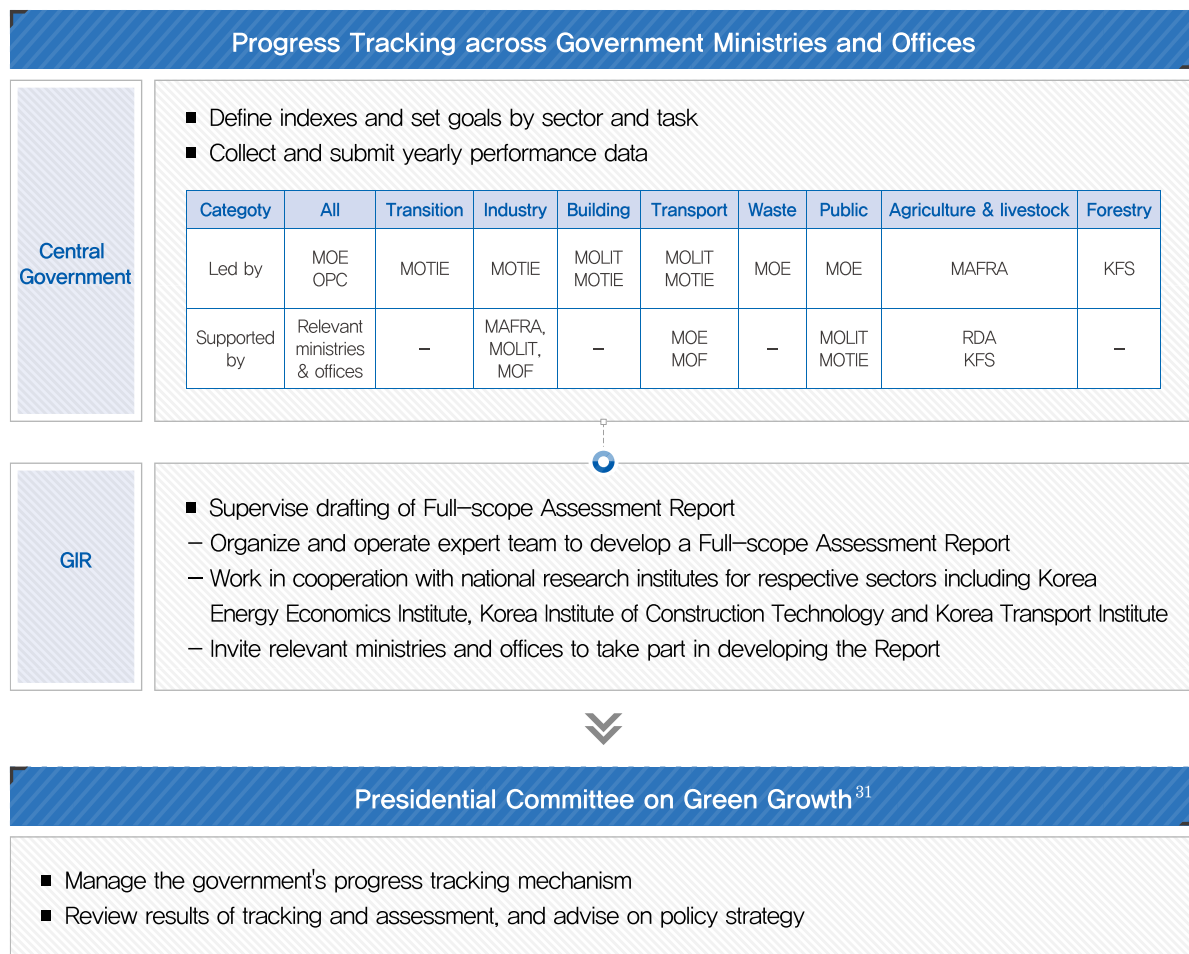
For the purpose of establishing a prompt and transparent progress tracking and assessment system across the government, the Office for Government Policy Coordination (OPC) and the Ministry of Environment (MOE) analyze and evaluate the progress of GHG reduction by each government ministry and office according to four principles of transparency, timeliness, accountability and feedback. Objective and quantifiable indexes are defined for each sector, and comprehensive evaluations are conducted to review the performance of each index and the goals specified in the Revised 2030 Roadmap. Ministries and offices ensure that the results are reflected in the following year's evaluation and track the performance.

²⁹ Reduction goals for each year and sector will be set in accordance with Article 8 of the Framework Act on Carbon Neutrality.



For tracking and assessment, authorities are appointed for each sector under OPC and MOE which are responsible for defining indexes, setting goals as well as collecting and submitting performance data. Submitted data are used by an expert team supervised by the GIR to draft a Full-scope Assessment Report. The Report is revised by the sectoral expert teams which is then reported to the Presidential Committee on Green Growth (PCGG) and released to the public after final confirmation. The first Full-scope National and Sectoral Assessment Report on the Progress of GHG Reduction (2018~2019) was published in December 2020.³⁰

[Figure 3-2] Progress Tracking and Assessment Mechanism



³⁰ To ensure that tracking and assessment are conducted in a timely manner, emissions data of 2018 from the National Inventory Report were used, and estimated emissions figures were used for 2019.

³¹ Following the replacement of the Framework Act on Low Carbon Green Growth (Jan 2010) by the Framework Act on Carbon Neutrality (Aug 2021), the Presidential Committee on Carbon Neutrality is responsible for tracking the progress and announcing the results.

3. Reduction Progress by Sectors

3.1 Overarching Reduction Policy

– Emissions Trading System

The ROK decided to introduce Emissions Trading System (K-ETS) according to Article 46 of the Framework Act on Low Carbon Green Growth enacted in January 2010 in order to manage industrial and development sectors in a cost-effective manner and to foster low-carbon industries. An Act on Allocation and Trading of Greenhouse Gas Emissions Allowances which is also called Emissions Trading Act was approved by the National Assembly and enacted in May 2012 after hearing opinions from industries and civic groups. The basic strategy for operation of K-ETS and major goals for each phase of the scheme are presented in accordance with the five basic principles³² as prescribed by Article 3 of the Act.

According to Article 4 of the Emissions Trading Act enacted in May 2012, the basic 10-year plan shall be established every five years starting from 2015 which was the year of implementation of K-ETS. For Phase I and Phase II, the plan was established every three years to identify issues occurring at the initial stage of implementation. The master plan and the allocation plan for K-ETS were developed for Phase I in 2014 considering the consistency with the national GHG reduction target which were then fine-tuned in overall and specific technical aspects. In 2017, to ensure stabilization of the system, the master plan and the allocation plan for K-ETS were developed for Phase II with relevant guidelines amended.

Under the Second Master Plan for Emissions Trading System established in January 2017, three strategies were presented as follows: 1) promoting innovation of low-carbon industry and investment in environmentally friendly sectors; 2) reducing GHG in a cost-effective and flexible manner; and 3) achieving the national reduction target, and leading as well as supporting the global carbon market.

32 ① Compliance with the United Nations Framework Convention on Climate Change and the relevant protocol, and consideration of international negotiations on climate change; ② Consideration of the implication of K-ETS on the global economic competitiveness; ③ Use of market function to effectively achieve the national GHG reduction target; ④ Encouragement of fair and transparent emissions trading in compliance with trading principles of the market; and ⑤ Policy operation that abides by the international standards associating with the global carbon market



<Table 3–2> Basic Strategy of the Second Basic Plan (Jan 2017)

No.	Description
1	<ul style="list-style-type: none"> • Compliance with United Nations Framework Convention on Climate Change and consideration of international negotiations – (Achievement of Reduction Target) Contribute to responding to the global climate crisis by achieving the national GHG reduction target – (BAU Projection) Maintain the principle of transparency and accountability for BAU projection – (Coordination with International Negotiations) Operate K-ETS in harmony with the latest international negotiations and discussions under the new climate regime introduced by the Paris Agreement
2	<ul style="list-style-type: none"> • Consideration of the implication on the global economic competitiveness – (Economic Growth and Employment) Minimize the negative effect of K-ETS on economic growth and employment – (Maintaining Global Competitiveness) Develop support measures considering trade and carbon intensity so that companies can maintain global competitiveness
3	<ul style="list-style-type: none"> • Increased use of market function to effectively achieve the national GHG reduction target – (Infrastructure Development) Reduce the entry barrier to facilitate emissions trading market and build infrastructure to enable accurate MRV (measurement, reporting and verification) – (Principle for Free Allocation and Allocation by Auction) Maintain the share of auction as prescribed by the Enforcement Decree to utilize the market function – (Guarantee of Reduction Means) Guarantee diverse and flexible means of reduction for companies such as carryover, borrowing or offsetting
4	<ul style="list-style-type: none"> • Fair and transparent emissions trading in compliance with trading principles of the market – (Fairness) Ensure that responsibilities of GHG reduction are equally taken by both sectors that adopt and that do not adopt K-ETS – (Minimizing Market Distortion) Ensure that K-ETS does not distort the economics among companies
5	<ul style="list-style-type: none"> • Abiding by the international standards associated with global carbon market – (International Carbon Offset) Enhance flexibility and cut reduction cost by facilitating international carbon offsetting by associating with emissions trading systems – (Minimizing Exclusions) Minimize exceptional clauses that exempt certain sectors and industries from K-ETS – (Incorporation of International Standards) Incorporate international regulations and standards such as new international carbon market mechanism introduced to follow up with the Paris Agreement

※ Source: Second Basic Plan for Emissions Trading System (Ministry of Strategy and Finance, 2017)

The target of Phase I is 23 sub-sectors of which 20 sub-sectors were provided with carbon allowances based on their emissions in the past years while preliminary allowances were issued to the remaining three sub-sectors, namely cement, oil and aviation, based on the efficiency of their facilities (benchmarking method). In Phase I, carbon allowances were allocated to all sub-sectors free of charge to minimize the economic burden on companies and stabilize the system. Offset credits acquired by entities through external reduction projects including Clean Development Mechanism (CDM) were also recognized. Total carbon allowances in Phase I were 1,687 million Korean Allowance Units (KAUs)³³.

33 Korean Allowance Unit: a unit for allowances allocated to entities according to Article 12 of the Act.

In Phase II, the application of the benchmarking allocation method was expanded from three to seven sub-sectors to include electricity generation, district heating and cooling, industrial complex and waste. The second allowance allocation plan prescribed the total emissions allowance of 1,777.1 million KAU and additional allowances in reserve of 19 million KAU according to the Revised 2030 Roadmap which was revised in 2018. According to the respective plan, 97% of allowances were issued to 26 out of 62 target sub-sectors for free while the remaining 3% was allocated through auction.

During Phase III, the latest international negotiations such as the reporting system required by the Paris Agreement and utilization of domestic and overseas reduction will be reflected to contribute to the international community's efforts to mitigate climate change. Total emissions allowance for Phase III is set out to be 3,048 million KAU with 34 million KAU of additional allowances in reserve. The share of allocation by auction is at least 10% of the allowance provided to each entity considering global competitiveness of the industry and the impact on the national economy. The target of application of the benchmarking method has been increased to 12 sub-sectors. In addition to the original method of using product as the benchmark, heat and fuel benchmarks are introduced for pilot operation. Market predictability will be enhanced by allowing the futures to be traded at the Korea Exchange (KRX) to promote emissions trading. Moreover, the implication of converting reductions achieved through external projects to Korea Credit Units (KCU) on achieving the national GHG reduction target will be evaluated for improvement that will lead to objective and fair operation of K-ETS.

〈Table 3-3〉 Strategy of Operation of Phase III (2021-2025)

Category	Description
Allocation of Allowances	<ul style="list-style-type: none"> Expand the scope of sub-sectors subject to benchmarking method, pilot operation of heat and fuel as benchmarks and change allocation unit from facility to business site Allocate by auctioning (at least 10% of the allowance allocated to the target entity)
Overseas Reduction Project	<ul style="list-style-type: none"> Pursue overseas projects after objectively evaluating the impact on achieving the GHG reduction target Allow conversion and use of overseas reductions which are recognized as ROK's reduction achievement to KCU
Trade Market	<ul style="list-style-type: none"> Allow participation of financial institutions, securities companies and individuals Allow futures to be traded at KRX to promote emissions trading
Industry Support	<ul style="list-style-type: none"> Support domestic companies' reduction activities Reinforce development of reduction technologies in Korea using domestic technologies for overseas reduction activities

※ Source: Third Basic Plan for Emissions Trading System (Ministry of Strategy and Finance/Ministry of Environment, Dec 2019) and The Phase 3 Allocation Plan (Ministry of Environment, Sept 2020)



During the trading period in Phase I (January 1, 2015~August 9, 2018), the total volume of allowances traded at KRX and over-the-counter (OTC) (KAU15 · KAU16 · KAU17 · KAU18, KCU15 · KCU16 · KCU17 · KCU18, KOC)³⁴ was 86.2 million tCO₂eq. of which 37.5 million tCO₂eq. was traded at KRX and 48.7 million tCO₂eq. was traded at OTC, accounting for 44% and 56% of the total trade respectively. The trade volume of KAU, KCU and Korean Offset Credit (KOC) were, respectively, 66.6 million tCO₂eq., 3.4 million tCO₂eq. and 16.2 million tCO₂eq., accounting for 77%, 4% and 19% respectively. Trade volume by year was: 5.7 million tCO₂eq. in 2015, 11.9 million tCO₂eq. in 2016, 29.3 million tCO₂eq. in 2017, and 39.2 million tCO₂eq. in 2018. The volume increased by 208%, 246% and 134% year-on-year respectively.

During the same period, the average KRX and OTC trading price of total allowances continued to increase from KRW 11,007 per tonne in 2015 to KRW 17,179 in 2016, and from KRW 20,879 in 2017 to KRW 22,127 in 2018. The average price continued the upward trend, increasing by 156%, 122% and 106% year-on-year. The closing price of the 2018 trading period was twice as high as the initial average trading price in 2015. The average trading price for the whole trading period was 20,279 won. KAU, KCU and KOC were 21,382 won, 15,767 won and 16,703 won respectively with KAU being traded at relatively higher price compared to other types as it was 5,615 won higher than KCU and 4,679 won higher than KOC. KRX price (20,831 won) was slightly higher (976 won) than OTC price (19,855 won).

A continued rise of trading price and increased volume of traded emissions affected the trading price. A total trading volume was KRW 63.1 billion in 2015 which increased to KRW 204.4 billion in 2016, KRW 612.3 billion in 2017 and to KRW 868 billion in 2018 indicating the respective annual growth rates of 324%, 300% and 142%. The aggregate trading volume was KRW 1,747.7 billion. The total trading volume of KAU, KCU and KOC was KRW 1,423.1 billion, 54 billion and 270.6 billion respectively, which respectively account for 81%, 3% and 15%. The aggregate KRX and OTC trading volumes were KRW 781 billion and 966.7 billion, proportionately accounting for 45% and 55% of the total transactions.³⁵

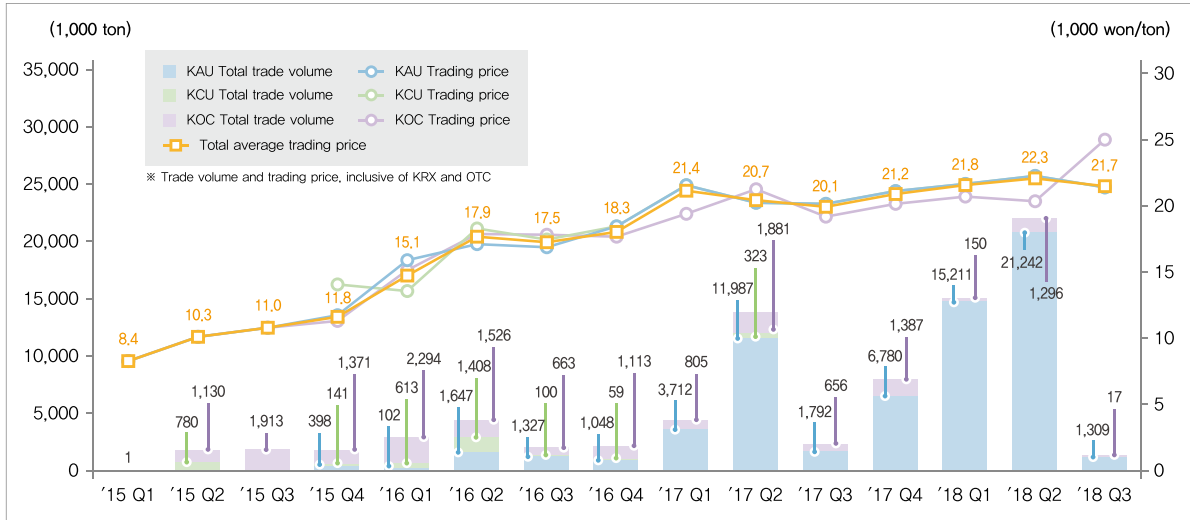
34 1 tCO₂eq. = 1KAU = 1KCU = 1KOC

KCU (Korean Credit Unit): a unit for allowances converted from certified reduction of external projects according to Article 29 of the Act.

KOC (Korean Offset Credit): a certified reduction credit from external projects in which the entity reduced, absorbed or removed GHG as per the international standards outside its business site according to Article 30 of the Act.

35 Considering only the allowances accounted for in the first year (2018) of Phase II which are KAU18 and KCU18, total emissions traded during the respective trading period (January 1, 2018~September 30, 2019) were 39.6 million tCO₂eq. with KAU and KOC representing 83.9% and 16.1% respectively. By market, OTC trading (65.5%) volume was almost twice of the KRX trading volume (34.5%).

[Figure 3–3] Trend of Total Volume and Price of Allowances



※ Source: Phase I (2015–2017) K-ETS Operation Outcome Report (Greenhouse Gas Inventory and Research Center, Ministry of Environment, 2019)

– GHG & Energy Target Management System (TMS)

ROK implements GHG & Energy Target Management System (TMS) according to the Framework Act on Low Carbon, Green Growth (2010). TMS aims to support the achievement of the national GHG reduction target by designating entities and business sites that emit GHG and consume energy above a certain level as controlled entities, and setting and managing each entity’s GHG and energy saving targets. Following the implementation of K-ETS since 2015, large-scale business sites with high emissions are managed under TMS.

By implementing TMS, the ROK government designates the controlled entities, and sets their GHG emission and energy consumption targets; non-delivery of the target is directly regulated in the form of an improvement order or a fine. The control tower supervises and coordinates the overall operation of TMS, and the sectoral supervising institutions set and manage the targets of the controlled entities.

The supervisory institutions, in consideration of each controlled entity’s plan to newly or additionally build facilities as well as its emission reduction potentials, establish annual reduction targets to support the achievement of the national GHG reduction target. They evaluate the delivery plan of the target and the progress to continuously manage entities’ GHG reduction and energy conservation. In compliance with TMS, controlled entities submit a detailed statement on their GHG emissions and energy consumption in March, followed by consultation with the government to determine the following year’s target in September. Then entities establish their delivery plan in December to be implemented in the following year, and report its performance to the government next March.



Controlled entities under TMS are distinguished by entities (corporation) and business sites. Entities whose average annual GHG emissions of the past three years are above 50,000 tCO₂eq. with energy consumption of above 200 Terajoules (TJ), and business sites whose emissions are above 15,000 tCO₂eq. with energy consumption of above 80 TJ are subject to emission reductions requirements.

(Table 3-4) Criteria for Selection of Controlled Entities under GHG & Energy Target Management System

Category	~2011		~2012		~2014	
	Entity	Business site	Entity	Business site	Entity	Business site
GHG Emissions (tCO ₂ eq.)	125,000	25,000	87,500	20,000	50,000	15,000
Energy Consumption (TJ)	500	100	350	90	200	80

※ Source: Guideline on the Operation of GHG & Energy Target Management System (Mar 2021)

A total of 774 entities in the public sector subject to TMS emitted 4.21 million tCO₂eq. of GHG in 2018 which was 19.6% or 980,000 tCO₂eq. reduced from the baseline emission of 5.02 million tCO₂eq. Compared with the total emissions of 4.73 million tCO₂eq. in 2011 when TMS was first introduced in the public sector, emissions were reduced by 11% or 520,000 tCO₂eq. to 4.21 million tCO₂eq. in 2018.

3.2 Reduction Policies and Measures by Sector

– Energy Transition

In order to support GHG reduction in the energy transition sector, the Renewable Energy 3020 Plan which aims to increase the share of renewable energy to 20% by 2030 was finalized in December 2017, and in the same month, detailed enforcement measures were defined through the 8th Master Plan for Electricity Supply and Demand.

〈Table 3–5〉 Key Reduction Policies in the Energy Transition Sector

Category	Description
Second Energy Master Plan ³⁶ (January 2014)	<ul style="list-style-type: none"> Based on the six priorities such as changing energy policies to focus on demand management, the share of nuclear power in total energy consumption will be reduced to 29% and the share of new and renewable energy will be increased to 11% by 2035
Renewable Energy 3020 Plan (draft) (December 2017)	<ul style="list-style-type: none"> Raise the share of renewable energy in power generation to 20% by 2030 Power 95% or more of new facilities with clean energy such as photovoltaic and wind energy Achieve the target leveraging development projects with participation of local communities and large-scale projects
8th Basic Plan for Long-term Electricity Supply and Demand (December 2017)	<ul style="list-style-type: none"> Gradually reduce the share of nuclear power in total power generation based on peak contribution to 16.5% by 2030, and increase new and renewable energy to 20% by 2030 to secure economic feasibility and create a safe and clean power system together with the implementation of Energy Transition Roadmap (October 2017)³⁷ Unlike previous supply and demand plans that focused on stabilizing demand and supply and the economic feasibility, the 8th Master Plan was established with emphasis on the environment and safety taking into account the revised Electric Utility Act Adjust power generation cost taking into account early closure of old coal power plants³⁸ and the environmental cost Focus on setting reasonable target demand through demand management; new power generation facilities will refrain from using nuclear and coal power, and primarily use eco-friendly and dispersed renewable energy and LNG

In 2018, the share of new and renewable energy under Renewable Portfolio Standard (RPS) reached 5.2% which was 0.2% higher than the set target of 5%. The volume of renewable energy newly supplied was 3,435 MW which was almost double the target of 1,738 MW. In 2019, new and renewable energy accounted for 6.4% of the total share which was 0.4% higher than the target. A total of 4,363 MW of renewable energy was newly supplied, nearly double the target of 2,402 MW. However, differences by types of renewable energy are observed as photovoltaic and biomass exceeded the targets whereas wind and hydropower were below the respective targets.

³⁶ The Third Energy Master Plan (June 2019) includes five priority tasks such as innovation of energy consumption structure and transition to cleaner and safer energy mix; it also seeks to increase the share of renewable energy up to 35% by 2040, and prohibit extension of the lifespan of old nuclear power plants and construction of new nuclear power plants.

³⁷ The Roadmap that stipulates the mid- and long-term goals of the overall energy transition policy which include: ① realizing gradual phase-out of nuclear power plants; ② increasing the share of renewable energy; and ③ implementing supplementary measures for respective regions and industries.

³⁸ Early closure of old coal power plants refers to the policy aiming to close 10 units of coal power plants by 2022 that have been in operation for over 30 years. Three were closed in July 2017, and the number of remaining plants scheduled to be retired from 2019 to 2021 is one (2019), two (2020) and four (2021).



<Table 3–6> Assessment of RPS Target and Achieved Supply of Renewable Energy

Category	2018		2019 (provisional)		2030
	Achieved	Target	Achieved	Target	Target
RPS Requirement(%) ¹⁾	5.2	5	6.4	6	10 (2022)
Supplied Renewable Energy (new) (MW)					
Total ²⁾	3,435	1,738	4,363	2,402	5,572
– Photovoltaic	2,367	1,423	3,789	1,632	3,442
– Wind	161	200	191	650	2,050
– Water	4	15	12	20	30
– Bio	865	100	290	100	50
– Waste	38	–	81	–	–

1) Korea Energy Agency, Korea New and Renewable Energy Center: percentage considering the fulfilled requirement out of the (baseline) respective year's RPS requirement (excluding deferred fulfillment)

2) Source: statistics on 2018 supply of new and renewable energy (Korea New and Renewable Energy Center, 2018)

Source: statistics on 2019 supply of new and renewable energy (excluding non-renewable waste) (Korea New and Renewable Energy Center, 2019)

Indexes and performance to be adjusted, considering the changed scope of renewable energy (to exclude non-renewable waste) and the establishment of the 9th Basic Plan for Long-term Electricity Supply and Demand

In the Fifth Basic Plan on Development, Utilization and Deployment of New and Renewable Energy (December 2020), RPS requirements are increased to the level that is necessary to achieve the supply target of new and renewable energy with the extended scope of mandated suppliers. The weight used for Renewable Energy Certificates (REC) are revised considering the economic feasibility, eco-friendliness, safety, acceptance and the impact on associated networks of each energy source³⁹.

<Table 3–7> Yearly Generation of New and Renewable Energy and Cumulative Total Supply by Facility

Category \ Year	2015	2016	2017	2018	2019
Generation of New and Renewable Energy (GWh)	37,079	40,656	46,623	52,718	51,122
Share in Total Generation (%)	6.61	7.24	8.08	8.88	8.69
Cumulative Total Supply of New and Renewable Energy (MW)	13,729	13,846	15,703	19,027	23,171

※ Source: statistics on supply of new and renewable energy (Korea Energy Agency, 2020)

Remark: power generated from non-renewable waste is excluded from waste energy following the amendment of the Act on Promotion of Development, Utilization and Supply of New Energy and Renewable Energy (enacted on October 1, 2019)

³⁹ The weight is revisited every three years according to operational guidelines on RPS and RFS (Renewable Fuel Standard). Also, hydrogen fuel cell will be separately managed by the Hydrogen Energy Portfolio Standard (HPS) (tentative) in order to distinguish between new and renewable energy.

Unused heat energy includes secondary heat from power generation, industrial waste heat and heat source for new and renewable energy. In the Revised 2030 Roadmap (July 2018), recovery of unused energy and utilization of unused heat by matching supply and demand among businesses are outlined as major means to reduce emissions in district heating. Further details are available in the Third Energy Master Plan (June 2019). A project is currently in progress to develop a national heat map which will serve as a platform that provides information on supply and demand of heat, a business model and economic feasibility analysis. The project will be completed in 2021.

– Industrial Sector

Policies enforced in the industrial sector to respond to climate change focus on enhancing the competitiveness of companies, and improving energy efficiency and demand management in an innovative manner to lift the burden of losing industrial competitiveness following GHG reduction efforts and take part in the global transition to carbon neutrality.

〈Table 3–8〉 Direction of Major Reduction Policies for the Industrial Sector

Category	Description
First National Climate Change Adaptation Plan (December 2016)	<ul style="list-style-type: none"> Establish a basic plan in response to climate change to commence the amendment of existing energy and climate change related policies, in order to shift to the new growth paradigm that is in line with the new climate regime (Introduction of New Technologies) Introduce new technologies and facilities in industrial processes to optimize energy consumption (Enhancement of Energy Efficiency) Enhance efficiency of common devices and expand the use of energy management system (Waste Heat Recovery) Enhance efficiency of heat energy utilization by recovering waste heat and steam generated during industrial processes and by reusing unused heat
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> Reduce GHG through enhanced energy utilization efficiency by improving the efficiency of common devices by distributing Factory Energy Management System (FEMS) and that of processing facilities Support development of eco-friendly refrigerant technology for refrigerators and air conditioners, and promote use of alternative refrigerants Replace bituminous coal or bunker-C fuel oil used for manufacturing and independent power generation with LNG and biomass fuel Increase introduction of waste heat power generation facilities to cut energy consumption by recovering the heat generated from facilities to produce steam

Energy Consumption Efficiency Grade Labeling System which mandates the indication of energy efficiency rating of the product according to the Energy Use Rationalization Act (December 2019) promotes production of highly efficient products, technological development and purchase of energy-saving products by consumers.



By supporting the establishment of the Factory Energy Management System (FEMS), productivity and energy efficiency are maximized through integrated management of production and non-production facilities. FEMS does not simply enhance the efficiency of the facility, but also serves as an operating system with an innovative emissions reduction technology which can be applied broadly regardless of the nature of the business. In 2018, FEMS was applied to a total of 15 business sites, and will continuously be extended throughout 2030.⁴⁰

In accordance with the Regulation on Demand Management and Investment Project Implementation by Energy Provider which was amended for the objective of GHG reduction in the industrial sector in May 2018, the pilot implementation of the Energy Efficiency Resource Standards (EERS) began in 2018. Under EERS, an annual energy saving target is imposed on energy providers who are mandated to implement an investment project aiming to enhance the energy efficiency. Energy providers subject to the pilot implementation are Korea Electric Power Corporation, Korea Gas Corporation and Korea District Heating Corporation. The target of each energy provider is determined by multiplying the annual target ratio (%) to the annual volume of energy sales from two years ago. As per the business plan, KRW 328.5 billion will be invested in 101 projects from 2018 to 2021 for enhanced energy efficiency of appliances including motors, boilers and freezers to save the potential volume of 301,948 toe of energy.

Since 2020, Korea Energy Agency (KEA) has been conducting a pilot project of voluntary energy efficiency targeting. Business sites of which annual energy consumption is above 2,000 toe are subject to the project. A business site that voluntarily achieves the target by enhancing energy efficiency through facility investment or process improvement is certified by KEA as a business with excellent performance in energy conservation, or is given an extended deadline for next energy diagnoses. As of September 2020, KEA signed an agreement on the pilot project with 45 energy-intensive business sites of 31 companies.⁴¹

⁴⁰ Source: 2018–2019 Evaluation of Progress of GHG Reduction (Greenhouse Gas Inventory and Research Center, 2020)

⁴¹ Source: 2020 MOU Signing Ceremony for Pilot Voluntary Energy Efficiency Target-setting Project (press release by KEA, 2020)

The Revised 2030 Roadmap (July 2018) stipulates that emissions reduction must be achieved in the steel industry through development and supply of new and innovative technologies as well as a shift toward high value-added products, considering that steel accounts for a large share of emissions in the industrial sector. Hydrogen-based iron and steel making is a key innovative technology in the steel industry that uses hydrogen instead of bituminous coal that emits a great volume of GHG in the steelmaking process to produce iron. Since 2017, government-led R&D projects have been in progress to develop hydrogen-based ironmaking technology that uses shaft furnace which is also referred to as a low-carbon hybrid steelmaking technology.

Approximately 46% of total emissions generated by the petrochemical industry which is one of the high-emitting industries is produced from basic petrochemical production. Therefore a considerable volume of GHG reduction is anticipated if the energy intensity of petrochemical production is improved. Major producers of petrochemicals in Korea are committed to improve the energy intensity through process improvement and energy efficiency enhancement.

The cement industry emits a large quantity of CO₂ while producing clinker⁴² using limestones. Currently, a feasibility study is in progress on raw materials that generate less emissions while developing cement and technologies to capture and utilize CO₂ in order to identify means to reduce CO₂ emissions in the cement production process. Additionally, R&D projects are planned for production of eco-friendly cement, manufacturing of secondary products, CO₂ capture and utilization system, and special cement application technology. In the medium to long term, a study on diverse types and ratios of admixtures is planned in order to increase the ratio of admixture in the Portland cement while developing eco-friendly cements.

– Buildings Sector

ROK enacted the Green Buildings Construction Support Act (February 2012) to achieve the national GHG reduction target in the building sector and to procure more green buildings. As part of the Act, the Master Plan on Green Building has been developed and implemented every five years since 2014.

⁴² Cement clinker is a solid material produced by sintering (a type of high-temperature treatment process that is widely used in mineral processing) materials such as clay and limestone during cement manufacturing as an intermediary product.



<Table 3–9> Direction of Major Reduction Policies for the Buildings Sector

Category	Description
First Master Plan on Green Building ⁴³ (December 2014)	<ul style="list-style-type: none"> • Establish the vision to Supply and Promote Green Building Industry to Create Low-emissions Environment and Eco-friendly Living and Culture • Develop 4 strategies to realize the vision: ① Enhance green building standards; ② Enhance energy performance of existing buildings; ③ Promote green construction industry; and ④ Expand the foundation for green construction • Major achievements of the Master Plan include securing the industrial infrastructure for green buildings through advancement of standards for new constructions, enhancement of existing buildings' performance, disclosure of energy performance to facilitate operation and management, and green remodeling business registration scheme (a total of 425 businesses registered during 2014~2018)
First National Climate Change Adaptation Plan (December 2016)	<ul style="list-style-type: none"> • (New Buildings) Increase zero energy buildings (ZEB) by gradually strengthening requirements for approval of buildings • (Existing Buildings) Promote improvement of energy performance of existing old buildings • (Operation) Develop technology and institutional ground to expand Building Energy Management System (BEMS)
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> • (New Buildings) Establish strengthened policies as means to reduce GHG that include raising energy standards for buildings such as insulation requirements for passive buildings and mandating ZEBs by phases • (Existing Buildings) Develop measures to enhance energy performance as means to reduce GHG such as mandating the conversion of high energy consuming public buildings to green buildings and facilitating green remodeling • (Other) Expand the application of energy consumption efficiency grading and high-efficiency energy machinery/equipment certification system for home appliances, office equipment and facilities, and strengthen efficiency standards in phases

The ROK government has developed diverse institutional measures to conduct a quantitative assessment on the eco-friendliness of new and existing buildings, and to promote green buildings. Submission of the Energy Saving Plan based on the design standards applied to the respective building to save energy has become obligatory for assessment of the building's energy performance. The Zero-energy Building Certification System (ZEB Certification System) primarily evaluates the energy consumption of the building to certify energy saving buildings and rate the grade of energy efficiency in a quantifiable and objective manner.

⁴³ Based on the achievements of the First Master Plan on Green Building (December 2014), the Second Master Plan on Green Building (December 2019) outlines five strategies and 12 policy tasks to contribute to realizing the vision of "green buildings that enhance people's quality of life with innovative growth and lead the transition to low-carbon and low-energy society."

Green Buildings Construction Support Act (February 2012) defines a zero energy building (ZEB) as "a green building of which energy requirement is minimized by using the least volume of the energy load for the building and by utilizing new and renewable energy." According to the Korea New Deal, Ministry of Land, Infrastructure and Transport (MOLIT) is taking steps to convert public and private buildings to ZEBs in phases. To enable early implementation of the Zero Energy Building Roadmap for New Buildings (ZEB New Building Roadmap), MOLIT has mandated that all public buildings with the floor area of over 1,000m² from 2020 and that of over 500m² from 2023, private buildings with that of over 1,000m² from 2025, multi-unit dwelling buildings housing more than 30 households, and all buildings with the floor area of over 500m² to be constructed from 2030 must be built as ZEB.

ZEB Certification was first introduced as a pilot program in January 2017. In order to qualify for ZEB Certificate, the energy efficiency grade of the building must be 1++ or higher which is graded from 1 to 5 according to the energy self-sufficiency rate, and the energy self-sufficiency rate with the use of new and renewable energy must be at least 20%. Also, buildings must be installed with the Building Energy Management System (BEMS) or digital power meters that allow remote management. ZEB Certificate is effective from the day of certification until the respective building's energy efficiency grade of 1++ expires.

〈Table 3-10〉 Details of Criteria for Zero Energy Building Certification

<ul style="list-style-type: none"> • Criteria for ZEB Certification <ul style="list-style-type: none"> – 1++ or higher energy efficiency rating – 20% or higher energy self-sufficiency rate – Installation of BEMS or digital power meter • Grades of ZEB Certification 					
ZEB Grades	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Energy self-sufficiency (%)	100% or above	80% ~ 99%	60% ~ 79%	40% ~ 59%	20% ~ 39%
<ul style="list-style-type: none"> • ZEB Certification Progress 					
Year	2017	2018	2019	2020	2021 (as of July)
Number of Certificates Granted	10	30	41	507	645

※ Source: Korea Energy Agency



Green remodeling refers to activities pertaining to converting existing buildings to green buildings by enhancing energy performance and efficiency. For the purpose of improving the energy efficiency of existing old buildings and enhancing the value of the buildings by providing pleasant and healthy indoor living environment, MOLIT and Korea Land & Housing Corporation (LH) provide financial support for the payment of interests incurred from green remodeling. It aims to bolster green remodeling business by partially subsidizing interests of the loans for construction expenses and to facilitate the improvement of private buildings' energy performance. To deliver Korea's Green New Deal, the scope of green remodeling will be gradually expanded to include : national and public daycare centers that were built more than 10 years ago; 2,000 public health centers and medical facilities; and public rental houses.

〈Table 3–11〉 Performance of Subsidizing Interest Payment for Green Remodeling

Category		2016	2017	2018	2019	2020
Projects	No. of Projects	7,742	8,551	9,278	11,428	12,005
	Amount (million KRW)	75,949	95,763	103,991	124,800	129,300

※ Source: Korea Land & Housing Corporation, Green Remodeling Creation Center website (<https://www.greenremodeling.or.kr/>)

The objective of Certification for Energy Saving Eco–friendly Green Houses is to develop standards and performance criteria for construction of energy saving and environmentally friendly houses as part of its efforts to respond to climate change and support low–carbon, green growth. An eco–friendly house uses new and renewable energy such as photovoltaic power, solar heat and geothermal heat, high–efficiency lighting and boiler, and eco–friendly insulation while minimizing the use of fossil fuels and thereby reduce energy consumption and GHG emissions. While the goal was to build eco–friendly houses for 400,000 households in 2018, a total of 490,000 eco–friendly houses were provided which is beyond the target by 90,000.

Carbon Point Program aims to provide Carbon Points to households and commercial and apartment complexes according to the reduced volume of electricity, water and gas to cut GHG emitted from respective utilities. It is a national GHG reduction program that provides incentives corresponding to the Carbon Points earned. As of 2018, a total of 2.87 million households and 7,894 commercial entities participated in the program.

〈Table 3–12〉 Scope of Participation in Carbon Point Program and Incentive Payment Criteria

Category		Description
Individual	Target Individual	<ul style="list-style-type: none"> Householder or member of each family, or a user of school, commercial facilities
	Incentive	<ul style="list-style-type: none"> Paid every half-year in June and December based on GHG reduction rate If GHG reduced for more than 2 consecutive years : points provided for reduction of 0–5% from the following half-year term
Group	Target Group	<ul style="list-style-type: none"> Management office, school principal and building manager of apartments housing more than 150 households, schools and common areas (street lamps and industrial electricity) of general buildings (the size of building or area subject to the program adjusted at the discretion of the local government)
	Incentive	<ul style="list-style-type: none"> Paid once a year according to the assessment result of each building or area * For building or area with over 5% GHG reduction rate, incentive is calculated by applying a 60:40 weight on GHG reduction rate and individual participation rate If GHG reduced for more than 2 consecutive years : points provided for reduction of 0–5% from the following half-year term

- (Carbon Points Calculation)
For each type of energy targeted for GHG reduction (electricity, water, gas), monthly average consumption of past two years from the bill settlement period (baseline) and current consumption are compared, and then Carbon Points are calculated based on the reduction rate for each energy type
- (Types of Incentives)
Cash, gift voucher, standard plastic garbage bag and green card point (for green cardholders only) as determined by the respective local government

※ Source: 2018–2019 Evaluation of Progress of GHG Reduction (Greenhouse Gas Inventory and Research Center, 2020)

Advanced Metering Infrastructure (AMI) is core infrastructure that manages energy consumption through remote inspections of real-time energy consumption and interactive exchange of information using wireline and wireless communication. AMI consists of interactive communication-based digital meter and equipment for transmitting electricity usage data and control. AMI delivers information on electricity price and consumption on real-time basis, enabling demand response (DR) for consumers, and accurate demand prediction and load control for providers. AMI was applied to seven million households in 2018 and will be applied to 15 million households by 2030. Korea Electric Power Corporation (KEPCO) which has been steadily expanding the application of AMI since 2010 aims to provide it to 22.5 million households by 2020.

Lighting devices are also a major target for management along with home appliances and office devices in reducing energy consumption and GHG emissions by buildings. Reinforcing the management of efficiency of lighting devices contributes to the expanded supply of energy-efficient lighting devices and encourages the development of related technology. MOTIE plans to gradually raise the minimum energy consumption efficiency standard for fluorescent lights of which the energy efficiency is lower than LED by 2028.



– Transportation Sector

In order to enhance people's living environment based on the Act on the Promotion of Development and Distribution of Environment-friendly Motor Vehicles (April 2020), the Fourth Master Plan for Development and Distribution of Environment-friendly Vehicles (February 2021) is implemented for the transportation sector. The Plan aims to support the development of hybrid, electric and hydrogen fuel cell vehicles with high energy efficiency and increase the number of eco-friendly vehicles on road throughout 2030 by supporting demonstration projects and providing subsidies.⁴⁴

(Table 3–13) Direction of Major Reduction Policies for the Transportation Sector

Category	Description
Local Government's Bicycle Promotion Plan	<ul style="list-style-type: none"> Promote energy saving and GHG reduction by encouraging use of public transportation and bicycles
First National Sustainable Transport Development Master Plan 2011–2020 (June 2011)	<ul style="list-style-type: none"> Establish mid- to long-term goals and strategies for sustainable transport policies Establish a sustainable regional transport development plan Develop low-carbon transport system for efficient GHG emissions and energy management in the transport sector
Fourth Development and Distribution of Environment-friendly Automobiles Promotion Master Plan (February 2021)	<ul style="list-style-type: none"> Increase sales of new eco-friendly vehicles by 51% by 2025 and 83% by 2030; reduce 5.9 million tonnes of GHG by 2025 and 17.3 million tonnes by 2030 Develop an eco-friendly vehicle oriented social & industrial ecosystem by 2025

Policies and measures to reduce GHG in the transportation sector are categorized into road, maritime, rail and aviation. In recent years, mitigation of fine dust is also considered in association with reducing emissions. As GHG in the transportation sector is mostly emitted on the road, the improvement of average fuel efficiency of vehicles is integral in the respective sector. ROK manages the average fuel efficiency of all vehicles that are either domestically produced or imported to ROK for one year based on the Notice on Average Energy Consumption Efficiency Criteria and GHG Emissions Permission Criteria for Vehicles, and the Application and the Management of Such Criteria. The average fuel efficiency of passenger cars was 17.24km/L in 2018 with the credit applied, marking 97% achievement of the target.

⁴⁴ According to the Fourth Master Plan for Development and Distribution of Environment-friendly Vehicles 2021–2025 (February 2021), ROK has the world's eighth-largest electric vehicle market and the largest hydrogen vehicle market as of 2019. ROK's global competitiveness is proven by increased supply and a growth in exports of eco-friendly vehicles. More charging facilities are built following the increased demand for eco-friendly vehicles. A supply of eco-friendly vehicles will be expanded by creating large demand for eco-friendly vehicles and increasing supply in the public and private sectors, increasing subsidies, and building economic and convenient refueling infrastructure.

〈Table 3–14〉 Improvement of Average Automobile Fuel Efficiency in 2018

Average Fuel Efficiency (km/L)		2018		2019
		Achieved	Target	Target
Passenger Car	With credit	17.24	17.47	17.7
	Without credit	16.23		
Small-sized Van and Truck	With credit	12.29	15.44	15.97
	Without credit	12.29		
GHG Emissions (g/km)		2018		2019
		Achieved	Target	Target
Passenger Car	With credit	136.27	138.61	131.01
	Without credit	141.62		
Small-sized Van and Truck	With credit	208.77	167.6	166.62
	Without credit	208.93		

* Average Fuel Efficiency Credit System

- Average fuel efficiency and average CO₂ emissions for new vehicles are measured by taking into account the percentage of sales of eco-friendly vehicles including plug-in hybrid vehicles, electric vehicles and hydrogen vehicles, compact cars and manual transmission cars (additional credit for LPG cars is applied for average fuel efficiency)
- The System encourages and supports respective car manufacturers to promote cars with high energy consumption efficiency and comply with regulations on average efficiency of energy consumption

※ Source: 2018–2019 Evaluation of Progress of GHG Reduction (Greenhouse Gas Inventory and Research Center, 2020)

[Reference] Future Cars and Market Occupation Strategy (October 2020)

In October 2020, the Future Cars and Market Occupation Strategy (October 2020) was announced aiming to establish a social system and an industrial ecosystem that are friendly toward future cars. Four goals and strategies were proposed for the vision of setting 2022 as the base year for widespread use of future cars and developing a future car-oriented social ecosystem by 2025. To expand the use of future cars, construction of refueling stations are in progress considering citizens' living and driving patterns. The goal is to build 500,000 slow chargers and 15,000 fast chargers by 2025.

No. of Future Car Charger Built by Year (as of December 31, 2021)

Category	~2018	2019	2020	2021	Total
Electric	27,352	17,440	19,396	42,513	106,701
Fast	5,213	2,183	2,409	5,262	15,067
Slow	22,139	15,257	16,987	37,251	91,634
Hydrogen	14	22	34	100	170

※ Source: Status of Supply of Electric and Hydrogen Vehicles and Establishment of Charging Infrastructure (Ministry of Environment, 2022)



The ROK government and oil companies entered into the agreement to use diesel fuel with 0.5% of biodiesel blend since 2006 in order to reduce GHG emissions. Subsequently, a mid- to long-term plan was developed in 2007 to increase the biodiesel blend by 0.5% every year to reach 3% in 2012. According to the plan, the share of bio-diesel increased to 1% in 2008, 1.5% in 2009 and 2% in 2010. However, the Second Mid- to Long-term Bio-diesel Supply Plan (December 2010) outlined to maintain the proportion of biodiesel at 2% until 2015. In 2013, Renewable Fuel Standards (RFS) was introduced which mandated the provider of transport fuel to use biodiesel blends in the conventional fossil fuel (diesel fuel). RFS was implemented from 2015, and the mandatory blend proportion is revisited every three years. The mandatory proportion of biodiesel which started at 2.5% at the end of July 2015 was revised to 3% in 2018 and to 3.5% in July 2021. It will be raised by 0.5%p every three years to reach 5% by 2030.⁴⁵

GHG emissions in the transportation sector can be reduced significantly by minimizing time on the road by leveraging information communication technology (ICT) based real-time traffic updates, extending the use of low-carbon transportation means and changing driving habits. Intelligent Transport System (ITS) applies information, communication and control technologies to transportation means and facilities, thereby optimizing and automating traffic operations, and providing traffic information to travellers to enhance mobility, safety and convenience. If application of ITS is extended to congested areas, traffic congestion can be relieved through real-time traffic management while improving the overall energy efficiency of the roads. By implementing Intelligent Transport System Master Plan 2020 (December 2011) and the ITS Plan 2020 for Vehicles and Road Transportation Sector (June 2012), the ROK government defined the strategy and sectoral targets to expand ITS nationwide.

Measures to reduce GHG in the maritime transportation sector include increasing the supply of new eco-friendly ships⁴⁶, disposing of and replacing old ships with new ships. To this end, the ROK government is committed to increasing the supply of environmentally-friendly ships in the public and private sectors in accordance with one of the 100 government tasks which is to become a maritime powerhouse through co-existence of maritime transport and shipbuilding. In the private sector, the government has been committed to increasing demand for eco-friendly ships by providing subsidies for disposal of old outbound vessels and for either replacement of old domestic vessels aged over 20 years with eco-friendly vessels or build new

⁴⁵ The updated 2030 NDC specifies that the increased proportion of biodiesel from 5% to 8% by 2030.

⁴⁶ The ROK government has established the 2030 Korean Green Ships (GreenShip-K) Promotion Strategy for the purpose of developing technologies and promoting the supply of eco-friendly ships to reduce GHG in the maritime industry. During the first basic planning period (2021~2030), the focus will be on developing GHG reducing technologies and expanding the use of technologies to create a foundation for reducing emissions generated by ships in line with major policies related to the Green New Deal and carbon neutrality. Specific goals include ① development of technologies to reduce GHG by 70% and ② convert 15% of public and private sector ships to eco-friendly ships.

vessels (a subsidy of approximately 10% of new shipbuilding cost) since 2018. In the public sector, as per the Act on the Promotion of Development and Distribution of Environment-friendly Ships, public ships that are built from 2020 must be Green Ships. Ministry of Oceans and Fisheries (MOF) is taking pre-emptive measures to convert all government-runner ships in possession (143 ships) into 100% environmentally-friendly ships by 2030.

〈Table 3-15〉 Targeted Replacement of Government Runner Ships with Green Ships

Category	2020	2021	2022	2023	2024
Shipbuilding for Replacement (No. of ships)	8	9	8	3	2

※ Source: 2018–2019 Evaluation of Progress of GHG Reduction (Greenhouse Gas Inventory and Research Center, 2020)

Alternative Maritime Power Supply (AMP) provides the electricity required by a ship when anchored at the port to ballast water facilities, freezer or air conditioning equipment from land instead of using a power generator that uses bunker C oil. To reduce fine dust and GHG generated by docked ships, the target outlines to install AMP on 248 berths in 13 ports by 2030 for which AMP pilot installation has been taking place since 2019.

〈Table 3-16〉 Target for AMP Installation

Category	2020	2025	2030
Target AMP Installation (No. of AMPs)	43	131	74

※ Source: 2018–2019 Evaluation of Progress of GHG Reduction (Greenhouse Gas Inventory and Research Center, 2020)

For the domestic aviation industry, the ROK government has set a target to improve its fuel efficiency by 1% per annum.⁴⁷ Although the target has not yet been achieved, flag carriers are exerting efforts in technical aspects such as shortening the air routes or regularly cleaning the engines. In 2010, MOLIT entered into voluntary GHG reduction agreements with domestic airlines to encourage voluntary engagement of airline companies in reducing GHG from international flights. Furthermore, the ROK government has been developing the National Action Plan for GHG Reduction from International Flights every three years since 2012 to identify its target of enhancing the fuel efficiency of overseas flights by 1.3% in average per annum by 2025. The national reduction target does not apply to international airlines but reduction efforts by international airlines can have positive impact on domestic airlines. Reduction of GHG emissions in the aviation industry will be further accelerated through participation in Carbon Offsetting and Reduction Scheme for International Aviation (CORSA) which will be implemented since 2021.

47 Revised Basic Roadmap to Achieve the National GHG Reduction Target for 2030 (Jul 2018)



At the local government level, plans to promote the use of bicycles are developed and promoted. Other efforts by local governments to ensure energy saving and GHG reduction include: planning for infrastructure development such as connecting bicycle routes; providing Carbon Points (eco mileage) as an incentive to bicycle users; partially reimbursing transportation expenses with mileages through Altteul (Cost-saving) Transportation Card System for those travelling by walk or bike; and encouraging the use of public transportation and bicycles. At the national level, the use of low-carbon transportation means is promoted by improving pedestrian environment, implementing bicycle policies customized to regions and users, and supporting the creation of safe cycling environment.

〈Table 3–17〉 2018 Performance, e.g. Development of Public Transportation Network

Category	2018		2019
	Achieved	Target	Target
Roads with ITS (km)	15,712	15,712	16,112
Extended Railway (km)	4,274	4,274	4,410
Extended Bicycle Route (km)	23,000	22,400	22,600
Number of People who Completed Eco-drive Training	1,986	2,000	2,000
Freight Transport Converted from Road → Rail (million tCO ₂ eq.)	2.37	2.37	2.11
Freight Transport Converted from Road → Marine (million tonnes)	2.62	2.62	2.48
Aircraft Fuel Efficiency Improvement Rate (%)	0.89	1	1

※ Source: 2018–2019 Evaluation of Progress of GHG Reduction (Greenhouse Gas Inventory and Research Center, 2020)

– Waste Sector

ROK's waste policy has moved away from simply emphasizing safety in waste disposal and shifted toward not only promoting recycling, but further focusing on economic and social circulation of resources. Enacting the Framework Act on Resource Circulation in 2016, ROK is driving the transition to a plastic-free society. GHG are reduced in the waste sector primarily by reducing the quantity of wastes and increasing recycling, and by recovery of methane from landfills. The Revised 2030 Roadmap (July 2018) outlined the plan to reduce 4.2 million tCO₂eq. of GHG through waste reduction and increased recycling, and 0.5 million tCO₂eq. of GHG through methane recovery by 2030.

〈Table 3–18〉 Direction of Major Reduction Policies in Waste Sector

Category	Description
First National Climate Change Adaptation Plan (December 2016) (2016.12)	<ul style="list-style-type: none"> • Create a sustainable society by reducing landfill and maximizing recycling leveraging a resource circulation mechanism • Create a resource circulation mechanism leveraging various systems introduced by the Framework Act on Resource Circulation (May 2016) to build required infrastructure • Use collected waste disposal levy to build infrastructure for resource circulation mechanism necessary to expand recycling and reduce landfill
First Resource Circulation Master Plan (2018~2027) (September 2018)	<ul style="list-style-type: none"> • As ROK is highly dependent on import due to scarce resources and has difficulty securing additional landfills due to limited land area, so transition to circular economy is an urgent issue. • Hence, the National Resource Circulation Action Plan has been implemented which specifies country's mid- to long-term policy and detailed strategies to build a circular economy • Based on the vision to create a sustainable circular economy through virtuous circulation of resources: ① enable resource circulation in the whole process of production, consumption, management and recycling; ② primarily reduce waste generation, and promote reuse of high-quality materials; and ③ develop core strategy which includes optimization of waste disposal process by region based on governance of public engagement

The First Resource Circulation Action Plan for 2018–2027 (September 2018) represents a 10-year national strategy established by the Ministry of Environment (MOE) for efficient use of resources, prevention of waste generation, and circular utilization. Resource circulation policy are categorized into: ① reduction and reuse; ② recycling; and ③ energy recovery.

Reduction and reuse policy includes regulation of the use of disposable items, over-packaging, volume-rate garbage disposal system, waste management at business sites and refundable containers. Waste management at business sites is designed to fundamentally prevent the generation of wastes not only from distribution and consumption but also from production. In 2018, Resource Circulation Performance Management System was introduced to measure and evaluate the progress at the national, regional and sectoral level in pursuit of facilitated resource circulation.

The Resource Circulation Performance Management System (2018) sets the target and manages the progress at the city and the province level as well as business sites that produce large quantities of waste to support the achievement of ROK's mid- to long-term resource circulation target by stages. The System is applicable to 18 divisions as per the Korea Standard Industry Code (KSIC) that produced over 100 tonnes of designated wastes in average per annum for the past three years, or that produced over 1,000 tonnes of undesignated waste. In order to verify waste reduction and the progress in resource circulation, final disposal rate and recycling rate targets are assigned. If the targets are not met, measures such as publicly announcing the name of the company or conducting a technical audit are taken.



As part of the recycling policy, various advanced mechanisms are introduced to promote recycling of wastes which include waste disposal levy program, mandatory separation of recyclable waste, Extended Producer Responsibility (EPR) and Environmental Assessment for Recycling Waste. Most importantly, respective policy has led to mandatory implementation of an evaluation of materials and structures of all packaging materials subject to EPR, introduction of differentiated disposal contributions, revised guidelines to improve materials and structures of electronic products, and development of production guidelines for resource circulation per product grouping. After EPR was introduced, recycled waste from 43 items subject to EPR increased by 200% from 642,500 tonnes in 2003 to 1,204,000 tonnes in 2018. Recycling rate was also increased by 15%p compared to 2003.

(Table 3–19) Progress of Delivery of Recycling Obligation

Category	2003	2005	2007	2009	2011	2013	2015	2017	2018
Recycling Obligation (Kilo tonnes)	642.5	710.0	754.9	758.8	925.6	925.6	1,096.0	1,180.2	1,204.0
Recycling Rate (%)	64	67	72	75	78	75	82	80	79

* Source: Korea Resource Circulation Service Agency (2018) (<http://www.kora.or.kr>)

Local governments and waste producing business sites that manage waste through incineration or landfill are subject to waste disposal levy program which encourage maximum recycling. The amount of levy is calculated in proportion to the quantity of incinerated or buried waste. The charging rate differs according to the type of waste and disposal means of either incineration or landfill. Levies on incinerated land landfill wastes from business sites in 2018 were imposed in 2019 while levies on construction wastes from construction projects that ended in 2018 were imposed in 2018. Progress of waste disposal levy program is assessed in the medium and long term. The program will continuously be improved by ensuring the effectiveness of levy to minimize waste incineration and landfill.

Lastly, the focus of energy recovery policy is on recovering energy from waste resources by generating energy from organic waste, producing Solid Refuse Fuel (SRF) and creating an environmentally–friendly energy town. Considering various means of waste management among which waste reduction is the most preferred mean followed by reuse, recycling and energy recovery, the policy focuses primarily on recycling and pursues energy recovery through implementation of SRF quality grading system (2018). Furthermore, wastes are disposed of in an eco–friendly manner with cooperation of residents in respective regions by ensuring that waste is produced and managed in the same region and prohibiting direct burial of inflammable municipal waste to achieve the target of environmentally friendly disposal.

– Public and Other Sectors

ROK is exerting pre-emptive and proactive efforts to reduce GHG in the public and other sectors by implementing Target Management System (TMS) in 780 public entities including central administrative agencies, local governments, public organizations as well as national and public universities since 2011. In order for the public sector to lead GHG reduction, most of the major reduction measures for the building sector are applied to public buildings, and such measures take place before applying to private buildings.

〈Table 3–20〉 Direction of Major Reduction Policies in Public and Other Sectors

Category	Description
Green New Deal	<ul style="list-style-type: none"> • Reduce GHG by increasing investment in public sector
First National Climate Change Adaptation Plan (December 2016)	<ul style="list-style-type: none"> • Improve energy efficiency by increasing LED usage in public institutions and remodeling old buildings • Enhance TMS
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> • Increase LED lighting supply from 90% to 100% by 2030 • Replace all street lamps to LED and renewable energy lamps by 2030 • Remodel public buildings that are over 15 years old including schools and universities

Article 12 of the Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy (New and Renewable Energy Act) (March 2017) stipulates that the central government, local governments and public institutions are obliged to use new and renewable energy. Construction, expansion or reconstruction of a building of which floor area is over 1,000 m² led by the public sector such as central or local governments must be installed with the facility that enables a certain share of energy consumption to be sourced from new and renewable energy. The mandatory share of new and renewable energy per year will be increased to 40% by 2030 in phases. The target of 24% for 2018 was achieved as the share of new and renewable energy consumed in the respective year was 24.6%. The target for 2019 was set at 27%.⁴⁸

Following the amendment of the Clean Air Conservation Act (November 2017), any new vehicles to be purchased by government agencies, local governments and public institutions that possess 10 or more vehicles must be low-emissions vehicles, and penalty shall be imposed on any violation from 2020. Such obligation was first imposed on the Seoul metropolitan area and has been subsequently expanded nationwide with an increased target ratio from 70% in 2019 to 100%.

⁴⁸ According to the New and Renewable Energy Act (October 2020), the mandatory share of new and renewable energy for 2020~2021 was 30%, and in 2020, the share reached 30.7% which is 0.7% above the target.



– Agriculture and Fisheries Sector

In the agriculture and fisheries sector, the Action Plan for Climate Change in Agriculture, Fisheries and Food Sector (2011~2020) (May 2011) and the Plan for Climate Change Implications and Response were developed. Additional efforts are also in place which include development of low-carbon agricultural technologies aiming to reduce GHG and introduction of the agriculture and rural voluntary GHG reduction project (2012) and the Low-carbon Agricultural and Livestock Product Certification System (2012).

〈Table 3-21〉 Direction of Major Reduction Policies for Agriculture, Stockbreeding and Fisheries Sector

Category	Description
Detailed Master Plan for Climate Change Adaptation in Agriculture, Fisheries and Food Sector (May 2011)	<ul style="list-style-type: none"> • Create sustainable foundation for agriculture and food via GHG reduction and climate change adaptation • Transition to eco-friendly stockbreeding to reduce GHG • Improve foundation for agricultural production by securing stable supply of agricultural water
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> • Most reduction in the agricultural sector is achieved through policy projects since institutional measures are most effective in the respective industry considering the nature of the sector in which small-sized, unspecified mass of households are the major source of GHG • Create the environment for farmers to manage the agricultural water by providing training through Agricultural Technology Center and improving the irrigation facilities including waterway • Enhance efficiency of livestock manure treatment and efficiency of bio-gas production by improving purification system and preprocessing procedure as well as developing digestion tank operation technology • Use bio-technology to develop technology that reduces methane emitted by livestock from enteric fermentation, and supply low-methane feed • Enhance energy efficiency of fishing boats by replacing engines in old littoral fishing boats

As part of voluntary GHG reduction projects, external business of offsetting K-ETS have been carried out since 2015.. Also, a supply of Smart Farms is increasing to save energy and reduce GHG, and enhance productivity in agriculture and stockbreeding.

In order to accurately identify GHG emissions at fishing sites, sample littoral fishing boats of nine sub-sectors including offshore longline fishing have been used since 2014. Fishing communities are provided with highly efficient devices that consume less fuel as well as energy-saving LED lights. Supports include replacement of old inefficient engines, equipment and facilities of littoral fishing boats. Research and development of energy-efficient eco-friendly fishing boats have been conducted since 2021. Eco-friendly boats will be supplied from 2026.

According to the Rural Development Administration (RDA), when the rice cropland is filled with lesser water of 2~5cm depth after drying up the cropland (intermittent irrigation), average annual emissions for three years decrease by 63.0% compared to when the depth of water is over 5cm as oxygen is naturally supplied to the land. Research showed that 50.6% of emissions can be cut only by drying up the cropland without reducing water. An area of rice farms decreased by 2.2% in 2018 compared to 2017. Although the percentage of the area that is dried up for over two weeks has increased (33%→38%), the adoption rate of the intermittent irrigation method has been stagnant at 84–87% since 2015. According to the Revised 2030 Roadmap (July 2018), the target aims to increase the area adopting the respective method to 97% by 2030.

Under the voluntary GHG reduction project of agriculture and rural sectors that began in 2012, incentives are paid corresponding to the amount of GHG reduced by farming entities through GHG reduction activities such as using less agricultural resources for resource circulation and saving energy by installing energy consumption reduction facilities. As of 2018, a total of 778 farming households have reduced 75,856 tCO₂eq. of GHG through such efforts.

〈Table 3–22〉 Progress of Voluntary GHG Reduction Projects in Agriculture and Stockbreeding Sector

Year	No. of Registration	No. of Registered Farmhouse	No. of Certification	No. of Certified Farmhouse	Quantity of Reduction (tCO ₂ eq.)
2012	5	68	—	—	—
2013	5	117	5	60	4,859
2014	6	108	9	171	9,779
2015	10	90	13	126	14,144
2016	9	47	17	191	16,480
2017	11	41	19	106	16,547
2018	10	17	26	124	14,047

※ Source: GHG Reduction Projects in Agricultural Sector (Ministry of Agriculture, Food and Rural Affairs)

Low-Carbon Agricultural and Livestock Product Certification is a national system applied to 61 items to certify eco-friendly or GAP (Good Agricultural Practices)-certified agricultural and livestock products that have contributed to reducing GHG emissions during the course of their production by using low carbon agricultural technology. Operational Rules for Low-carbon Agricultural and Livestock Product Certification (March 2014) were established to provide the grounds for its operation, and accordingly, the mark to indicate government-certified agricultural and livestock products has been placed on certified agricultural and livestock products since 2014.



Smart farm refers to a farm that is managed with the minimum use of unnecessary inputs such as fuel, fertilizer and water by utilizing ICT and renewable energy. The ROK government established plans to expand smart farms in 2018, and accordingly, development of four Smart Farm Innovation Valleys which will serve as a central hub for expansion of smart farms are under progress throughout 2022. Smart farms are built at 1,425 stockbreeding farmhouses, and the area of horticultural smart farm reached 2,900 hectares by 2018 which will increase to 5,750 farmhouses and 7,000 hectares by 2022.

The livestock smart farm utilizes ICT convergence which includes communication, sensors, surveillance cameras, Internet of Things (IoT), big data, robotics and artificial intelligence to manage the environment of the sheds and the livestock remotely and automatically, thereby requiring less labor and enhancing productivity. To create the foundation for sustainable agricultural and food industry which is one of the ROK government’s 100 national agenda, Ministry of Agriculture, Food and Rural Affairs (MAFRA) has set a target to supply ICT equipment required for smart farming to 5,750 stockbreeding households by 2022.

<Table 3–23> Progress of GHG Reduction Projects by Year

(Unit : tCO₂eq.)

Category	Year	2015	2016	2017	2018	2019	2020
Voluntary GHG Reduction Projects for agricultural industry and farmhouses		14,144	16,480	16,547	14,047	11,425	9,738
K-ETS by External Project in Agricultural Industry		–	–	3,229	12,413	24,224	35,551
Low-carbon Agricultural and Livestock Goods Certification		9,154	11,901	25,963	68,455	74,947	77,769

* K-ETS by external companies in agricultural industry began in 2017

** Divided into voluntary reduction project (small-scale) and external project (large-scale) based on the scale of GHG reduction

After announcing the Third Comprehensive Plan for Climate Change Adaptation by Ocean and Fisheries Sector 2016–2020 (November 2016), Ministry of Oceans and Fisheries (MOF) is laying the foundation to build eco-friendly and energy-saving fisheries industry in order to reduce GHG emitted by fishing boats. MOF is currently developing a highly-efficient standard vessel model for littoral fishing boats that could reduce emissions by more than 7% per tonne. In addition, MOF will continue to replace old engines in order to continue reducing GHG emissions by fishing boats and the fisheries industry.

– Forest Carbon Sink Sector

ROK has been establishing the Forestry Master Plan every 20 years for forest management since 1973. Forests are continuously maintained by planting trees after lumbering and afforestation to allow forest carbon sinks absorb more GHG. The Carbon Sinks Improvement Master Plan 2015–2019 (December 2014) was established to respond to climate change by maintaining and enhancing GHG absorption by forests of which the progress is assessed every year.

〈Table 3–24〉 Direction of Major Reduction Policies for Forest Carbon Sink Sector

Category	Description
First National Climate Change Adaptation Plan (December 2016)	<ul style="list-style-type: none"> • Contribute to GHG reduction by enhancing the adaptation capability to climate change of carbon sinks such as forests • Manage forests systematically and intensively through commercial forest complexes • Enhance carbon absorption by forests by replacing afforestation tree species and creating forests by function • Create multi-layered forests to ensure ecological health and sustainable carbon absorption in regions where water yield function, maintaining scenery and disaster prevention are important • Expand tideland restoration projects in closed salt farms and idle reclaimed land nationwide, and create vegetation in estuary and saltmarsh in order to contribute to GHG reduction
Sixth National Forest Master Plan 2018–2037 (January 2018)	<ul style="list-style-type: none"> • Strengthen the role of forests to achieve Sustainable Development Goals (SDGs) • Promote eco-friendly forestation projects and increase forest welfare service • Promote reasonable use of mountain land and conservation of ecosystem
Second Comprehensive Plan for Improvement of Carbon Sinks (January 2018)	<ul style="list-style-type: none"> • Promote carbon absorption, storage, reduction via forests • Strengthen capacity of forestry and forests to adapt to climate change • Enhance GHG statistics and expand forest carbon offset program • Enhance global cooperation for the new climate regime • Expand R&D for climate technology
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> • Promote virtuous carbon cycle in forest management by creating commercial forest complex, developing forest management plan considering carbon absorption capacity and forest trail system; increase carbon absorption capacity of forest tree species; create multi-layered/mixed forest and functional forests • Create new carbon sinks by expanding urban forests in residential areas, converting idle land (marginal land) to forest, and creating coastal forest belt • Improve carbon storage effect by managing domestic lumber history and expanding lumber production, developing processing technology of lumber that stores carbon for long periods

In 2013, the Act on the Management and the Improvement of Carbon Sinks (February 2013) was implemented together with the announcement of Forest Carbon Offset Operational Standard for Social Contribution (June 2013) to promote voluntary forest carbon sink projects. Accordingly, the Forest Carbon Offset Scheme has been in place since 2013. Also, Korea Forest Service (KFS) established the Second Master Plan for Improvement of Carbon Sinks (January 2018) and the Sixth National Forest Master Plan (January 2018) to expand ROK's forest carbon sinks.



The Sixth National Forest Master Plan (January 2018) seeks to advance the management of forest resources and mountain land by strengthening the role of forests in achieving SDGs while nurturing the lumber industry and creating high value-added domestic wood in pursuit of promotion of forest industry and more jobs created. At the international level, the ROK is seeking to adapt to the new climate regime by procuring overseas forest resources and preventing conversion of forests in developing countries (Reducing Emissions from Deforestation and Forest Degradation Plus, REDD+), thereby leading the global cooperation in forestry and achieving land reforestation in the Korean peninsula.

〈Table 3–25〉 Potential Volume of Forest Carbon Absorption

(Unit: ktCO₂eq.)

Category	2017	2018	2019	2020	2025	2030
Quantity of Absorption	42,050	39,279	37,544	35,773	28,673	22,246

※ Source: Second Comprehensive Plan for Improvement of Carbon Sinks (Korea Forest Service, 2018)

KFS certifies the amount of carbon absorbed by entities that voluntarily conduct forest carbon offset activities as per Forest Carbon Offset Scheme. To promote the Scheme, KFS provides information on the types of forest carbon offset projects available and supports entities with following the administrative procedure.

As per the Revised 2030 Roadmap (July 2018), 21.17 million tCO₂eq. of carbon which accounts for 95.8% of 22.1 million tCO₂eq. which is the target volume of absorbed emissions in 2030 shall be absorbed through virtuous carbon circulation enabled by creating commercial forest complexes, developing forest management plan considering carbon absorption capacity, laying forest trails, increasing carbon absorption by forest tree species and creating multi-layer/mixed forests and functional forests. Since designating 450 grouped forests of 2.92 million hectares that demonstrate robust management conditions as commercial forest complexes for the first time in 2005, the ROK government continues to enhance management of forests especially those that have optimal circumstances for forest activities including collective areas of afforestation. Areas no longer suitable for forest treatment after 10 years since their designation as commercial forest complexes were excluded, and new suitable areas with forest trail facilities were added in 2016, resulting in 387 commercial forest complexes of 2.34 million hectares.

As offering tax benefits upon development of forest management plans contribute to planned management of forests and reinforced function of forests as carbon sinks, a new article was added to the Special Tax Treatment Control Act (September 2017) to exempt capital gains tax on self-cultivated mountain land (Article 69.4) to promote long-term forest business. KFS has developed a plan to expand supports in connection with such tax exemption and subsidies, and to strengthen promotion of such benefits offered by distributing brochures as part of its medium and long-term efforts.

[Reference] Future Plans for the Forest Sector

The Revised 2030 Roadmap expects that 0.9 million tCO₂eq. of carbon will be absorbed in 2030, leveraging the enhanced carbon storage capacity enabled by managing the history of domestic lumber and expanding lumber production, and developing processing technology of lumber that stores carbon for long periods. As forests in the ROK were mostly created in 1970s and their lumbering period is approaching, relevant ministries and departments plan to establish a special avenue with the use of regionally produced wood, create jobs in the region by building wooden houses and welfare facilities with timber, and develop eco-friendly wood city and increase timber buildings. In the medium to long term, a roadmap will be established by 2024 and a total of KRW 8.4 billion will be invested to implement the pilot wood city project and operate supporter groups for the wood city.

There are carbon sinks other than forests available such as coastal wetlands which are excluded in the 2030 target. Blue carbon refers to the carbon absorbed by salt plants in the coasts through photosynthesis and also those captured by the coastal ecosystem from the movement of deposits from the neighboring land and ocean ecosystems. It is highlighted as a new option for GHG absorption.

The speed of GHG absorption by the ocean ecosystem is up to 50 times faster than that by the land ecosystem. As it is submerged in water and is thus anaerobic, decomposition of the organism occurs slowly which allows the carbon captured inside the plant stay for a long time. The ROK has the world's fifth largest tideland with the total area of 2,482km² and has a huge potential in blue carbon. However, a rapid loss of tidelands is observed recently due to coastal development and environmental pollution which calls for protection and restoration of the coastal habitat. To restore the polluted and damaged ocean ecosystem including closed salt farms, closed aquafarms and idle tideland, MOF has established the First Master Plan for Management and Restoration of Tideland (2021~2025) (August 2021) and plans to restore tideland of 4,5km² in total by 2025.

Furthermore, during Blue Carbon Research Phase 1 (2017~2021), MOF plans to develop technology to measure and verify the amount of carbon absorbed by salt marshes, tidelands and seagrasses; Blue Carbon Phase II (2022~2026) will begin in 2022 to develop technology for discovering and enhancing new carbon sinks in order to establish the foundation for reducing carbon at the oceans.



〈Table 3-26〉 Reduction Actions and Performance Index Status

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ³¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
All sectors	Emissions Trading System	CO ₂ CH ₄ N ₂ O HFCs PFCs SF ₆	Use market function to effectively achieve national GHG reduction target	<ul style="list-style-type: none"> Managing over 70% of national GHG emissions through K-ETS since January 2015 Phase I (2015~2017) and Phase II (2018~2020), respectively, lasting 3 years; Phase III and on to last 5 years 62 sub-sectors are subject to Phase II, with permitted emissions of total 1,777 million KAU (6 sectors: transition, industry, buildings, transportation (domestic), waste, public/others) 	Regulation	<ul style="list-style-type: none"> Ministry of Economy and Finance Ministry of Land, Infrastructure and Transport Ministry of Agriculture, Food and Rural Affairs Ministry of Trade, Industry and Energy Ministry of Oceans and Fisheries Ministry of Environment 	In progress	2015	Reduced volume of GHG (tCO ₂ eq.)
	GHG Energy Target Management System	CO ₂ CH ₄ N ₂ O	GHG reduction and energy saving	<ul style="list-style-type: none"> GHG emissions and energy consumption are regulated to achieve national mid-term GHG reduction target and to save energy In 2015, 740,000 tCO₂eq. of GHG were reduced from all controlled entities 	Regulation	<ul style="list-style-type: none"> Ministry of Environment/ Korean Environment Corporation Ministry of Trade, Industry and Energy/Korea Energy Agency Ministry of Land, Infrastructure and Transport/ Korea Energy Agency, Korea Real Estate Board, Korea Transportation Safety Authority Ministry of Agriculture, Food and Rural Affairs/Foundation of Agricultural Technology Commercialization and Transfer/ Korea Tree Health Association Ministry of Oceans and Fisheries/ Korea Maritime Transportation Safety Authority 	In progress	2010	Reduced volume of GHG (tCO ₂ eq.)

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Transition	GHG Energy Target Management System in public sector	CO ₂ CH ₄ N ₂ O	GHG reduction and energy saving	<ul style="list-style-type: none"> GHG emissions and energy consumption of high-emitting & high energy consuming companies are regulated to achieve national mid- to long-term GHG reduction target and to save energy <ul style="list-style-type: none"> In 2018, 410,000 tCO₂eq. of GHG were reduced from all controlled entities (774 institutions) 	Voluntary Agreement	Ministry of Environment/ Korean Environment Corporation	In progress	2011	Reduced volume of GHG in public sector (tCO ₂ eq.)
	Mix of low-carbon power supply	CO ₂ CH ₄ N ₂ O	Maintaining stable demand & supply of power, and GHG reduction	<ul style="list-style-type: none"> To expand low-carbon power generation facilities to ensure stable power demand & supply and to reduce GHG based on the 8th Basic Plan for Long-term Electricity Supply and Demand (December 2017) 	Policy	Ministry of Trade, Industry and Energy/ Power producer	In progress	2015	Share of low-carbon power generation (%)
	Mandatory Supply of New and Renewable Energy System	CO ₂	Create new & renewable energy market and reduce GHG by promoting stable investment environment in new & renewable energy industry	<ul style="list-style-type: none"> To mandate entities that produce certain level of power (over 500 MW) to supply a certain proportion of total power generation with new & renewable energy 	Policy	Ministry of Trade, Industry and Energy/Power producers (23), Korea Energy Agency	In progress	2012	Number of new & renewable energy supply certificate (REC) granted
	District energy business	CO ₂ CH ₄ N ₂ O	National energy saving and GHG reduction	<ul style="list-style-type: none"> To supply energy (thermal or thermal plus electricity) produced by more than 1 concentrated energy generation facility such as combined heat power plant, heat-only boiler, resource recovery facility to multiple users; applicable to regional heating and cooling companies and integrated energy companies for industrial complexes 	Policy	Ministry of Trade, Industry and Energy/ District Heating Entities (74), Korea Energy Agency	In progress	1985	Volume of heat & electricity sales (%)



Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Industry	Mandatory Energy Diagnosis System	CO ₂ CH ₄ N ₂ O	Enhancing efficiency of energy utilization of high energy consuming companies	<ul style="list-style-type: none"> To mandate companies using 2,000toe or more per year to receive periodical energy diagnosis 	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	2007	Volume of potentially saved energy (toe)
	Consultation on energy utilization plan	CO ₂ CH ₄ N ₂ O	Promoting rational use of energy and energy saving	<ul style="list-style-type: none"> To analyze the impact of projects subject to consultation and installation of facilities on demand & supply of energy, and the impact of energy consumption on GHG emissions To draw up the plan to supply energy in demand and the plan on rational consumption as well as evaluation 	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1993	–
	Investment support and tax support for energy saving facility	CO ₂	Acceleration of supply of energy-saving facilities, and enhancement of efficiency of energy saving and energy utilization	<ul style="list-style-type: none"> To provide long-term low-interest loan to cover investment made to rationalize energy utilization and install energy-saving facilities for GHG reduction 	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1980	Volume of energy saved (toe)
	Project expansion by companies specializing in energy saving	CO ₂ CH ₄ N ₂ O	Acceleration of supply of energy-saving facilities, and enhancement of efficiency of energy saving and energy utilization	<ul style="list-style-type: none"> An energy user with insufficient technology and financing capacity can enter into an agreement with an Energy Service Company (ESCO) to replace its facilities with energy-saving facilities 	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1992	–

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Industry	Energy Consumption Efficiency Rating System	CO ₂	Promotion of development of technology to produce highly-efficient products and guiding consumers to purchase energy-saving products	<ul style="list-style-type: none"> Labeling efficiency rating (grade 1~5) according to the product's energy consumption <ul style="list-style-type: none"> Products that do not meet the minimum efficiency requirement are banned from production and sales 	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1992	Number of applicable products
	Standby Power indication system	CO ₂	Promoting installation of standby power reduction function in electronic products and distribution of products with great capacity of standby power reduction	<ul style="list-style-type: none"> Encouraging switch to power saving mode when not in use and minimization of standby power Energy conservation mark is optionally placed on products that satisfy standby power reduction requirements; non-compliance must be indicated on the product 	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1999	–
	Highly-efficient energy equipment certification system	CO ₂	Acceleration of supply of highly-efficient equipment with huge energy saving effect	<ul style="list-style-type: none"> Government to certify products that satisfy a certain level of requirements for energy consumption efficiency to promote development and distribution of technologies for highly-efficient products <ul style="list-style-type: none"> Issue a certificate for certified product and label the product with a highly-efficient equipment mark 	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1996	–



Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Industry	Factory Energy Management System (FEMS)	CO ₂	Maximizing productivity and energy efficiency through comprehensive management of factories' production and non-production facilities	<ul style="list-style-type: none"> Revised 2030 Roadmap (July 2018) designated Factory Energy Management System (FEMS) as one of the major GHG reduction measures for the industry sector FEMS is installed in 227 business sites, cumulatively, as of 2021 	Policy	<ul style="list-style-type: none"> Ministry of Trade, Industry and Energy 	In progress	2014	–
	Energy Efficiency Resource Standard (EERS)	CO ₂	Mandating the achievement of specific energy efficiency improvement to energy suppliers	<ul style="list-style-type: none"> To mandate individual energy reduction of electricity, gas and heat for suppliers, and depending on performance, impose penalty or provide incentive in order to achieve the energy efficiency enhancement target set by the government Korea Electric Power Corporation: 2019 target to save energy by 0.2% Korea Gas Corporation: 2019 target to save energy by 0.2% Korea District Heating Corporation: 2019 target to save energy by 0.15% 	Regulation	<ul style="list-style-type: none"> Ministry of Trade, Industry and Energy 	In progress	2018	Volume of energy saved
Buildings	Strengthened standards on energy performance incl. insulation	CO ₂	Ensuring efficient energy utilization in building sector by strengthening the standards on designing buildings to consider energy conservation such as prevention of heat loss to ensure efficient building energy management from the design stage	<ul style="list-style-type: none"> Strengthening standards on designing buildings to consider energy conservation such as insulation requirement to ensure efficient building energy management * Windows & doors (W/m²/K) : (July 2008) 3.0 → (2010) 2.1 → (2013) 1.5 → (2015) 1.2 → (2017) 0.9 * Exterior wall (W/m²/K) : (July 2008) 0.47 → (2010) 0.36 → (2013) 0.27 → (2015) 0.21 → (2017) 0.15 	Regulation	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport/ Korea Energy Agency 	In progress	2001	Number of energy saving plan reviewed

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ³⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Buildings	Zero Energy Buildings	CO ₂	Effectively achieving national GHG reduction target by constructing zero energy buildings that minimize energy load upon new construction and minimize energy consumption by using new & renewable energy	<ul style="list-style-type: none"> Since implementation of Zero-energy building certification system in January 2017, 1,233 buildings have been certified as of June 30, 2021 	Regulation	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport / Ministry of Trade, Industry and Energy 	In progress	2017	Number of zero energy building certifications
	Support for interest payment for Green Remodeling	CO ₂	Encouraging private building owners to improve the performance of buildings without the burden of initial expenses by providing financial support	<ul style="list-style-type: none"> Supported around 58,000 cases as of June 30, 2021 after starting to subsidize interest payments for private sector green remodeling in January 2014 	Fiscal	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport 	In progress	2014	Number of subsidy cases
	Certification for energy-saving eco-friendly Green Houses	CO ₂	Introducing new & renewable energy and using highly-efficient facilities and eco-friendly insulation, and refraining from using fossil fuels as much as possible to supply houses of less energy consumption and GHG emissions	<ul style="list-style-type: none"> Multi-dwelling buildings housing over 30 households must submit a Green Home performance evaluation and supporting documents to the responsible authority (local government) for approval of construction which are reviewed considering opinions from energy expert institutions such as KEA <ul style="list-style-type: none"> Energy efficiency of the Green Home is assessed from diverse perspectives including performance evaluation, design criteria and efficiency rating certification No. of Green Homes supplied: 490,000 (2018), 410,000 (2019) 	Regulation	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport 	In progress	2009	Number of certifications



Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Buildings	Carbon Point Program	CO ₂	Nationwide GHG reduction program that provides Carbon Point and incentives based on the reduced volume of electricity, water and gas	<ul style="list-style-type: none"> For each GHG reduction target category (electricity, water, gas), 2-years' monthly average usage since the settlement period (baseline) and current usage are compared, and Carbon Points are provided for each category according to the reduction rate <ul style="list-style-type: none"> In 2018 and 2019, 2.87 million households and 2.99 million households took part in the Program respectively 	Other	Ministry of Environment	In progress	2009	–
	Advanced Metering Infrastructure (AMI)	CO ₂	Transmitting electricity price and utilization information on real-time basis, to enable Demand Response by consumers and enable suppliers to make accurate demand predictions and load management	<ul style="list-style-type: none"> AMI is core infrastructure to manage energy consumption through real-time inspections of energy consumption remotely and interactive exchange of information using fixed and mobile communication. AMI consists of interactive communication-based digital meter and other devices that transmit electricity usage data and control <ul style="list-style-type: none"> A cumulative number of AMI installed is 7 million in 2018 and 848 in 2019. 	Other	Ministry of Trade, Industry and Energy/ Korea Electric Power Corporation	In progress	2010	Number of cases for installation

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ³⁰	Type of Means ³¹	Ministry/Agency	Delivery Status ³²	Year of Implementation	Performance Index
Transportation	Reinforcing average fuel efficiency criteria for passenger cars and supply of eco-friendly vehicles	CO ₂ CH ₄ N ₂ O	GHG reduction by strengthening passenger car fuel efficiency and increasing supply of eco-friendly vehicles	<ul style="list-style-type: none"> • Manage average fuel efficiency criteria for passenger cars <ul style="list-style-type: none"> – Strengthen average fuel efficiency of passenger cars (33.1km/ℓ by 2030) • Supply eco-friendly vehicles <ul style="list-style-type: none"> – Create large scale demand for eco-friendly vehicles in public and private sectors, build charging infrastructure, support eco-friendly vehicle technology development, transition/nurture future car parts manufacturing companies – Supply hybrid vehicles (4 million by 2030) – Supply electric vehicles (3 million by 2030) – Supply hydrogen electric vehicles (850,000 by 2030) • Average fuel efficiency of medium & large vehicles <ul style="list-style-type: none"> – 2.0% improvement by 2023 compared to 2021~2022, 7.5% improvement by 2030 	Regulation, Research (Technology development)	<ul style="list-style-type: none"> – Ministry of Land, Infrastructure and Transport – Ministry of Trade, Industry and Energy – Ministry of Environment 	In progress	2017	Passenger car fuel efficiency
	Bio-diesel blend in road transport	CO ₂ CH ₄ N ₂ O	Mandating the mix and supply of bio-diesel in diesel fuel for cars	<ul style="list-style-type: none"> • Mandating 3% of bio-diesel blend in diesel fuel for cars by 2020 	Regulation	– Ministry of Trade, Industry and Energy	In progress	2015	Percentage of bio-diesel blend
	Introduction & operation of wired/wireless rechargeable electric buses	CO ₂ CH ₄ N ₂ O	Commercialization of wired/wireless rechargeable electric buses to replace intra-city buses that run on diesel and CNG	<ul style="list-style-type: none"> • To supply 12,300 electric buses (battery exchange type, wireless charging) by 2030 	Other	<ul style="list-style-type: none"> – Ministry of Trade, Industry and Energy – Ministry of Environment 	Planning stage	2017	Number of wired/wireless rechargeable electric buses



Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Transportation	Encouraging less use of passenger cars and expanding operation of public transportation	CO ₂ CH ₄ N ₂ O	Expanding public transportation by encouraging less use of passenger cars via traffic demand management and by developing the transport system focusing on public transportation	<ul style="list-style-type: none"> Encourage less use of passenger cars <ul style="list-style-type: none"> Expand introduction and use of Allteul (Cost-saving) Transportation Card Designate and operate special regulated zones Designate and operate zones restricting entry of old vehicles Operate rotational driving system to reduce fine dust Expand public transportation <ul style="list-style-type: none"> Expand Bus Rapid Transit (BRT) and build transfer facility Improve services by expanding railway network including high-speed, metropolitan and urban railway, and providing faster transportation Expand BIS (Bus Information System) Improve bus system by expanding M-buses (express metropolitan) and metropolitan buses 	Regulation, (Technology development)	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport Ministry of Environment 	In progress	2017	Share of public transportation used for transport (%)
	Streamlining green transport	CO ₂ CH ₄ N ₂ O	Accelerate shifting road transport to rail and coastal shipping	<ul style="list-style-type: none"> To provide subsidy for a shift from road freight to rail or marine transportation <ul style="list-style-type: none"> (Rail) Total freight shifted to rail transportation between 2010~2020 reached 7.6 billion tonnes · km 	Voluntary Agreement	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport Ministry of Oceans and Fisheries 	In progress	2010	Transportation converted (ton · km.)
	Enhancing efficiency of air transport	CO ₂	GHG reduction in aviation sector by improving aircraft fuel efficiency	<ul style="list-style-type: none"> To strengthen technical management such as managing aircraft engine and weight to enhance their fuel efficiency 	Other	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport 	In progress	2018	Energy efficiency improvement (%)

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ³⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Transportation	Intelligent Traffic System (ITS)	CO ₂	Automated and systematic operation and management of transportation system for convenience and safety	<ul style="list-style-type: none"> Create eco-friendly future-oriented transportation system that manages and controls transportation facilities and means in real-time, and collects and uses real-time traffic data by applying cutting-edge technologies in transportation, electronics, communication and control to components of the transportation system including transportation facilities such as road, railway and airport, and transportation means such as cars and trains Examples of ITS: bus arrival notice system at bus stops, automatic intersection traffic control system based on the traffic volume, real-time traffic information on navigation systems, Hi-pass system(Korea's automated highway toll payment system) <ul style="list-style-type: none"> Investment to reduce traffic congestion (traffic congestion costs) has been steadily rising by average 2.0% per year for the past 10 years Length of roads installed with ITS was 15,712km in 2018 and 16,112km in 2019 	Other	<ul style="list-style-type: none"> Ministry of Land, Infrastructure and Transport, National Transport Information Center 	In progress	2011	-
	Passenger car mileage	CO ₂	Providing mileage according to the amount of GHG reduced by voluntarily reducing the driving distance	<ul style="list-style-type: none"> Implemented the Municipal Ordinance on Accumulation of Eco Mileage after abolishing the ordinance on Weekly No-driving Day <ul style="list-style-type: none"> Providing 20,000~70,000 points (1 point corresponding to KRW 1) of incentive according to reduction rate and distance by comparing annual average driving distance and 1-year driving distance since joining the program; earned points can be used to pay car tax After reviewing the submitted proof, a member of Eco Mileage Program will receive 3,000 points every time a passenger does not drive a car during an emergency action against fine dust in place 	Voluntary Agreement	Seoul Metropolitan City	In progress	2017	Level of contribution in GHG reduction



Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Transportation	Alteul (Cost-saving) Transportation Card	CO ₂	Support to save transportation cost of citizens who regularly use public transportation for commuting to work or school, and to encourage the use of eco-friendly transportation such as public transportation, walking and cycling	<ul style="list-style-type: none"> Alteul (Cost-saving) Transportation Card intends to cut transportation cost by up to 30% by earning mileage proportionate to the distance of walking or riding bicycle <ul style="list-style-type: none"> To save public transportation cost by combining functions of travel pass and mileage Aims to encourage more use of public transportation, walking and riding bicycles and less use of passenger cars to promote sustainable advancement of the transportation system by accumulating mileages corresponding to the distance to a station or bus stop or the destination via public transport (20% of public transportation cost) and additional discount offered by a card company (10% of public transportation cost) Currently implemented in 137 cities and districts and will be continuously expanded Reduced average KRW 12,862 per month per capita (20.2% of public transportation cost) Increase use of public transportation by 7.6% (29.1 → 31.3 times) 89% of user satisfaction rate on the overall Alteul (Cost-saving) Transportation Card system 	Other	– Ministry of Land, Infrastructure and Transport	In progress	2019	–
Waste	Enhance recycling rate and reduce percentage of municipal waste disposal on land	CO ₂ CH ₄	GHG emissions reduction by increasing recycling of domestic waste and decreasing landfills	<ul style="list-style-type: none"> To reduce GHG emissions generated in the course of burying and incinerating wastes by increasing recycling of domestic wastes and decreasing landfills and incineration 	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2008	Recycling rate of domestic wastes (%)

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index														
Waste	Enhance recycling rate and reduce percentage of industrial waste disposal on land	CO ₂ CH ₄	GHG emissions reduction by increasing recycling of business site waste and decreasing landfills	<ul style="list-style-type: none"> To reduce GHG emissions generated in the course of burying and incinerating wastes by increasing recycling of business site wastes and decreasing landfills and incineration 	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2008	Recycling of business site wastes (%)														
	Increase recovery of methane gas from landfills	CH ₄	Reduce GHG emissions by recovering more methane gas through capturing and utilizing landfill gas	<ul style="list-style-type: none"> To reduce GHG emitted by burying wastes through recovery of methane gas from landfills – In 2015, 118,000 tCO₂eq. of methane gas was recovered from landfills nationwide 	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2010	Volume of recovered methane gas (1,000 tCO ₂ eq./year)														
	Extended Producer Responsibility (EPR)	CO ₂	Mandate producer(s) responsible for product design and packaging selection to play an integral role in the recycling system	<ul style="list-style-type: none"> To mandate producers or manufacturers of products that use packaging to recycle wastes generated from respective products or packaging; a fine that is greater than the cost of recycling is imposed for non-compliance <p>Progress of recycling (Unit: tonne)</p> <table border="1"> <thead> <tr> <th>Category</th> <th>2018</th> <th>2019</th> </tr> </thead> <tbody> <tr> <td>Paper pack</td> <td>15,773</td> <td>14,900</td> </tr> <tr> <td>Glass bottle</td> <td>271,260</td> <td>273,541</td> </tr> <tr> <td>Metallic can</td> <td>172,140</td> <td>178,366</td> </tr> <tr> <td>Plastic</td> <td>880,155</td> <td>867,046</td> </tr> </tbody> </table>	Category	2018	2019	Paper pack	15,773	14,900	Glass bottle	271,260	273,541	Metallic can	172,140	178,366	Plastic	880,155	867,046	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2003
Category	2018	2019																					
Paper pack	15,773	14,900																					
Glass bottle	271,260	273,541																					
Metallic can	172,140	178,366																					
Plastic	880,155	867,046																					



Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Waste	Waste Disposal Levy Program	CO ₂	Encouraging local government and business sites responsible for waste management to recycle as much as possible by imposing levy on incinerated wastes or land disposal	<ul style="list-style-type: none"> Levies are calculated in proportion to the quantity of waste incinerated or buried; the rate differs according to the type of waste and disposal means of either land disposal or incineration Wastes are categorized into municipal waste and industrial waste; the program is operated via periodical and ad hoc reporting 	Regulation	Ministry of Environment/ Korean Environment Corporation	In progress	2018	-
	Increasing areas of intermittent irrigation in rice cropland	CH ₄	GHG reduction through irrigation management	<ul style="list-style-type: none"> To reduce GHG generated from rice paddy through development and distribution of technology to use less water for irrigation Promote intermittent irrigation by providing education for New Year's farming planning organized by Agricultural Technology Center and safely cultivating high-quality rice production management Enhance irrigation conditions by improving and repairing irrigation facilities such as waterways 	Education, Fiscal policy	Ministry of Agriculture, Food and Rural Affairs/ Rural Development Administration	In progress	2010	Percentage of area with Intermittent irrigation (%)
				<ul style="list-style-type: none"> ※ (2015) 551km / Cumulatively 8,111km (2018) 122km / Cumulatively 9,036km 					
Agriculture, livestock and fisheries	Reduce use of chemical fertilizer	N ₂ O	GHG emissions reduction through less use of chemical fertilizer	<ul style="list-style-type: none"> To reduce use of chemical fertilizers through increased support for organic fertilizers and soil conditioners Encourage use of quality fertilizers by prescribing the amount of fertilizers based on the soil test result through Soil and Environmental Information System of Korea Number of fertilizer prescriptions issued: (2015) 525,000 cases → (2018) 598,000 cases Providing education on correctly using farming equipment to reduce utilization of chemical fertilizer 	Technology development, Education	Ministry of Agriculture, Food and Rural Affairs/ Rural Development Administration	In progress	2000	Quantity of chemical fertilizer used (kg/ha)

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ³⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Agriculture, livestock and fisheries	Expand facilities to treat livestock excretion	CH ₄	GHG reduction by using livestock manure as a resource	<ul style="list-style-type: none"> To reduce GHG by using livestock manure for energy and increasing facilities to make composts and liquefied manure <ul style="list-style-type: none"> Reduce GHG by supporting continued expansion of facilities to generate energy from livestock manure and facilities to produce common resources Number of facilities to generate energy from livestock manure: (2015) 3 venues → (2018) 6 venues Number of facilities to convert livestock manure to resource: (2015) 76 venues → (2018) 86 venues 	Fiscal policy	Ministry of Agriculture, Food and Rural Affairs	In progress	2007	Number of new livestock manure treatment facilities
	Expand cultivation of high-quality forage	CH ₄	GHG reduction through increased supply of high-quality forage	<ul style="list-style-type: none"> To reduce GHG by improving intestinal fermentation of livestock through cultivation of high-quality forage and increased supply to livestock <ul style="list-style-type: none"> Full implementation of "Forage Quality Rating System" to facilitate production and utilization of high-quality forage (2016) Promoting stable expansion of forage production foundation by continuously increasing specialized forage production complexes by grouping and scaling up complexes Specialized complexes: (2015) 19,314.1ha (40 venues) → (2018) 23,763.1ha (54 venues) (increased by 4,449ha) 	Regulation, Fiscal policy	Ministry of Agriculture, Food and Rural Affairs	In progress	1998	Quantity of high-quality forage supplied (1,000 tCO ₂ eq.)
	Expand supply of new & renewable energy facilities	CO ₂ CH ₄ N ₂ O	Reducing GHG from controlled agriculture by increasing the supply of new & renewable energy facilities	<ul style="list-style-type: none"> To reduce the use of chemical fertilizers by increasing the supply of new & renewable energy facilities for controlled agriculture <ul style="list-style-type: none"> Reducing GHG by supporting installation of heating and cooling facilities that use new & renewable energy such as geothermal heating/cooling facility and heaters using wooden pellets inside greenhouses Increased supply of new & renewable energy such as geothermal heat and wooden pellet (2015) 944 hectares → (2018) 991 hectares 	Fiscal policy	Ministry of Agriculture, Food and Rural Affairs	In progress	2010	Area supported with new & renewable energy facility (ha)



Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ⁵⁰	Type of Means ⁵¹	Ministry/Agency	Delivery Status ⁵²	Year of Implementation	Performance Index
Agriculture, livestock and fisheries	Expansion of energy saving facilities	CO ₂ CH ₄ N ₂ O	Reducing GHG generated by controlled agriculture through increased supply of energy saving facilities	<ul style="list-style-type: none"> To reduce the use of fossil fuels by increasing the supply of energy saving facilities for controlled agriculture <ul style="list-style-type: none"> Reducing GHG by using less fossil fuels through supply of energy saving heat-conservation materials such as multi-layer thermal curtains Increased installation of energy saving equipment such as thermal covers, multi-layer thermal curtains, etc.: (2015) 7,961 hectares → (2018) 11,304 hectares 	Fiscal policy	– Ministry of Agriculture, Food and Rural Affairs	In progress	2009	Area of energy saving facility supported (ha)
	Supporting highly-efficient fuel-saving equipment of fishing ships	CO ₂	GHG reduction by supporting the replacement of old engines of littoral fishing boats and supplying highly-efficient LED lamps (fishing lamps and related lamps)	<ul style="list-style-type: none"> To reduce GHG by supporting fishing boats with highly-efficient fuel-saving equipment <ul style="list-style-type: none"> Energy-efficient LED lamps and fishing lamp reflector supplied since 2009 Supporting installation of fuel-saving equipment at fishing boats Replacing inefficient and old engines To facilitate highly-efficient LED lamp supply and old engine replacement for littoral fishing boats <ul style="list-style-type: none"> Reduced 38,358 tCO₂eq. of GHG between 2009~2015 Reduced 15,500 tCO₂eq. of GHG in 2016 2017 target: to provide LED lamps to 65 boats and support 1,069 boats with installation and replacement of engines, equipment and devices 	Fiscal policy	– Ministry of Oceans and Fisheries	In progress	2009	Volume of GHG emissions reduced (tCO ₂ eq.)
Forest Carbon Sinks	Sustainable forest management	CO ₂	Continuing maintenance and enhancing GHG absorption function	<ul style="list-style-type: none"> To promote intensive forest management to create healthy forests by creating a package consisting of laying forest trail, planting trees and afforestation To increase GHG absorption capacity by planting strong seed orchards in the forest 	Economic/ Fiscal policy	– Korea Forest Service	In progress	2015	Utilization rate of seed orchard in afforestation (%) Collection rate of forestation products (%)

Sector ⁴⁹	GHG Reduction Action	Regulated Gas(es)	Objective	Overview of Reduction Action and Progress (Key Achievements) ³⁰	Type of Means ³¹	Ministry/Agency	Delivery Status ³²	Year of Implementation	Performance Index
Forest Carbon Sinks	Establishment of new carbon sinks including urban forests	CO ₂	Increasing GHG absorption by creating forest carbon sinks such as urban forest and school forest	<ul style="list-style-type: none"> To develop new carbon sinks such as urban forest in the residential area, forest in idle land, coastal forest belt, restoration of damaged forests, etc 	Other	– Korea Forest Service	In progress	2003	Area of newly created carbon sinks such as urban forest (ha)
	Utilization of domestic wood	CO ₂	Promoting the use of wood that capture carbon dioxide	<ul style="list-style-type: none"> To increase production of wood in ROK and develop processing technology to produce lumber that stores carbon for long periods 	Information Sharing	– Korea Forest Service	In progress	2015	Domestic wood produced (m ³) Share of domestic lumber produced (%)
	Utilization of forest biomass energy	CO ₂	Increasing replacement of fossil fuels with forest biomass energy which is an eco-friendly fuel	<ul style="list-style-type: none"> To increase production of domestic pellets and use of domestically produced fuels 	Information Sharing	– Korea Forest Service	In progress	2015	Quantity of domestic pellets produced (1,000 tCO ₂ eq.)
	Forest Carbon Offset Scheme	CO ₂	Promoting voluntary GHG absorption activities by the private sector	<ul style="list-style-type: none"> To provide economic incentives to private forest owners who account for 67% of total forest area to encourage proactive maintenance of forests 	Economic/Fiscal policy	– Korea Forest Service	In progress	2013	Number of cases participating in Forest Carbon Offset Scheme/ Volume of CO ₂ absorbed (tCO ₂ eq.)
	National wildfire prevention	CO ₂	Preventing wildfire to maintain GHG absorption capacity of forests and minimizing damage from wildfire by establishing prompt response measures	<ul style="list-style-type: none"> To develop various prevention measures and response plans to minimize damage from fire in forests which are major carbon sink 	Information Sharing	– Korea Forest Service	In progress	2017	Area affected by wildfire compared to number of dry days



- 49** Sector: All sectors, Transition, Industry, Building, Transportation, Waste, Agriculture livestock and fisheries, Forest Carbon Sinks
- 50** Overview of Reduction Action and Progress: Includes the title of relevant policies and laws; overview of the latest progress highlighting major achievements and presenting official quantifiable data (if applicable)
- 51** Types of Means: Regulation, Economic/Fiscal policy, Voluntary Agreement, Information Sharing, Education, Technology Development, Other
- 52** Delivery Status: In progress, Planning stage
- ※ (1) "In progress", if implemented before 2021; (2) "Planning stage," if the expected year of implementation (tentative) is decided but the policy is yet to be drafted
-



An aerial photograph of a coastal landscape. In the foreground, a dark, rocky coastline meets the ocean with white-capped waves. A dirt path winds through a wetland area with shallow, greenish water. A white wind turbine stands prominently in the middle ground. To the left, a small white lighthouse is visible. The background shows a mix of green fields, some buildings, and distant hills under a blue sky with scattered white clouds.

CHAPTER 4

International Cooperation and
Public Awareness of Climate Change



The ROK recognizes the importance of cooperation among nations for climate change response and is increasing support to developing countries. To this end, the ROK will continue to participate in joint efforts made of the international community by sharing its commitment through biennial update report⁵³.

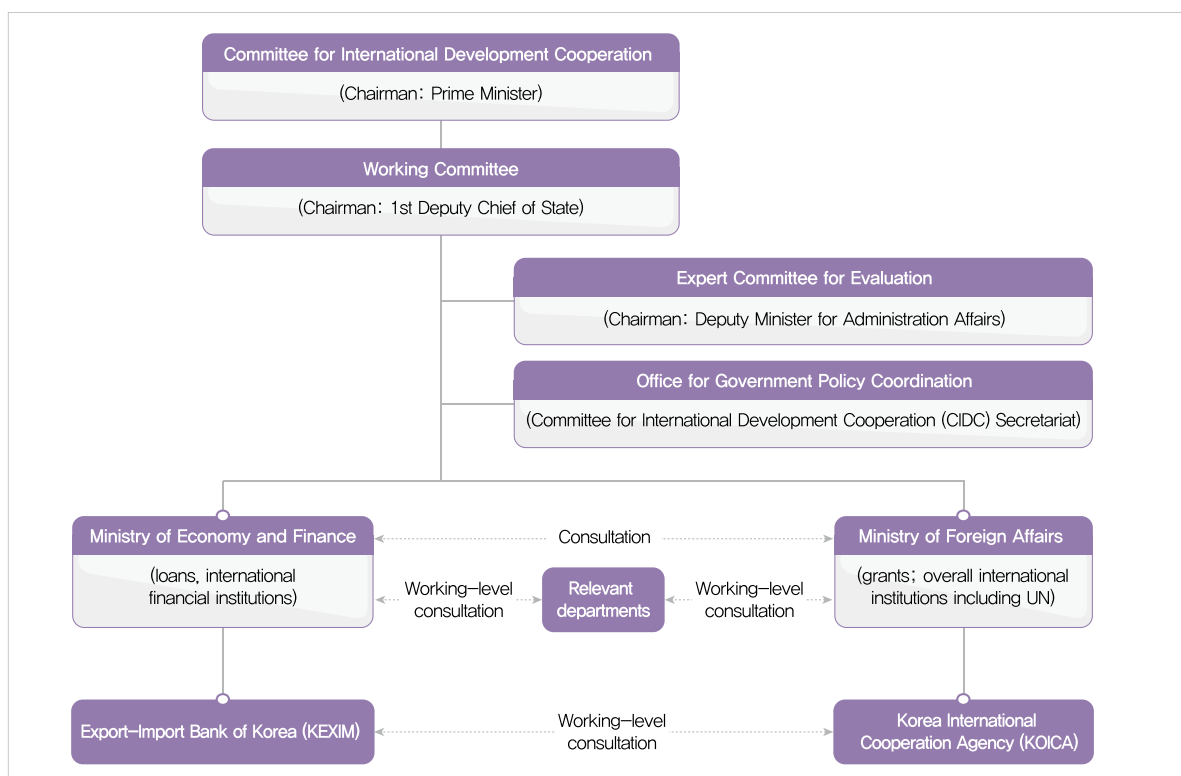
1. Financial Support

The ROK provides concessional loans and grant aid to developing countries through Official Development Assistance (ODA), and voluntarily carries out diverse assistance projects for technology development and transfer as well as capacity building.

In accordance with the Framework Act on International Development Cooperation enacted in January 2010, the ROK's ODA implementation system is consisted of organizations on three levels as each organization performs the role of (1) supervision and coordination, (2) organizing, and (3) implementation. The Committee for International Development Cooperation which supervises and coordinates the ODA is chaired by the Prime Minister. Under the Committee, there is a Working Committee for International Development Cooperation and Expert Committee for Evaluation. The Ministry of Economy and Finance (MOEF) and the Ministry of Foreign Affairs (MOFA) organize bilateral concessional loans and grants respectively by preparing Annual Implementation Plan per sector and monitoring the progress. Each ministry supervises multilateral cooperation through multilateral development banks and the United Nations (UN) as well as other international organizations respectively. The MOEF manages the Economic Development Cooperation Fund (EDCF) which is operated by the Export-Import Bank of Korea (KEXIM). The MOEF supervises development, implementation and evaluation of concessional loan programs carried out by EDCF. The MOFA oversees the establishment, implementation and coordination of grant aid policies by drafting basic master plans and annual implementation plans. It also manages the implementing organization which is the Korea International Cooperation Agency (KOICA). A total 42 implementing organizations has carried out 1,682 ODA projects as of 2021.

⁵³ Chapters 1 to 3 are based on data in 2018 for emissions and performance measurement whereas Chapter 4 is based on 2021 data to provide an overview of policies that the ROK is currently implementing.

[Figure 4–1] ROK's ODA Implementation Process



As a responsible member of the international community, the ROK strives to achieve the SDGs and aims to continually increase the size of ODA, comprehensively considering international standards and the ROK's conditions. The ROK plans to expand the total ODA size by at least twice the 2019 level by 2030 based on the 3rd Comprehensive Master Plan on International Development and Cooperation released in January 2021.

The size of ROK's ODA rapidly increased after 2010 with the annual average increase rate of 9.7% which is second highest among Development Assistance Committee (DAC)⁵⁴ member countries.⁵⁵ The ODA size recorded KRW 2,587.5 billion based on the 2020 grant equivalent (tentative), ranking 16th among 29 Organization of Economic Co-operation and Development (OECD) DAC member countries. The distribution ratio of assistance was 78 for bilateral and 22 for multilateral assistance based on tentative statistics of 2020. The ODA ratio against national income (ODA/GNI) remained between 0.14% and 0.16% since 2015.

⁵⁴ DAC was founded in 1961 to establish ODA's international cooperation system. A total of 29 member countries joined as of April 2020 with the ROK being the 24th member country in 2010.

⁵⁵ The annual average ODA growth rate of all DAC member countries is 2.7% since 2010. The ROK maintains one of the highest levels with an annual average increase rate of 9.7% (KRW 1.3 trillion in 2010 → KRW 3.4 trillion in 2020).



<Table 4–1> ROK’s ODA Financial Support (2010–2020)

Descriptions	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020 (Tentative)
Total ODA (A+B)	1,173.79	1,324.59	1,597.45	1,755.38	1,856.73	1,915.39	2,246.16	2,201.35	2,358.25	2,463	2,249
Bilateral assistance (A)	900.63	989.57	1,183.17	1,309.58	1,395.77	1,468.79	1,548.47	1,615.02	1,734.45	1,857	1,764
Proportion (%)	76.7	74.7	74.1	74.6	75.2	76.7	68.9	73.4	73.5	75.3	78.4
Multilateral assistance (B)	273.15	335.02	414.28	445.80	460.96	446.60	697.69	586.33	623.80	606	485
Proportion (%)	23.3	25.3	25.9	25.4	24.8	23.3	31.1	26.6	26.5	24.7	21.6
ODA/GNI (%)	0.12	0.12	0.14	0.13	0.13	0.14	0.16	0.14	0.14	0.15	0.14

※ Source: OECD DAC Statistics (as of July 27, 2020)

* Measurement method: Based on (1) net expenditure until 2017; and (2) grant equivalent from 2018; (unit:USD million)

The ROK will make a flexible adjustment in concessional loans and grant aid considering international trends based on the 40:60 principle. In terms of region, the ROK plans to continue Asia– and Africa–centered assistance in consistence with its New Southern · New Northern Policy.

The ROK has set the vision of ‘Realizing National Interests of Global Value and Win–Win through Cooperation and Solidarity’, presenting four major strategic goals which are ① Inclusive ODA, ② Win–win ODA, ③ Innovative ODA, and ④ Together ODA, as well as 12 key tasks through the 4th Comprehensive Master Plan on International Development and Cooperation released in January 2021 that will be implemented for five years from 2021 to 2025.

While providing support for the establishment of large–scale infrastructure for growth of developing countries, the ROK will focus on generating synergies through private–government collaboration and will actively take part in the new climate regime by leading international discussions on responding to climate change in order to facilitate green transition. The ROK will also move forward with quantitative expansion and qualitative improvement of ODA in the areas of climate and environment based on its Green New Deal ODA Implementation Strategy announced in July 2021. At ‘P4G⁵⁶ Seoul Summit 2021’

⁵⁶ Partnering for Green Growth and the Global Goals 2030 (P4G): the multilateral cooperation network that aims at accelerating green growth and achieving 2030 Sustainable Development Goals (SDGs) by expanding cooperation among public and private organizations all across the globe. It is participated by 12 countries including the ROK and Denmark. The 1st and 3rd Summit were held in Denmark in 2018, and in Seoul in 2021 respectively.

held in 2021, the ‘Seoul Declaration’ was adopted which embodies the commitment of the international community to actively and jointly take responses to realize the carbon neutrality vision through inclusive green recovery. The Declaration includes countries’ active support towards developing countries by strengthening cooperation with international organizations.

〈Table 4-2〉 Climate-Related ODA Financial Support

	Total Amount of Multilateral Finance		Total Amount of Bilateral Finance		Total Amount of Multilateral and Bilateral Finance	
	KRW Million	USD Thousands	KRW Million	USD Thousands	KRW Million	USD Thousands
2014	38,657	36,709	72,978	69,301	111,635	106,010
2015	68,909	60,912	339,564	300,153	129,821	361,065
2016	101,438	87,657	68,533	59,050	169,971	146,707
2017	103,675	91,696	171,547	151,730	275,222	243,426
2018	62,685	56,977	162,073	147,314	224,758	204,291
2019	81,690	70,103	188,532	161,789	270,222	258,635

* Exchange rate applied per USD 1 by year: (2014) KRW 1,053,064; (2015) KRW 1,131,309; (2016) KRW 1,160,589; (2017) KRW 1,130,635; (2018) KRW 1,100,186; (2019) KRW 1,165,294

In case of grant aids, the ROK is making an additional contribution of KRW 233.05 billion to the Green Climate Fund (GCF) as declared in September 2019. An MOU was signed with the Global Green Growth Institute (GGGI) in May 2021 to create a trust fund worth KRW 5.7 billion annually, continuing to expand the size of grant aids to respond to climate change. In case of concessional loans, the ROK announced that it will expand support in green areas from KRW 200 billion in 2020 to KRW 690 billion in 2025, and also increase the proportion of support from 22% to 40% through the EDCF Fund Management Committee on two occasions in January and May 2021. The ROK will particularly focus on internalizing factors of climate change response in the process of EDCF projects and diversifying the form and scope of the EDCF supports by facilitating cooperation with international organizations.

The ‘EDCF Green Index’ is developed in April 2021 through case studies of domestic and overseas policies including the Korean Green New Deal, EU Green Deal, and Rio Marker. Through the index, the ROK will stipulate requirements of individual EDCF projects, and quantitatively measure and manage the level of climate change response.



<Table 4–3> EDCF Green Index Components

Components	Proportion	Detailed Indexes
Ease climate change	40%	Replace fossil fuels (20), increase energy efficiency (10), carbon capture, use and storage (10)
Ease climate change	30%	Strengthen individuals' capacity to respond to climate change (10), enhance infrastructure resilience (10), increase natural resource productivity (5), preserve the natural ecosystem (5)
Circular economy	20%	Reduce resource input (10), increase the resource circulation rate (10)
Social inclusion	10%	Remove the income gap (5), balanced regional development (3), enhance gender perception (2)

* Aggregate the level of contribution per index by ratio to come up with the final index (out of five points)

2. Technology Development and Transfer

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 ahead of the Paris Agreement. The Ministry of Science and ICT established relevant policies and strategies to support the implementation and promote international cooperation regarding climate technology in accordance with the UNFCCC.

In terms of policy and strategy, the ROK domestically established and implemented a foundation for development and innovation of climate technologies while developing a global climate technology cooperation model to conduct climate technology cooperation projects with developing countries.

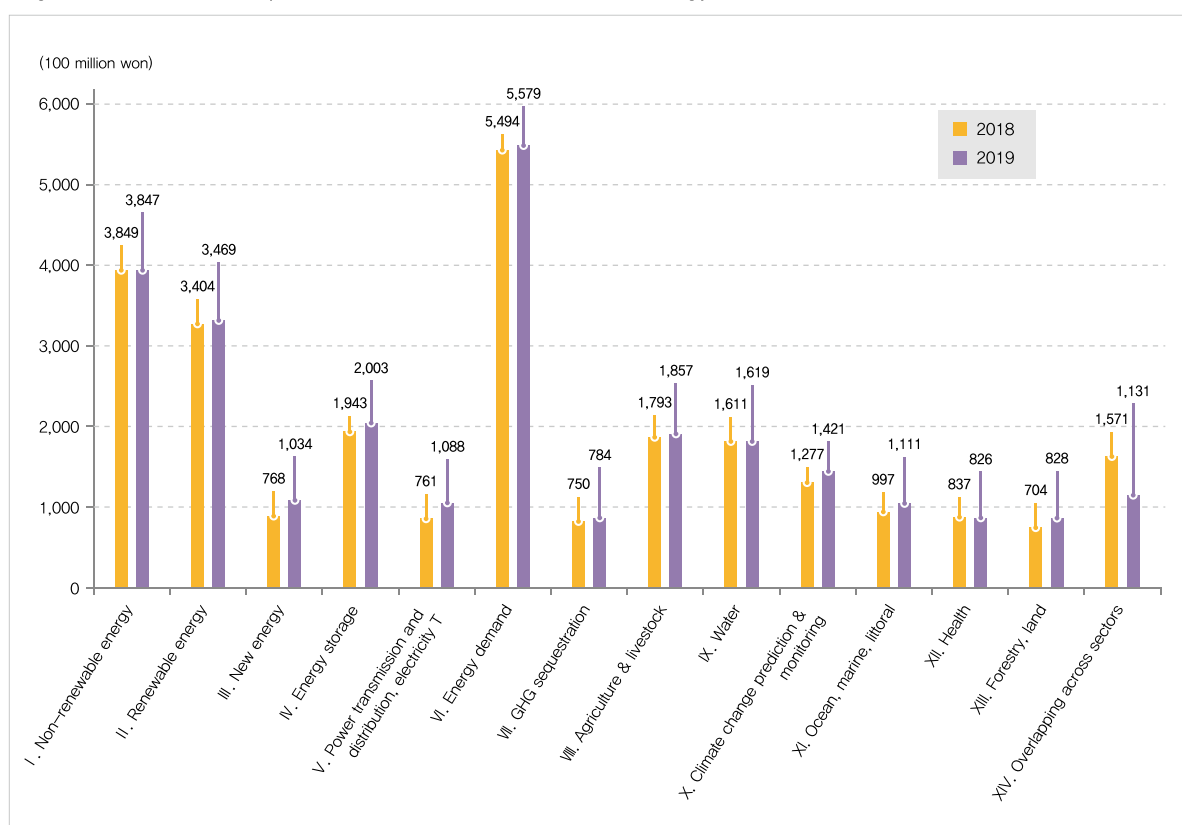
ROK's investments in national R&D projects on climate technology totaled KRW 2,659.7 billion in 2019 which account for 12.9% of the total R&D investment. Investments were made to the fields of (1) GHG reduction (KRW 1,780.3 billion, 66.9%), (2) adaptation (KRW 766.3 billion, 28.8%), and (3) convergence (KRW 113.1 billion, 4.3%). The area that takes up the highest proportion of investments for GHG reduction is energy demand (KRW 557.9 billion) followed by non-renewable energy (KRW 384.7 billion) and renewable energy (KRW 346.9 billion). The area that takes up the highest proportion of investments for climate change adaptation is agriculture and livestock (KRW 185.7 billion) followed by water (KRW 161.9 billion) and climate change forecasting and monitoring (KRW 142.1 billion).

〈Table 4-4〉 Climate Technology and National R&D Investments in 2019

	Investment per Major Area of Climate Technology R&D				Total national R&D
	Reduction	Adaptation	Convergence	Climate Technology Total	
Total Investment (KRW)	1,780.3 billion	766.3 billion	113.1 billion	2,659.7 billion	20,625.4 billion
No. of Research Project (Case)	5,625	4,688	454	10,520	70,327
Proportion (%)	66.9	28.8	4.3	100	—

※ Source: Report on a Survey and Analysis of National R&D Projects on Climate Technology (Green Technology Center, 2019)

[Figure 4-2] Investment per sub-level area of Climate Technology R&D (2018–2019)



The Ministry of Science and ICT established the Global Technology Cooperation Strategy for Climate Change in September 2015 and decided to actively participate in the Technology Mechanism which is the UNFCCC's technology development and transfer system. The Ministry also developed the Climate Technology Roadmap in 2016 and revised it in 2018. It formulated the Mid- to Long-term Plan for Climate Technology Cooperation in April 2018 and established detailed strategies which consist of ① support for R&D based on innovation technology, ② systematization of support for global climate technology cooperation projects, ③ establishment of a foundation for climate technology cooperation, ④



facilitated participation in technology mechanisms, and ⑤ cooperation among governmental departments. The ROK established a detailed strategy for technology innovation in March 2021, the Carbon Neutrality Technology Innovation Strategy. It presents 10 major technologies for carbon neutrality in consideration of the level of contribution to GHG reduction and issue analysis per sub-sector based on LEDS as well as mid- to long-term innovation strategies. It also developed strategies on strengthening research capabilities and foundation that include enhanced international cooperation and capacity building. Accordingly, the ROK plans to build a technology innovation ecosystem that continuously provides innovative carbon reduction methods by coordinating large-scale R&D projects.

The ROK has been carrying out various climate technology cooperation activities based on its policies and strategies. One of the most highlighted activities is carried out by Climate Technology Centre & Network (CTCN), an organization for the implementation of technological mechanisms of the UNFCCC. A total 11 council meetings were held with domestic climate technology-related institutions from 2016 to the first half of 2021 that resulted in an increase in the number of CTCN members to 81 by June 2021. At the 25th Conference of Parties (COP25) to the UNFCCC held in 2019, a decision was made to establish a regional CTCN office in Songdo, Incheon. The office was opened in June 2020. The Ministry of Science and ICT, the ROK's National Designated Entity (NDE), provided active support for CTCN's Technology Assistance (TA) projects that led to the implementation of cooperation projects to support 12 countries⁵⁷ in terms of climate technology through CTCN. Some projects are connected to other projects of ODA or GCF which have enabled continued implementation. Conducting such climate technology cooperation activities, the ROK built a Climate Technology Information System (CTis) in March 2018 which is an online technology cooperation hub. CTis is an integrated information platform that systematically provides information focused on climate technology including international trends, statistical data and climate technology demand based on a system that distinguishes climate technology into 45 categories

The ROK enacted the Act on Promoting Technology Development for Climate Change Response in April 2021, establishing a systematic legal foundation to expand technology development and transfer. Based on the Act, the ROK will achieve technology development and innovation that encompass every area of society through which the ROK will increase support for cooperation between countries.

⁵⁷ Guinea, Kenya, Bangladesh, Ethiopia, Sri Lanka, Serbia, Cambodia, Togo, Tanzania, Namibia, Vietnam and Mozambique

3. Capacity Building

The ROK carries out a wide range of capacity building projects for domestic and overseas experts in the area of climate change response technology. The Korea Institute of Human Resources Development in Science and Technology (KIRD) has developed a training program aimed at strengthening competencies of stakeholders in international transfer of climate technologies in 2016 and has been running the program since then. Through the program, the ROK is contributing to enhanced capacity of practitioners in industry and researchers for policy development and the implementation of international technology transfer. The Green Technology Center (GTC) is an affiliated organization of the Ministry of Science and ICT which provided a capacity-building program on Korea's waste management policies and technologies as well as construction of low-carbon and green cities to public officials from developing countries from 2016 to 2018 in cooperation with the Jeju International Training Center of the United Nations Institute for Training and Research (UNITAR). Korea shared its experiences on policy coordination and enhanced competencies of experts from developing countries which led to expanded networks for cooperation in climate technology between the ROK and developing countries.

The Ministry of Science and ICT also established a plan on systematic fostering of climate change response technology experts to build a climate technology foundation in accordance with the Act on Promoting Technology Development for Climate Change Response (April 2021) and plans to operate a relevant training program starting in 2022.

〈Table 4-5〉 Climate Technology Cooperation Programs (UNITAR Jeju International Training Center-GTC)

Green Energy and Sustainable City Plan Workshop (March 27, 2016, UNITAR Jeju Training Center)	Seminar on Technology Implementation and Solutions for Sustainable Consumption and Production (1 st : September 26, 2017, Bangkok, Thailand, 2 nd : November 6-8, 2017, Jeju, Korea)	Workshop on Low-Carbon Integrated Solid Waste Management and Strengthened Governance for Circular Economy (April 24-27, 2018, UNITAR Jeju Training Center)
<ul style="list-style-type: none"> Participated by 30 government officials and experts in the climate field from 14 developing countries in the Asia-Pacific region Strengthened competencies related to green city plan, green energy and waste management Workshop was held at the 3rd International Electric Vehicle Expo to introduce Korea's climate technologies 	<ul style="list-style-type: none"> Jointly held by the GTC, UNITAR and United Nations Environment Program (UNEP) with participants of 42 government officials from 8 developing countries in the Asia-Pacific region Strengthened competencies in sustainable city development strategies, construction of a low-carbon and green city, and smart climate technology systems Shared ROK's experiences in the development of low-carbon building 	<ul style="list-style-type: none"> Participated by 21 government officials and experts in the climate field from 12 developing countries in the Asia-Pacific region Shared knowledge and experiences in ROK's waste policies and technologies, UNEP's sustainable production and consumption, and Japan's waste management and international cooperation Introduced a City Share Program that facilitates sharing of capacity-building experiences among participants

※ Source: Strengthening Competencies of Domestic and Overseas Experts in Climate Technology (GTC, 2018)



The GIR of the Ministry of Environment runs the international training program on greenhouse gases, “UNFCCC–GIR–CASTT Program”, for three to four weeks every year to support building capacity in GHG management in developing countries. The program offers lectures and hands–on exercises on GHG inventory preparation and mitigation modeling analysis by sub–sector to government officials and researchers who are shortlisted. A total number of trainees participated in the program per year is: 28 from 28 countries in 2017, 30 from 30 countries in 2018, 32 from 32 countries in 2019 and 34 from 32 countries in 2020. The number of countries seeking to participate in the training program is steadily increasing. As the training programme is recognized globally for its excellence, the ROK signed a memorandum of understanding with the UNFCCC secretariat in March 2017 to jointly conduct the program.

The Korea Environmental Industry & Technology Institute (KEITI), an affiliated organization of the Ministry of Environment, has been providing domestic companies and organizations with support for the development of projects for capacity building of developing countries in climate change response (adaptation and mitigation) since 2016. Project development is classified into two categories: preliminary project and main project. For preliminary project, supports are provided to facilitate readiness, preparation of Project Preparation Facility (PPF) proposal, concept note and preliminary feasibility report. For main project, supports include preparation of a project proposal, feasibility survey and annexed documents required to attain an approval for financing from GCF. KEITI supported the development of a total of 20 projects over the last five years from 2016 to 2020. Among them, GCF and Adaptation Fund (AF) approval was received for four projects for Namibia, Marshall Islands, Vietnam and Fiji.

<Table 4–6> KEITI Projects for Climate Change Response (approved by International Organizations)

No.	Project Name (KEITI Support Period)	Project Size (KRW 100 million)	Support Size (KRW 100 million)	Certification Organization	Notes
1	Construction of Eco–friendly Livestock Production Facilities in Namibia (Dec 12, 2016–Aug 25, 2017)	113 (grants)	1.5	Environmental Fund of Namibia	19 th GCF BOD (March 2018) approval
2	Marshall Islands Sustainable Water Supply Project (Oct 10, 2016–Jan 31, 2017)	290.1 (grants)	0.5	UNDP	23 rd GCF BOD (July 2019) approval
3	Climate Adaptability Improvement through Water Resource Infrastructure of the Mekong River Basin in Vietnam (Mar 20, 2019–Jul 30, 2019)	73.4 (grants)	1.2	UN Habitat	35 th AF BOD (June 2020) approval
4	Fiji Agricultural Solar Power Generation Project (Jan 30, 2019–Jul 31, 2019)	23.3 (investment)	1.2	Fiji Development Bank	26 th GCF BOD (August 2020) approval

※ Source: KEITI (2021)

4. Enhancement of Public Awareness and Private–Government Cooperation

The ROK government established the 3rd Comprehensive Environmental Education Plan 2021–2025 in December 2020 to raise public awareness on the environment and establish a system of cooperation to jointly resolve the climate crisis. It is a statutory plan that the Minister of Environment establishes every five years in accordance with the Environmental Education Promotion Act. The plan presents 15 implementation tasks in four areas which include environmental education foundation, school environmental education, social environmental education and environmental education cooperation based on the vision of ‘a sustainable future jointly created by environmentally conscious citizens.’

〈Table 4–7〉 Comprehensive Environmental Education Plan Areas and Tasks

Strategy	Task
Build a foundation for environmental education	<ol style="list-style-type: none"> 1) Overhaul systems and foundation to realize environmental learning rights 2) Enhance the foundation for facilitating regional environmental education 3) Build an integrated information system for national environmental education 4) Strengthen environmental education services with regard to climate change and environmental disasters 5) Develop and supply digital environmental education materials
Facilitate environmental education at school	<ol style="list-style-type: none"> 1) Strengthen the environmental education foundation within the school system 2) Establish environmental education support measures at the city and provincial level 3) Enhance support for environmental education per level of each school 4) Increase opportunities for teachers to strengthen their environmental education capabilities
Strengthen social environmental education	<ol style="list-style-type: none"> 1) Overhaul the social environmental education foundation for lifelong learning 2) Enhance the expertise of workers in social environmental education and increase the number of related jobs 3) Ensure environmental education of all citizens
Increase environmental education cooperation	<ol style="list-style-type: none"> 1) Strengthen collaboration among organizations related to environmental education 2) Increase partnerships for social environmental education 3) Expand the international environmental education network

※ Source: 3rd Comprehensive Environmental Education Plan (Ministry of Environment, 2020)

In addition to building a foundation for environmental education through the establishment of a statutory plan, the ROK communicates through social media and promotes collaboration with companies and civil society to allow citizens to easily access climate change–related matters. The Ministry of Environment has been conducting a campaign called ‘SOS, Please Save My Earth!’ since 2019. The campaign was joined by several companies and contributed to raising public awareness about climate change. There was another campaign led by the same Ministry which was ‘Cool Appearance SOS Campaign’ in August 2019 to respond to



the heat wave together with an apparel firm. It delivered a message to citizens to take part in GHG reduction activities by less use of air conditioning by wearing clothes that make wearers feel cool and still look stylish.

Korea Energy Agency has been organizing the 'Energy-Saving Store Accreditation Campaign' since 2017 which involves introducing and promoting stores that have their doors closed while having cooling or heating devices turned on during business hours, aiming to spread the energy-saving culture in the commercial sector. The Agency carries out site surveys of shopping centers in 18 concentrated business districts across the nation and certifies stores with an accreditation label(sticker) to praise their efforts for prevention of unnecessary energy loss. A total 438 out of 1,230 stores across the nation were accredited through the campaign in 2019.

The Ministry of Environment has been operating an international training program for environment experts together with Korea Environment Corporation since 2009 to foster experts who will lead in responding to environmental issues such as climate change which is highlighted as one of the most significant global challenges and international environmental regulations at home and abroad. Training is provided for two weeks on general environmental knowledge, environmental policies and evaluation techniques, and sectoral issues and policies. Trainees who successfully complete the course are given an opportunity for an internship at an environment-related international organizations including GGGI, UNEP, United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), and United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Centre.

Korea Environment Corporation has also been providing a training program on fostering GHG management experts since 2009 with the goal of nurturing experts who will establish and implement strategies for GHG emissions management and reduction in the industrial sector in response to fulfilling Korea's commitment to the new climate regime. Topics of training courses cover an outline of climate change, GHG emissions measurement and practice, outline of climate change adaptation and domestic and overseas trends, and emissions trading scheme. Curriculum is consisted of mainly practical exercises which include theory education and field training to increase trainees' understanding.

Not only the government, but diverse stakeholders are also actively engaging in activities to enhance the awareness of climate change and to achieve goals under the new climate regime. Greenpeace, through its ‘Green New Deal Citizen Action’ which is a volunteer activity, investigates the government’s climate crisis response measures and energy transition activities together with the Korean public and releases the results in a way that can be easily understood by citizens. The World Wide Fund for Nature organizes the Climate Action Round Table (CART) to provide a platform for companies in the ROK to jointly explore climate action strategies and share relevant knowledge. Such activities provide citizens and companies with opportunities to easily take part in tackling climate change and also to voice their opinions on related policies, contributing to further development of the ROK’s climate change and environmental policies as well as enhanced awareness.

CHAPTER 5

Appendix



1. GHG Inventory Details¹⁾

(Table 1-1) GHG Emissions Trends – Summary

Greenhouse Gas Emissions ²⁾	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018	
	kt CO ₂ -eq. ³⁾	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	kt CO ₂ -eq.	(%)	
CO ₂ emissions including net CO ₂ from LULUCF	213727.67	240275.11	266720.86	303542.38	323803.00	353033.07	383803.32	406866.93	331462.17	355808.52	394971.28	401221.17	422537.51	420004.39	432719.03	443031.45	448523.36	488132.19	490561.87	485492.69	541152.21	573004.20	590467.15	593807.44	596274.88	588640.75	591500.98	606300.95	623226.35	191.6	
CO ₂ emissions excluding net CO ₂ from LULUCF	252002.88	274861.80	293744.63	334701.25	356392.54	384233.36	418613.91	446193.40	379380.75	411469.00	453891.81	459384.75	478855.85	487344.37	492765.43	497467.64	504051.24	524355.01	537688.84	542202.22	585324.89	625049.96	627796.00	636655.51	638702.62	634340.56	637393.67	650156.47	664727.24	163.8	
CH ₄ emissions including CH ₄ from LULUCF	30471.55	30353.21	29809.90	29265.32	29285.00	28659.68	29266.01	28551.63	28293.17	28026.21	28003.57	28376.99	28592.35	28333.59	28326.96	27390.17	27370.44	27280.30	27101.56	27061.93	27067.16	27181.91	27189.75	27733.11	27592.33	27353.84	27214.73	27252.64	27407.09	27678.41	-8.1
CH ₄ emissions excluding CH ₄ from LULUCF	30207.76	30158.06	29605.01	29068.71	29063.36	28757.22	29061.40	29297.40	28106.09	27799.36	27790.26	28131.33	28333.59	28333.59	28326.96	27390.17	27370.44	27280.30	27101.56	27061.93	27067.16	27181.91	27189.75	27733.11	27592.33	27353.84	27214.73	27252.64	27407.09	27678.41	-8.4
N ₂ O emissions including N ₂ O from LULUCF	9102.54	9548.27	12095.05	12537.92	13306.61	14322.70	15327.54	16312.42	16887.71	17135.63	17946.69	18126.13	17955.91	23863.51	25422.55	21694.44	12593.94	12593.94	12593.94	13067.65	13067.65	13067.65	13422.96	13613.20	13624.64	13550.05	13542.82	13919.01	14404.79	58.3	
N ₂ O emissions excluding N ₂ O from LULUCF	8823.51	9308.46	11909.03	12388.07	13222.29	14247.61	15289.27	16254.67	16515.55	17067.12	17877.29	18064.46	17897.73	21290.00	23863.51	25422.55	21694.44	12593.94	12593.94	13067.65	13067.65	13067.65	13422.96	13613.20	13624.64	13550.05	13542.82	13919.01	14404.79	62.9	
HFCs	982.8	798.88	1877.22	2117.21	3837.90	5094.87	5779.02	7160.07	4911.10	8091.49	8443.31	5851.64	8652.61	6442.92	6590.97	6651.18	6097.96	7392.59	6881.07	5946.15	8067.59	7907.00	8694.42	8094.74	8337.55	7981.23	7365.92	9648.58	9304.52	846.7	
PFCs	NONE	NONE	0.28	1.62	NONE	63.21	587.4	1862.59	1646.15	1890.01	2246.73	1989.49	1973.16	2266.90	2740.7	2796.16	2925.12	2978.31	2762.80	2047.14	2294.59	2077.79	2267.88	2320.56	2426.90	1521.49	1489.26	2122.77	3179.78	1151.84	
SF ₆	173.4	332.61	345.41	381.31	543.94	1506.10	1152.22	1527.32	989.17	3231.99	2823.47	2721.80	2914.53	3313.64	3293.47	4271.87	5312.60	6420.28	7463.86	8453.34	10089.77	8565.40	8705.16	9450.44	10432.44	6235.16	6823.65	6323.09	8370.59	4777.3	
Total (including LULUCF)	254403.96	281938.07	310838.72	347857.77	370777.55	403966.63	438105.51	463070.96	383932.49	414153.96	444484.04	463282.23	483026.08	493968.15	501021.70	506794.72	512000.92	524851.97	527054.54	541593.37	602476.62	632323.87	641310.68	654948.71	648153.41	647975.18	668261.96	686348.19	168.8		
Total (excluding LULUCF)	282190.35	315459.90	345481.57	378674.17	403800.03	433892.37	470463.21	502115.45	431531.81	469518.36	502895.87	516143.48	538827.47	546897.64	557255.12	560393.34	567392.24	580751.92	583853.57	597895.54	656322.62	684928.54	688308.06	697383.89	691932.56	682514.57	683634.62	707493.97	727633.30	149.0	
1. Energy	240388.84	282238.53	279147.05	308654.68	327987.98	352170.75	385915.06	411870.95	351654.35	382200.76	411798.71	426160.49	445569.63	453208.89	460341.86	468874.45	475131.70	482774.43	508494.54	513054.70	566120.19	585092.52	596471.49	605013.89	597373.47	600906.45	602600.00	615658.30	622376.09	163.1	

Greenhouse Gas Emissions ^a	Change from 1990 to 2018 (%)																														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018	
2. Industrial Processes	20,444.37	24,350.15	23,954.39	34,421.64	38,742.12	43,146.29	44,770.05	49,642.63	40,764.22	48,422.26	50,998.27	49,392.45	53,676.42	56,487.00	58,692.78	54,590.26	54,330.32	51,144.29	50,736.69	47,795.32	52,950.69	52,680.92	54,420.19	54,819.52	57,539.24	54,281.28	53,232.14	55,920.01	56,974.29	178.7	
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	NE	NE	NE	NE
4. Agriculture	20,971.70	21,238.36	21,640.67	22,108.38	22,554.07	22,920.65	23,333.73	23,341.75	23,069.65	21,941.91	21,398.79	20,668.30	20,791.31	20,474.00	20,597.85	20,788.73	20,844.62	21,070.50	21,145.99	21,654.57	22,070.25	21,120.57	21,470.18	21,347.72	21,374.43	20,983.86	20,899.52	20,959.19	21,190.51	1.0	
5. LULUCF ^d	-37,956.40	-33,355.73	-32,622.85	-33,871.40	-32,912.49	-30,952.74	-34,357.71	-38,044.50	-47,598.33	-55,365.10	-58,401.52	-57,854.25	-55,601.39	-55,018.49	-63,234.42	-54,138.62	-55,218.32	-55,899.95	-50,799.02	-55,363.18	-52,676.67	-49,957.37	-46,979.37	-42,534.98	-43,282.12	-44,361.16	-45,599.64	-47,495.01	-41,265.11	9.3	
6. Waste	10,375.45	11,631.76	12,739.45	13,493.57	14,405.67	15,754.68	16,544.37	17,290.21	18,046.39	16,884.03	18,882.10	19,732.24	18,720.11	18,816.75	17,682.62	16,749.50	17,012.40	15,782.69	15,546.36	15,477.95	15,181.29	15,835.54	15,946.20	16,202.56	15,656.43	16,552.88	16,892.26	17,204.47	17,092.40	64.7	
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	NA	NA	NA	NA
Total (including LULUCF)	25,403.96	28,130.07	31,088.72	34,785.77	37,777.35	40,246.63	43,103.51	46,307.96	38,332.49	41,153.86	44,449.04	45,282.23	48,026.98	49,991.15	50,021.70	50,678.72	51,200.92	52,485.97	51,054.54	54,199.37	62,276.92	63,233.67	64,131,068	65,648.71	68,650.44	68,163.41	67,975.18	68,261.96	68,948.19	1638	

- 1) Detailed information is listed as "Emissions trends (CO2)," "Emissions trends (CH4)," "Emissions trends (N2O)" and "Emissions trends (HFCs, PFCs, SF6)" according to the common reporting format
- 2) 2016 is the most recent year for which inventory data is available
- 3) 1 kt CO₂eq. is equal to 1 Gg CO₂eq.
- 4) Includes net CO₂, CH₄ and N₂O from LULUCF
- 5) NA = Not Applicable
- 6) NE = Not Estimated
- 7) NO = Not Occurring



(Table 1-1) GHG Emissions Trends – CO₂

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018	
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	(%)	
1. Energy	231,689.44	250,427.78	272,454.42	302,793.30	322,742.15	347,306.12	380,877.74	406,750.77	346,983.58	377,257.26	406,392.86	420,984.28	439,710.88	447,257.49	454,036.88	462,394.83	469,451.92	466,697.48	459,193.21	505,998.95	558,142.77	586,599.12	597,476.09	595,948.83	598,570.12	592,056.49	593,888.26	606,983.20	622,753.83	188.8	
A. Fuel combustion	231,689.44	250,427.78	272,454.42	302,793.30	322,742.15	347,306.12	380,877.74	406,750.77	346,983.58	377,257.26	406,392.86	420,984.28	439,710.88	447,257.49	454,036.88	462,394.83	469,451.92	466,697.48	459,193.21	505,998.95	558,142.77	586,599.12	597,476.09	595,948.83	598,570.12	592,056.49	593,888.26	606,983.20	622,753.83	188.8	
1. Energy industries	461,883.34	54,000.37	62,167.44	68,288.83	83,313.35	91,361.15	108,684.23	121,877.03	105,879.03	115,695.79	135,584.74	146,801.58	155,143.14	159,330.39	172,166.83	178,291.16	186,652.75	197,594.41	210,686.69	229,398.05	254,081.52	262,226.29	268,218.13	272,563.49	257,852.09	260,008.39	261,898.46	269,181.30	285,701.61	482.9	
2. Manufacturing industries and construction	76,130.16	87,598.49	97,356.05	107,371.18	112,081.83	115,097.15	123,207.53	128,736.47	119,418.26	124,857.36	128,674.68	130,287.58	136,307.56	138,042.21	138,262.86	138,971.12	138,721.24	141,947.11	146,816.93	160,576.99	182,203.21	178,087.74	179,777.39	191,443.43	185,675.35	179,769.62	184,744.12	184,817.68	142.8		
3. Transportation	35,289.63	38,348.67	43,674.32	55,201.65	57,187.12	64,301.11	68,341.38	73,697.36	57,127.45	62,100.86	68,382.37	72,533.05	77,444.78	80,228.58	80,980.53	81,180.89	81,862.11	84,352.07	82,177.78	80,028.50	84,407.21	85,774.03	87,698.96	88,012.25	93,463.19	98,031.94	97,655.06	97,386.84	176.1		
4. Other sectors	71,920.61	65,334.96	66,331.80	88,361.05	67,337.86	73,789.45	77,688.13	79,535.29	61,920.47	71,883.91	69,363.08	67,810.66	68,001.54	67,860.70	62,103.57	63,780.09	60,288.36	58,951.69	57,033.59	54,478.12	55,234.02	54,816.09	54,493.05	53,012.22	48,423.46	49,544.59	51,180.09	51,749.46	-28.0		
5. Other	180.49	4,629.29	2,924.83	3,130.59	2,822.18	2,765.26	3,051.47	2,904.62	2,038.38	2,708.95	2,897.99	3,091.41	2,813.86	3,233.61	3,123.08	3,201.56	2,826.46	2,882.20	2,579.23	2,882.45	2,853.33	2,904.14	2,957.77	2,838.89	3,074.97	3,050.14	3,171.63	3,098.33	161.6		
B. Fugitive emissions from fuels	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	
1. Solid fuels	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ
2. Oil and natural gas	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ	NEQ
2. Industrial processes	18,820.06	22,561.88	24,967.69	28,078.35	31,259.47	32,855.15	33,126.78	34,328.45	27,594.63	28,632.88	29,843.82	30,833.79	32,427.67	33,308.12	31,982.48	29,281.10	29,145.83	32,520.86	32,832.94	30,722.11	31,787.64	33,487.65	33,770.83	34,021.69	35,256.98	35,720.33	36,645.40	36,881.96	36,165.29	85.9	
A. Mineral industry	18,822.69	22,461.80	24,880.48	28,988.25	31,134.92	32,713.07	32,975.94	34,157.22	27,450.07	28,458.42	29,664.41	30,759.32	32,249.88	33,120.62	31,761.62	29,055.86	29,000.65	32,738.85	32,612.11	30,565.31	31,698.14	33,307.35	33,587.66	33,842.26	35,084.25	35,580.97	36,493.03	36,521.48	35,005.12	86.0	
B. Chemical industry	1.56	2.18	2.37	2.57	3.63	4.28	5.12	4.6	3.43	3.29	3.71	3.86	3.45	3.03	3.15	11.07	2.13	1.83	1.84	1.53	1.73	1.83	1.81	1.77	1.72	1.58	1.56	1.57	1.33	-31.8	
C. Metal industry	95.43	77.9	84.84	107.53	120.91	137.8	145.72	166.63	137.13	141.56	147.7	143.61	153.38	157.16	168.36	194.18	143.05	180.18	218.99	155.27	177.77	178.47	181.37	177.65	171.01	137.78	150.81	158.91	158.84	66.4	
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	NA	NA	NA	
E. Production of halocarbons and SF ₆																															
F. Consumption of halocarbons and SF ₆																															



GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018	(%)	
B. Sewage and wastewater treatment																																
C. Waste incineration	1,393.37	1,872.14	2,322.51	2,829.00	2,990.92	4,072.10	4,614.38	5,114.18	4,782.53	5,578.86	7,445.13	7,966.88	6,772.30	6,778.70	6,766.07	5,811.71	6,453.49	5,736.67	5,672.69	5,515.16	5,394.48	5,855.20	6,851.07	6,663.99	6,043.52	6,593.75	6,890.01	6,891.32	6,898.02	886.6		
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	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	NA	NA	NA	NA	
Total CO ₂ emissions including net CO ₂ from LULUCF	213,727.67	240,875.11	266,730.86	300,542.38	323,803.30	353,033.07	383,993.32	406,996.93	331,462.17	355,806.52	384,971.28	401,221.17	422,837.51	432,004.39	443,031.45	446,523.38	488,132.19	480,591.97	485,492.69	541,155.21	573,092.20	590,487.15	593,807.44	596,274.88	589,640.75	591,500.88	608,350.95	623,126.35	191.6			
Total CO ₂ emissions excluding net CO ₂ from LULUCF	252,002.88	274,861.80	299,744.63	334,707.25	356,892.54	384,233.38	418,613.91	446,193.40	376,360.75	411,489.00	443,691.61	459,384.75	478,865.85	487,344.31	492,765.43	497,465.64	524,955.01	537,698.84	542,206.22	595,324.89	625,949.96	627,795.00	636,855.51	639,870.62	634,940.56	637,393.67	650,156.47	664,727.24	163.8			
Memo Items:																																
International bunkers	13,892.66	16,882.34	20,703.94	21,941.28	25,282.46	29,140.86	34,729.00	38,114.43	37,705.71	40,780.37	38,667.09	37,787.90	37,998.08	40,495.71	42,270.72	42,721.11	40,805.40	41,383.94	38,926.62	35,735.67	38,238.39	37,952.97	37,764.47	37,228.62	37,771.22	40,815.45	45,842.15	48,763.77	45,882.41	231.0		
International aviation	6,188.94	4,221.64	5,049.73	5,982.32	6,298.04	7,088.33	7,746.39	8,435.34	6,990.39	7,216.94	7,617.70	7,982.79	9,016.73	9,476.44	10,099.19	10,510.30	8,522.62	12,006.38	10,954.16	10,433.84	11,615.98	11,715.28	11,804.66	12,494.00	12,849.44	14,354.34	14,705.45	15,493.82	150.3			
International marine	7,673.72	12,460.70	15,657.21	16,938.66	19,023.42	22,056.53	26,982.61	29,679.09	30,714.73	33,573.43	31,049.39	29,805.11	28,861.35	31,019.28	32,171.53	32,210.81	32,283.78	29,377.26	27,972.46	25,301.83	26,622.41	26,247.59	25,359.81	24,764.61	25,271.10	27,966.01	31,487.81	32,056.31	30,388.59	296.0		
Multilateral operators	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C		
CO ₂ emissions from biomass	3,001.20	2,284.45	2,670.19	2,737.52	3,344.93	3,729.69	3,903.51	4,439.23	5,122.35	6,190.18	7,813.92	9,217.32	10,972.99	11,991.04	14,918.67	14,806.78	16,015.19	17,359.29	18,707.32	19,092.18	20,895.70	22,888.60	28,514.89	31,353.54	39,462.75	45,481.74	46,778.07	53,287.55	55,459.92	1747.9		



GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018	
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	(%)
G, Other																															
5. Land Use, Land-Use Change and Forestry	999	929	976	941	963	964	974	1068	1110	1080	1144	1179	1232	1235	1212	1145	1225	1251	1313	1269	1232	1307	1236	1285	1325	1494	1407	1340	1351	35	
A. Forest 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	NE	NE	NE	
B. Cropland	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	NE	NE	NE	
C. Grassland	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	NE	NE	NE	
D. Wetlands	999	929	976	941	963	964	974	1068	1110	1080	1144	1179	1232	1235	1212	1145	1225	1251	1313	1269	1232	1307	1236	1285	1325	1494	1407	1340	1351	35.3	
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	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	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	NE	NE	NE	
6. Waste	380.18	419.63	449.26	483.72	493.21	506.70	517.43	526.57	484.62	483.67	485.54	507.95	512.94	514.62	481.35	457.39	444.21	417.22	408.83	412.40	397.92	407.46	376.22	380.36	383.03	397.90	397.90	414.36	411.57	83	
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	374.98	373.03	4.6	
B. Sewage and wastewater treatment	23.42	29.00	32.81	24.54	40.97	40.18	36.37	29.23	29.38	28.96	28.42	29.81	33.62	31.05	28.00	29.90	26.76	29.88	26.75	25.13	27.53	37.66	29.68	34.14	30.41	26.90	31.66	35.54	33.22	41.8	
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	NE	NE	NE	
D. Other	NO	NO	NO	NO	NO	0.04	0.13	0.40	0.38	1.37	2.69	2.85	3.68	3.99	4.14	6.01	7.25	7.71	7.94	8.48	1.03	1.52	1.29	4.10	3.32	2.93	3.97	3.84	5.32	5.32	
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	NA	NA	NA	
Total CH4 emissions including CH4 from LULUCF	1,448.45	1,445.39	1,419.52	1,393.63	1,394.55	1,379.03	1,393.62	1,405.79	1,349.01	1,334.98	1,334.79	1,351.38	1,361.54	1,361.35	1,316.41	1,314.81	1,311.31	1,303.06	1,301.32	1,301.60	1,324.37	1,326.04	1,320.62	1,312.49	1,302.56	1,297.74	1,318.50	1,331.63	-81		
Total CH4 emissions excluding CH4 from LULUCF	1,438.46	1,436.10	1,409.76	1,384.22	1,384.92	1,369.39	1,383.88	1,395.11	1,337.91	1,323.78	1,323.35	1,339.59	1,349.22	1,349.00	1,304.29	1,303.35	1,299.06	1,290.55	1,286.19	1,288.91	1,312.05	1,314.96	1,308.26	1,299.84	1,289.32	1,281.00	1,293.68	1,305.10	1,318.02	-84	
Memo items:																															
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	2.13	2.03	2705	
International aviation	0.04	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.06	0.06	0.08	0.08	0.07	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.11	1449	
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	2.03	1.93	2814	
Multilateral operations	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
CO ₂ emissions from biomass																															

〈Table 1-1〉 GHG Emissions Trends – N₂O

GHG Source and Sink Categories	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
1. Energy	295	316	351	384	418	447	485	535	464	501	555	585	619	636	662	674	693	730	753	776	866	912	931	956	976	1003	1007	1035	1083	267.3
A. Fuel combustion	295	316	351	384	418	447	485	535	464	501	555	585	619	636	662	674	693	730	753	776	866	912	931	956	976	1003	1007	1035	1083	267.3
1. Energy industries and construction	0.79	0.83	1.09	1.19	1.48	1.63	1.94	2.17	1.78	1.96	2.34	2.55	2.71	2.79	2.99	3.11	3.28	3.47	3.65	4.01	4.49	4.74	4.81	4.98	5.02	5.05	5.21	5.35	5.68	621.3
2. Manufacturing industries and construction	0.98	1.12	1.38	1.55	1.64	1.70	1.83	1.96	1.92	2.02	2.17	2.25	2.37	2.44	2.55	2.54	2.59	2.77	2.96	2.72	3.11	3.22	3.31	3.46	3.63	3.79	3.82	3.93	3.96	233.6
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	0.69	0.69	0.74	0.78	0.79	0.80	167.5
4. Other sectors	0.88	0.74	0.64	0.60	0.66	0.57	0.57	0.56	0.42	0.48	0.44	0.43	0.46	0.46	0.41	0.43	0.39	0.39	0.37	0.37	0.38	0.48	0.50	0.39	0.39	0.43	0.43	0.45	0.46	-47.8
5. Other	0.00	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	0.03	0.03	1618.2
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	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	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	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	34.63	41.76	35.83	33.38	3.06	0.86	0.72	0.66	1.01	1.42	1.27	1.04	0.85	1.07	1.17	1.15	38.4
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	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	34.63	41.76	35.83	33.38	3.06	0.86	0.72	0.66	1.01	1.42	1.27	1.04	0.85	1.07	1.17	1.15	38.4
C. Metal 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	NO	NO	NO
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	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	NE	NE	NE
4. Agriculture	21.47	22.20	23.54	24.62	26.14	27.27	28.56	28.83	28.30	26.44	25.46	24.46	24.16	23.82	24.46	25.28	25.53	26.00	26.05	27.19	28.00	28.46	27.57	27.96	28.02	27.47	27.17	27.86	29.09	36.5
A. Enteric fermentation																														
B. Manure management	6.59	7.15	7.86	8.71	9.28	9.82	10.55	10.74	10.42	9.39	8.82	8.41	8.43	8.43	8.73	9.17	9.59	9.99	10.21	10.71	11.37	10.89	11.07	11.15	11.02	10.54	10.24	10.85	11.43	73.6
C. Rice cultivation																														
D. Agricultural soils	14.86	15.03	15.65	15.90	16.84	17.43	17.99	18.07	17.86	17.03	16.62	16.03	15.71	15.37	15.71	16.09	15.92	16.00	15.82	16.47	16.61	15.48	16.49	16.82	16.99	16.92	16.92	17.20	17.65	18.8
E. Prescribed burning of savannas	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	NO	NO	NO
F. Field burning of agricultural residues	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	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-47.7



GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018		
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	(%)	
G, Other																																
4. 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	0.12	0.10	-88.5		
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	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	0.12	0.10	-88.5		
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	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	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	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	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	NE	NE	NE		
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	4.88	4.82	4.94	5.03	5.28	5.25	5.20	5.29	64.4		
A. Waste landfill																																
B. Sewage and wastewater treatment	3.10	2.90	2.98	2.84	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	3.42	3.37	3.37	8.5		
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	0.86	0.67	0.71	0.71	0.61	0.57	0.67	0.88	0.84	0.80	0.80	0.95	0.98	0.86	1.00	0.92	0.93	0.94	703.5		
D. Other	NO	NO	NO	NO	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	0.54	0.67	0.73	0.85	0.91	0.90	0.99			
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	NA	NA	NA		
Total N ₂ O emissions including N ₂ O from LULUCF	29.36	30.80	39.02	40.44	42.92	46.20	49.44	52.62	53.49	55.28	57.89	58.47	57.92	68.88	76.98	72.33	69.88	40.63	38.80	40.09	42.15	41.50	43.30	43.91	43.95	43.71	43.69	44.90	46.47	56.3		
Total N ₂ O emissions excluding N ₂ O from LULUCF	28.46	30.03	38.42	39.99	42.68	45.96	49.26	52.43	53.28	55.06	57.67	58.27	57.70	68.08	76.79	72.15	69.81	40.43	38.60	39.88	41.94	41.30	43.13	43.76	43.84	43.63	43.56	44.78	46.36	62.9		
Memo items:																																
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	0.66	0.66	180.1		
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	0.41	0.43	144.9		
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	0.24	0.23	281.4		
Multilateral operations	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C		
CO ₂ emissions from biomass																																

〈Table 1-1〉 GHG Emissions Trends – HFCs, PFCs, SF₆

GHG Source and Sink Categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Change from 1990 to 2018 (%)	
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	(%)
Emissions of HFCs – (Gg CO ₂ eq.)	862.8	798.88	1,877.22	2,117.21	3,857.90	5,084.67	5,779.02	7,160.07	4,911.10	8,061.49	8,443.31	5,851.64	8,652.61	6,425.92	6,590.97	6,851.18	6,027.96	7,382.89	6,881.07	5,846.15	8,087.59	7,907.00	8,634.42	8,094.74	8,537.55	7,931.23	7,365.92	9,648.59	9,304.62	846.7	
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	0.03	0.04		
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	NO,NE	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.02	0.03	
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	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	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	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	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	5.66	5.41	6.89	6.48		
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	0.85	0.77	1.04	2.68	2.82		
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	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	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	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	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	NO	NO	NO	
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	NO	NO	NO	
Emissions of PFCs – (Gg CO ₂ eq.)	NO,NE	NO,NE	0.28	1.62	63.21	567.4	1,682.59	1,649.15	1,890.01	2,249.73	1,968.49	1,973.16	2,766.90	2,774.07	2,796.76	2,925.12	2,978.31	2,769.80	2,047.14	2,264.59	2,071.79	2,267.88	2,320.56	2,426.90	1,521.49	1,469.26	2,122.77	3,179.78	1151994.3		
CF ₄	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	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	0.21	0.32			
C ₂ F ₆	NO,NE	NO,NE	0.00	0.00	NO,NE	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	0.02	0.02	0.02		
C ₃ F ₈	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0.00	0.00	0.01	0.03	0.05	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	0.02	0.02	0.02	0.02	
C ₄ F 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	NO	NO	NO	
c-C ₃ F 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	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.05	0.09		
C ₂ F 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	NO	NO	NO	
C ₃ F ₄	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	NO	NO	NO	
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	NO	NO	NO	
Emissions of SF ₆ – (Gg CO ₂ eq.)	173.4	332.61	345.41	387.31	543.94	1,505.10	1,152.22	995.17	3,231.99	2,823.47	2,721.80	2,914.53	3,313.64	3,929.47	4,271.87	5,312.80	6,420.28	7,463.86	8,453.24	10,089.77	8,959.40	8,705.16	9,450.44	10,924.44	8,235.16	6,823.85	6,520.09	8,970.59	4727.3		
SF ₆	0.01	0.01	0.01	0.02	0.02	0.06	0.05	0.04	0.14	0.12	0.12	0.11	0.12	0.14	0.16	0.18	0.22	0.27	0.31	0.35	0.42	0.36	0.36	0.40	0.44	0.35	0.29	0.27	0.35	4727.3	

<Table 1–2> 2018 Greenhouse Gas Emissions by Sector – Energy Sector

GHG Source and Sink Categories	CO ₂	CH ₄	N ₂ O
	(Gg)		
Energy	622,753.93	298.35	10.83
A. Fuel combustion	622,753.93	85.64	10.83
1. Energy industries	285,701.61	7.16	5.68
a. Public electricity and heat generation	267,690.36	6.70	5.61
b. Oil refining	15,835.72	0.35	0.05
c. Solid fuel manufacturing and other energy industry	2,175.53	0.12	0.02
2. Manufacturing industries and construction	184,817.68	27.68	3.86
a. Steel	94,627.11	10.44	1.42
b. Non-ferrous metals	2,963.42	0.28	0.03
c. Chemicals	45,513.99	5.91	1.01
d. Pulp, paper and printing	660.54	0.05	0.00
e. Food and beverage processing and tobacco manufacturing	1,950.21	0.16	0.00
f. Other	39,102.40	10.83	1.39
Non-metal	11,001.06	1.04	0.14
Fabricated metal	4,961.93	0.42	0.01
Wood and timber	122.5	0.01	0.00
Construction	2,162.00	0.15	0.02
Textile and leather	704.29	0.05	0.00
Other manufacturing	20,150.62	9.16	1.22
3. Transportation	97,386.84	22.72	0.80
a. Civil aviation	1,588.85	0.02	0.05
b. Road transport	94,012.78	22.50	0.73
c. Railways	286.63	0.02	0.00
d. Shipping	1,014.96	0.07	0.01
e. Other transport	483.63	0.11	0.00
4. Other	51,749.46	27.65	0.46
a. Commerce/Public	14,688.46	16.18	0.25
b. Residential	33,541.50	11.19	0.18
c. Agriculture/Forestry/Fishery	3,519.50	0.28	0.03
5. Other	3,098.33	04.42	0.03
a. Fixed	3,098.33	04.42	0.03
b. Movable	IE	IE	IE
B. Fugitive emission from fuels	NE,NO	212.71	NO
1. Solid fuels	NE,NO	16.04	NO
2. Oil and natural gas	NE,NO	196.67	NO
a. Oil	NE	10.28	NO

GHG Source and Sink Categories	CO ₂	CH ₄	N ₂ O
	(Gg)		
b. Natural gas	NE	186.39	
Memo items			
International bunkers	45,882.41	2.03	0.66
International aviation	15,493.82	0.11	0.43
International marine	30,388.59	1.93	0.23
Multilateral operations	NO	NO	NO
CO ₂ emissions from biomass	55,459.92		

※ Reporting table according to the 1996 IPCC Guidelines Annex

- 1) According to the 1996 IPCC Guidelines, negative numbers (–) are always used for removal and positive numbers (+) are used for emissions for reporting purposes
- 2) NO (Not Occurring) = In case there are no corresponding activities and processes in which emission and removal occur domestically. NE (Not Estimated) = In case there are emission and removal activities and processes but they are not measured. NA (Not Applicable) = In case of emission and removal activities and processes that do not occur naturally, theoretically. IE (Included Elsewhere) = In case it is included in a different item for report. C (Confidential) = In case of confidential information

<Table 1–2> 2018 Greenhouse Gas Emissions by Sector – Industrial Processes Sector

GHG Source and Sink Categories	CO ₂	CH ₄	N ₂ O	HFCs		PFCs		SF ₆	
				P	A	P	A	P	A
	(Gg)			(GgCO ₂ eq.)				(Gg)	
Industrial processes	35,165.29	28.52	0.15	11,225.85	482.08	948.00	3,179.78	0.31	0.35
A. Mineral industry	35,005.12	NO	NO						
1. Cement production	24,702.06								
2. Lime production	3,664.46								
3. Lime and dolomite consumption	6,409.60								
4. Soda ash production and consumption	228.99								
5. Asphalt roofing	NE								
6. Asphalt road paving	NE								
B. Chemical industry	1.33	28.52	1.15						
C. Metal industry	158.84	IE,NA,NO	NO				NO		0.00
1. Steel production	158.84	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				11,225.85	482.08	948.00	3,179.78	0.31	0.35
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	482.08	NO, NE, IE	3,179.78	IE	0.15
8. Heavy electric equipment								IE	0.20
9. Other (provisional emissions)				11,225.85	NO	948.00	NO	0.31	NO

- 1) HFCs and PFCs emissions are expressed in CO₂ 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〉 2018 Greenhouse Gas Emissions by Sector – Agriculture Sector

GHG Source and Sink Categories	CH ₄	N ₂ O
	(Gg)	
Agriculture	579.58	29.09
A. Enteric fermentation	212.90	
1. Cattle	193.07	
2. Buffalo	NO	
3. Sheep	0.01	
4. Goat	2.14	
5. Camel and llama	NO	
6. Horse	0.50	
7. Mule and donkey	NO	
8. Pig	17.04	
9. Poultry	NE	
10. Other livestock (deer)	0.15	
B. Manure management	66.30	11.43
1. Cattle	17.73	6.91
2. Buffalo	NO	NO
3. Sheep	0.00	0.00
4. Goat	0.05	0.54
5. Camel and llama	NO	NO
6. Horse	0.03	0.03
7. Mule and donkey	NO	NO
8. Pig	34.08	2.21
9. Poultry	14.41	1.70
10. Other livestock (deer)	0.00	0.04
C. Rice cultivation	299.85	
1. Irrigation	298.42	
2. Rain-fed paddy	1.43	
D. Agricultural soils	NA	17.65
1. Direct emissions	NA	9.74
2. Ranch, grazing and manure		NE
3. Indirect emissions	NA	7.92
E. Prescribed burning of savannas	NO	NO
F. Field burning of agricultural residues	0.53	0.01
1. Cereals	0.08	0.00
2. Pulses (beans)	0.10	0.00
3. Root vegetables	NO	NO
4. Sugar cane	NO	NO
5. Other	0.35	0.01

※ Reporting table according to the 1996 IPCC Guidelines Annex

<Table 1–2> 2018 Greenhouse Gas Emissions by Sector – LULUCF Sector

GHG Source and Sink Categories	Net CO ₂ Emissions/ Removal	CH ₄	N ₂ O
	(Gg)		
LULUCF	-41,600.89	13.51	0.10
A. Forest land	-45,595.65	NE,NO	NE,NO
1. Forest land maintained	-45,595.65	NE,NO	NE,NO
2. Forest land converted from other land	IE	NE,NO	NE,NO
B. Cropland	3,975.71	NE,NO	0.10
1. Cropland converted from other land	-289.45	NE,NO	
2. Cropland converted to other land	4,160.81	NE,NO	NE,NO
3. N ₂ O emissions due to conversion to cropland			0.10
4. CO ₂ emissions due to use of agricultural lime	104.35		
C. Grassland	-16.55	NE,NO	NE,NO
1. Grassland maintained	0.00	NE,NO	NE,NO
2. Grassland converted from other land	-16.55	NE,NO	NE,NO
D. Wetlands	35.60	13.51	NE,NO
1. Wetlands maintained	NE	13.51	NE,NO
2. Wetlands converted from other land	35.60	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> 2018 Greenhouse Gas Emissions by Sector – Waste Sector

GHG Source and Sink Categories	CO ₂	CH ₄	N ₂ O
	(Gg)		
Waste	6,808.02	411.57	5.29
A. Waste landfill	NA, NO	373.03	
1. Managed landfill	NA	388.24	
2. Non-managed landfill	NA	34.79	
B. Sewage and wastewater treatment		33.22	3.37
1. Wastewater treatment		19.86	NE
2. Sewage treatment		13.35	3.37
C. Waste incineration	6,808.02	NE	0.94
D. Other	NA	5.32	0.99

※ Reporting table according to the 1996 IPCC Guidelines Annex

〈Table 1-3〉 Country-specific Emission and Removal Factors by Sector of National Greenhouse Gas Inventory Application (1990-2018)

Sector (Sub-sector)	Name of Factor	Unit	Country-specific emission and removal factor		
			2007~2011	2012~2016	2017~2018
Energy sector (Fuel combustion)	Gasoline	ton C/TJ	19.7	20.0	19,548
	Jet oil	ton C/TJ	19.6	19.8	19,931
	Kerosene	ton C/TJ	19.5	19.6	19,969
	Diesel	ton C/TJ	20.0	20.2	20,111
	Bunker-A (B-A)	ton C/TJ	20.2	20.4	20,657
	Bunker-B (B-B)	ton C/TJ	20.6	20.5	21,384
	Bunker-C (B-C)	ton C/TJ	20.8	20.6	21,929
	By-product fuel oil No. 1	ton C/TJ	-	19.7	20,067
	By-product fuel oil No. 2	ton C/TJ	-	21.0	21,729
	Propane	ton C/TJ	17.6	19.6	17,641
	Butane	ton C/TJ	18.1	18.1	18,107
	Naphtha	ton C/TJ	18.6	19.2	19,157
	Asphalt	ton C/TJ	21.5	21.6	21,544
	Lubricants	ton C/TJ	19.7	19.9	19,979
	Petroleum coke	ton C/TJ	27.2	27.2	26,086
	Domestic anthracite	ton C/TJ	29.7	30.5	30,185
	Imported anthracite (fuel)	ton C/TJ	-	28.6	27,404
	Imported anthracite (coking coal)	ton C/TJ	-	29.2	29,909
	Bituminous (coking coal)	ton C/TJ	-	26.2	25,963
	Bituminous (fuel)	ton C/TJ	25.9	26.0	25,951
Liquefied Natural Gas (LNG)	ton C/TJ	15.4	15.3	15,312	
City gas (LNG)	ton C/TJ	15.4	15.3	15,272	
City gas (LPG)	ton C/TJ	17.6	17.6	17,454	

※ 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.



Sector (Sub-sector)	Name of Factor	Unit	Factor
			1990
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 ₂ O emission factor for coal	kg N ₂ O/TJ	1.66
	N ₂ O emission factor for oil	kg N ₂ O/TJ	1.75
	N ₂ O emission factor for natural gas and city gas (LNG)	kg N ₂ O/TJ	1.06
Energy sector(Fugitive emission from LNG)	Emission factor for transport venting of LNG	Gg CH ₄ /10 ⁶ m ³	2,028 × 10 ⁻⁶
	Emission factor for transport leaks of LNG	Gg CH ₄ /10 ⁶ m ³	8,567 × 10 ⁻⁶
	Emission factor for storage venting of LNG	Gg CH ₄ /10 ⁶ m ³	3,756 × 10 ⁻⁶
	Emission factor for storage leaks of LNG	Gg CH ₄ /10 ⁶ m ³	6,835 × 10 ⁻⁶
Industrial process sector(Cement production)	EFI	ton CO ₂ /ton	0.5295
Agriculture sector(Rice cultivation sub-sector)	Methane baseline emission factor for rice cultivation (EF _C)	kg CH ₄ /ha/day	2.32
	Scaling factor for organic amendment applied (SF _O) for rice straw :When applying rice straw (dry matter) of 5–7 mg/ha	–	2.5
	Scaling factor for water management (SF _w) : Continuously flooded	–	1.00
	Scaling factor for water management (SF _w) : Intermittently flooded – 1 week	–	0.83
	Scaling factor for water management (SF _w) : Intermittently flooded – 2 weeks	–	0.66
	Scaling factor for water management (SF _w) : Intermittently flooded – 3 weeks	–	0.49
Agriculture sector(Agricultural soils sub-sector)	Direct N ₂ O emission factor from synthetic fertilizer for potato (EF _{1i})	kg N ₂ O–N/kg N	0.0049
	Direct N ₂ O emission factor from synthetic fertilizer for pepper (EF _{1i})	kg N ₂ O–N/kg N	0.0086
	Direct N ₂ O emission factor from synthetic fertilizer for soybeans (EF _{1i})	kg N ₂ O–N/kg N	0.0119
	Direct N ₂ O emission factor from synthetic fertilizer for spring cabbage (EF _{1i})	kg N ₂ O–N/kg N	0.0056
	Direct N ₂ O emission factor from synthetic fertilizer for autumn cabbage (EF _{1i})	kg N ₂ O–N/kg N	0.0058
	Direct N ₂ O emission factor from synthetic fertilizer for field crops (EF _{1i})	kg N ₂ O–N/kg N	0.00596
	Direct N ₂ O emission factor from N leaching and runoff (EF _{1i})	kg N ₂ O–N/kg N	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 above-ground biomass to below-ground biomass (R) for coniferous forest	–	0.27
	Ratio of above-ground biomass to below-ground biomass (R) for broadleaf forest	–	0.36

Sector (Sub-sector)	Name of Factor	Unit	Factor
			1990
Waste sector(Waste landfill sub-sector)	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 paper 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	0.00148
	CH ₄ factor for non-metal industry	ton CH ₄ /ton BOD	0.00020
	CH ₄ factor for power and water supply industry	ton CH ₄ /ton BOD	0.00028
	CH ₄ factor for wastewater treatment business	ton CH ₄ /ton BOD	0.0325
	CH ₄ factor for metal	ton CH ₄ /ton BOD	0.0033
Waste sector (Waste incineration sub-sector)	Municipal solid waste	g N ₂ O/ton	52.1
	Industrial solid waste	g N ₂ O/ton	129.7
	Sewage sludge	g N ₂ O/ton	595.0



〈Table 1-4〉 Measurement Guidelines and Emission Factors

Sectors	CO ₂		CH ₄		N ₂ O		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	96D	96D, CS ¹⁾	96D	96D, 06D, CS ²⁾	96D	96D, 06D, CS						
2. Manufacturing industries and construction	96D	96D, CS	96D	96D, 06D, CS ³⁾	96D	96D, 06D, CS						
3. Transportation												
a. Civil aviation	General aviation GPG T1 Civil aviation GPG T2	96D	General aviation GPG T1 Civil aviation GPG T2	96D	General aviation GPG T1 Civil aviation GPG T2	96D						
b. Road transport, railway, shipping and other transport	96D	96D, 06D, CS ⁴⁾	96D	96D, 06D ⁵⁾	96D	96D, 06D						
4. Other sectors	96D	96D, 06D, CS	96D	96D, CS ⁶⁾	96D	96D, CS						
5. Other	96D	96D, 06D, CS	96D	96D, CS	96D	96D, CS						
B. Fugitive emission from fuels	NA	NA	96D	96D, 06D, CS ⁷⁾	NA	NA						
2. Industrial processes												
A. Mineral industry	96D, GPG T1 ⁸⁾	06CS, GPG D, 96D ⁹⁾	NA	NA	NA	NA						
B. Chemical industry	96D	96D	96 T1	96D	06 T2, 96 T1 ¹⁰⁾	06D, 96D ¹¹⁾						
C. Metal industry	96D, IE ¹²⁾	96D, IE	NA	NA	NA	NA					96 T1	
D. Other industry	NA	NA										

Sectors	CO ₂		CH ₄		N ₂ O		HFCS		PFCs		SF ₆	
	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor
E. Production of halocarbons and SF ₆							IE, NO ⁽³⁾	IE, NO	NO	NO	NO, NE ⁽⁴⁾	NO, NE
F. Consumption of halocarbons and SF ₆							96 T1a, 06 T2a, 06 T2b ⁽⁵⁾	06 T2	96 T1a, 06 T2a, 06 T2b	06 T2	96 T1a, 06 T2a, 06 T2b, 06 T1 ⁽⁶⁾	06 T2, 06 D ⁽⁷⁾
G. Other	NA	NA	NA	NA	NA	NA						
4. Agriculture												
A. Enteric fermentation			96 T1	96 D								
B. Manure management			96 T1	96 D	96 T1	96 D						
C. Rice cultivation			06 T2	CS, GPG D								
D. Agricultural soils			NA	NA	06 T2, 06 T1, GPG T1 ⁽⁸⁾	CS, 06 D ⁽⁹⁾						
E. Prescribed burning of savannas			NO	NO	NO	NO						
F. Field burning of agricultural residues			96 T1	96 D ⁽²⁰⁾	96 T1	96 D						
G. Other			NO	NO	NO	NO						
5. LULUCF												
A. Forest land	06 T2	CS, 06 D ⁽²¹⁾	NO, NE ⁽²²⁾	NO, NE	NO, NE ⁽²³⁾	NO, NE						
B. Cropland	GPGL T1	GPGL D	NO, NE ⁽²⁴⁾	NO, NE	GPGL T1	GPGL D						
C. Grassland	GPGL T1	GPGL D	NO, NE ⁽²⁵⁾	NO, NE	NO, NE	NO, NE						
D. Wetlands	06 OTH ⁽²⁶⁾	06 D	06 OTH ⁽²⁷⁾	06 D	NO, NE ⁽²⁸⁾	NO, NE						
E. Settlements	NE	NE	NE	NE	NE	NE						
F. Other lands	NE	NE	NE	NE	NE	NE						
G. Other	NE	NE	NE	NE	NE	NE						
6. Waste												
A. Waste landfill	NA, NO ⁽²⁹⁾	NA, NO	GPG T2	CS, 96 D, GPG D ⁽³⁰⁾								



Sectors	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor
B. Sewage and wastewater treatment			GPG T2, 06 T1 ³¹⁾	CS, 06 D ³²⁾	GPG T1	GPG T2a						
C. Waste incineration	GPG T1	GPG D	NE	NE	GPG T2	CS						
D. Other	NA	NA	06 T1	06 D	06 T1	06 D						

- 1) Year 1990–2006: 96 D, Year 2007–2018: CS
- 2) 06 D(refinery gas, LPG), CS(city gas), all other fuels are 96 D
- 3) 06 D(refinery gas, LPG, naphtha, lubricant, petroleum coke), CS(diesel, gasoline, propane, butane), all other fuels are 96 D
- 4) Year 1990–2006: 06 D(LPG), all other fuels are 96 D, Year 2007–2018: CS
- 5) 06 D(LPG), all other fuels are 96 D
- 6) CS(city gas), all other fuels are 96 D
- 7) 06 D(1B2b production, processing), CS(1B2b transport, storage), all other fuels are 96 D
- 8) 96 D(cement production, lime and dolomite consumption, soda ash production and consumption), GPG T1(lime production)
- 9) 06 T2(cement production), GPG D(lime production), 96 D(lime and dolomite consumption, soda ash production and consumption)
- 10) 06 T2(nitric acid production), 96 T1(adipic acid production)
- 11) 06D(nitric acid production), 96 D(adipic acid production)
- 12) 96 D(steel production, aluminum production), IE(ferroalloy production)
- 13) IE(by-product emissions), NO(fugitive emissions)
- 14) NO(by-product emissions), NE(fugitive emissions)
- 15) 96 T1a(potential emissions), 06 T2a(semiconductor), 06 T2b(LCD)
- 16) 06 T1(heavy electric equipment)
- 17) 06 T2(semiconductor, LCD), 06 D(heavy electric equipment)
- 18) Direct emissions: 06 T2(chemical fertilizer nitrogen input: 06 T1, nitrogen input in returned-to-soil manure and agricultural residues from among organic nitrogen: GPG T1), indirect emissions: 06 T1
- 19) Direct emissions: CS(field), 06 D(rice paddy), indirect emissions: CS(leaching and runoff), 06 D(atmospheric emission)
- 20) Parameters other than emission factors: residue/grain ratio (wheat is GPG D, others are the reference approach), dry matter ratio (wheat is GPG D, others are RA), ratio of field burning of residues (RA), oxidation rate (rice is 06 D, others are 96 D), carbon content (wheat is GPG D, others are RA), emission factor(96 D)

- 21) CS(basic wood density, biomass expansion factor, ratio of above-ground biomass to below-ground biomass), 06 D(carbon fraction)
- 22) NO(non-CO₂ emission from drainage, biomass combustion (prescribed burning)), NE(biomass combustion(forest fire))
- 23) NO(non-CO₂ emission from drainage, biomass combustion (prescribed burning)), NE(direct N₂O emission from nitrous fertilization, biomass combustion(forest fire))
- 24) NO(biomass combustion(prescribed burning)), NE(biomass combustion(forest fire))
- 25) NO(biomass combustion(forest fire)), NE(biomass combustion(prescribed burning))
- 26) 06 Appendix 2
- 27) 06 Appendix 3
- 28) NO(non-CO₂ emission from drainage, biomass combustion(prescribed burning)), NE(non-CO₂ emission from drainage, biomass combustion(forest fire))
- 29) Managed landfill, non-managed landfill(NA), other(NO)
- 30) CS(k, F), 96 D(DOC), GPG D(MCF, DOCt, OX)
- 31) GPG T2(Industrial, Domestic), 06 T1(Uncollected, Untreated Wastewater)
- 32) CS(Industrial, Domestic Wastewater), 06 D(Uncollected, Untreated Wastewater)



<Table 1–5> List of Activity Data

Sectors	Sub-sectors	Name of Activity Data	Sources
Energy	All sub-sectors	Energy Consumption Survey	Ministry of Trade, Industry and Energy
		Yearbook of Energy Statistics	Ministry of Trade, Industry and Energy
		Petroleum Products Supply and Demand Statistics	Korea National Oil Corporation
	Chemical	Korea Petrochemical Statistics	Korea Petrochemical Industry Association
	Public Electricity and Heat Production	Domestic Anthracite Consumption Statistics	Korea Coal Association
		Statistics on Consumption of Imported Anthracite for Power Generation	Statistics of Electric Power in Korea
Civil Aviation	Aviation Statistics	Korea Airports Corporation	
Industrial processes	All sub-sectors	Greenhouse Gas and Energy Target Management Scheme and Emissions Trading Scheme Business Site Statistics	Ministry of Environment
	Cement	Yearbook of Cement Statistics	Korea Cement Association
	Limestone	Lime Production Statistics, Lime and Dolomite Consumption Statistics	Limestone Processing Cooperative, Korea Iron & Steel Association
	Soda Ash	Exports and Imports Statistics	Korea International Trade Association
	Steel	Exports and Imports Statistics	Korea International Trade Association
	Chemical Industry	Korea Petrochemical Statistics, CDM Report	Korea Petrochemical Industry Association, CDM execution company
	Fluorinated Gas	Fluorinated Gas Statistics, Exports and Imports Statistics	Korea Semiconductor/Display Industry Association, Korea Specialty Chemical Industry Association, Korea International Trade Association
	Charging Apparatus	SF ₆ Charging Statistics	KEPCO, power generation companies, Korea Electrical Safety Corporation
Agriculture	All sub-sectors	Agriculture, Food and Rural Affairs Statistics Yearbook	Ministry of Agriculture, Food and Rural Affairs
		Census of Agriculture, Forestry and Fisheries	Statistics Korea
		Agriculture, Forestry and Fisheries Research	Statistics Korea
	Livestock	Livestock Survey Report	Ministry of Agriculture, Food and Rural Affairs
	Plowing and Sowing	Fertilizer Yearbook	Korea Fertilizer Industry Association
		Agricultural Production Cost Survey	Statistics Korea
		Crop Production Survey	Statistics Korea
Agricultural Area Survey		Statistics Korea	
LULUCF	Forest Land	Statistical Yearbook of Forestry	Korea Forest Service
		Basic Forest Statistics	Korea Forest Service
	Cropland	Cultivated Area Survey	Statistics Korea

Sectors	Sub-sectors	Name of Activity Data	Sources
LULUCF	Cropland	Fertilizer Business Statistics Booklet	Materials Department of the NongHyup Agribusiness Group
	Cropland, Grassland	Korea's Soil Categorization and Explanation	National Institute of Agricultural Sciences
	Grassland, Wetlands	Cadastral Statistics	Ministry of Land, Infrastructure and Transport
	Wetlands	Freezing Day Statistics	Korea Meteorological Administration
Waste	All sub-sectors	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
		Population Projection	Statistics Korea
		GHG Emissions Survey in the Environmental Sector and Establishment of Statistics	Ministry of Environment
	Sewage and wastewater	Sewer Statistics	Ministry of Environment
		Generation and Treatment of Industrial Wastewater	Ministry of Environment
		Report on Results of Wastewater Discharge Facility Survey	Ministry of Environment
		Korea National Health and Nutrition Examination Survey	Ministry of Health and Welfare

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

Land Use	Annual Carbon Storage Change (GgCO ₂)				CH ₄ (Gg)	N ₂ O (Gg)
	Growing tree biomass A	Dead organic matter B	Soil C	CO ₂ Emissions/ Removal D=A+B+C		
Forest land	-45,595.65	NE	NE, NO	-45,595.65	NE,NO	NE,NO
Cropland	NE	NE	3,975.71	3,975.71	NE, NO	0.10
Grassland	NE, NO	NE, NO	-16.55	-16.55	NE,NO	NE,NO
Wetlands	NE, NO	NE, NO	35.60	35.60	13.51	NE,NO
Settlements	NE	NE	NE			
Others	NE	NE	NE			
Total	-45,595.65	NE	3,994.76	-41,600.89	13.51	0.10

- 1) NO (Not Occurring) = In case there are no corresponding activities and processes in which emission and removal occur domestically. NE (Not Estimated) = In case there are emission and removal activities and processes but they are not measured. NA (Not Applicable) = In case of emission and removal activities and processes that do not occur naturally, theoretically. IE (Included Elsewhere) = In case it is included in a different item for report. C (Confidential) = In case of confidential information

〈Table 1-7〉 Comparison between Reference Approach (RA) and Sectoral Approach (SA)
(Unit: Thousand tCO₂eq.)

Descriptions	Reference Approach	Sectoral Approach	Difference (%)
Liquid fuel	191,943.62	183,228.55	4.76
Solid fuel	320,858.61	322,826.60	-0.61
Gaseous fuel	116,648.68	116,698.78	-0.04
Other	NO	NO	-
Total	629,450.91	622,753.93	1.08

〈Table 1-8〉 Not Estimated Emission Source of National Greenhouse Gas Inventory (1990-2018)

GHGs	Sectors	Sub-sectors	Reasons for non-estimation
CO ₂	1. Energy	1.B.1.a.i. Underground mine	IPCC/No national emission factor
	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
	5. LULUCF	5.A.1. Forest land maintained (dead organic matter and soil carbon)	No activity data
	5. LULUCF	5.A.2. Forest land converted from other lands (dead organic matter and soil carbon)	No activity data
	5. LULUCF	5.B.1. Cropland maintained (biomass, dead organic matter)	No activity data
	5. LULUCF	5.B.2. Cropland converted from other lands (biomass, dead organic matter)	No activity data
	5. LULUCF	5.C.1. Grassland maintained (biomass, dead organic matter)	No activity data
	5. LULUCF	5.C.2. Grassland converted from other lands (biomass, dead organic matter)	No activity data
	5. LULUCF	5.D.1. Wetlands maintained	No IPCC methodology presented
	5. LULUCF	5.E.1. Settlement maintained	No activity data
	5. LULUCF	5.E.2. Settlement converted from other lands	No activity data
	5. LULUCF	5.F.1. Others maintained	No activity data
	5. LULUCF	5.F.2. Others converted from other lands	No activity data
	5. LULUCF	5.V. Biomass combustion	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

GHGs	Sectors	Sub-sectors	Reasons for non-estimation
CH ₄	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.V. Biomass combustion	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 ₂ O	5. LULUCF	5.I.A.1. Direct N ₂ O emission from nitrogen fertilization (Forest land maintained)	No activity data
	5. LULUCF	5.I.A.2. Direct N ₂ O emission from nitrogen fertilization (Forest land converted from other lands)	No activity data
	5. LULUCF	5.V. Biomass combustion	No activity data
	6. Waste	6.B.1.a. Industrial wastewater	No IPCC GL methodology presented
	6. Waste	6.B.1.b. Industrial wastewater sludge	No IPCC GL methodology presented
	6. Waste	6.B.2.b. Sewage sludge	No IPCC GL methodology presented
HFCs and 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
	2. Industrial processes	2.F.6. Consumption of halocarbons and SF ₆ (Use of ODS alternatives for other uses)	No activity data

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

Ranking	IPCC GHG Emission and Sinks (including LULUCF)		GHGs	2018 Emissions (Gg CO ₂ eq.)	Tier 1 Level Assessment (Total=1)	Tier 1 Level Assessment Accumulated Share
1	1A1	Energy industry: Solid fuel	CO ₂	202,499	0.26	0.26
2	1A2	Manufacturing industries and construction: Solid fuel	CO ₂	118,416	0.152	0.412
3	1A3b	Road transport	CO ₂	94,013	0.121	0.533
4	1A1	Energy industry: Gaseous fuel	CO ₂	61,011	0.078	0.612
5	5A1	Forest land maintained	CO ₂	-45,596	0.059	0.67
6	1A2	Manufacturing industries and construction: Liquid fuel	CO ₂	44,305	0.057	0.727
7	1A4	Other sectors: Gaseous fuel	CO ₂	30,984	0.04	0.767
8	2A1	Cement production	CO ₂	24,702	0.032	0.799
9	1A1	Energy industry: Liquid fuel	CO ₂	22,191	0.029	0.827
10	1A2	Manufacturing industries and construction: Gaseous fuel	CO ₂	22,096	0.028	0.856
11	1A4	Other sectors: Liquid fuel	CO ₂	18,854	0.024	0.88
12	2F9	Consumption, etc. of halocarbons and SF ₆	HFCs	8,822	0.011	0.891
13	6A	Waste landfill	CH ₄	7,834	0.01	0.901
14	2F7	Semiconductor production (LCD production)	HFCs, PFCs, SF ₆	7,131	0.009	0.91
15	6C	Waste incineration	CO ₂	6,808	0.009	0.919
16	2A3	Lime and dolomite consumption	CO ₂	6,410	0.008	0.927
17	4C	Rice cultivation	CH ₄	6,297	0.008	0.936
18	4D	Agricultural soils	N ₂ O	5,472	0.007	0.943
19	2F8	Heavy electric equipment	SF ₆	4,812	0.006	0.949
20	4A	Enteric fermentation	CH ₄	4,471	0.006	0.954

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

Ranking	IPCC GHG Emission and Sinks (including LULUCF)		Green house Gas	Emissions (Gg CO ₂ eq.)		Tier 1 Trend Assess ment	Tier 1 Trend Assessment Share (Total=1)	Tier 1 Trend Assessment Accumulated Share
				1990	2018			
1	1A1	Energy industry: Solid fuel	CO ₂	17,604	202,499	0.46	0.203	0.203
2	1A4	Other sectors: Solid fuel	CO ₂	34,477	1,912	0.27	0.119	0.323
3	1A4	Other sectors: Liquid fuel	CO ₂	35,736	18,854	0.23	0.102	0.424
4	5A1	Forest land maintained	CO ₂	-38,227	-45,596	0.214	0.095	0.519
5	1A2	Manufacturing industries and construction: Liquid fuel	CO ₂	36,985	44,305	0.165	0.073	0.592
6	1A1	Energy industry: Gaseous fuel	CO ₂	4,802	61,011	0.143	0.063	0.655
7	1A1	Energy industry: Liquid fuel	CO ₂	25,782	22,191	0.141	0.062	0.717
8	1A4	Other sectors: Gaseous fuel	CO ₂	1,708	30,984	0.078	0.035	0.752
9	4C	Rice cultivation	CH ₄	10,533	6,297	0.066	0.029	0.781
10	1A2	Manufacturing industries and construction: Gaseous fuel	CO ₂	–	22,096	0.066	0.029	0.81
11	2A1	Cement production	CO ₂	15,873	24,702	0.054	0.024	0.833
12	1A2	Manufacturing industries and construction: Solid fuel	CO ₂	39,145	118,416	0.038	0.017	0.85
13	1B1	Solid fuel	CH ₄	4,833	337	0.038	0.017	0.867
14	6A	Waste landfill	CH ₄	7,492	7,834	0.037	0.016	0.883
15	1A3b	Road transport	CO ₂	30,690	94,013	0.033	0.015	0.898
16	2F9	Halocarbons and SF ₆ consumption, etc.	HFCs	NO, NE	8,822	0.026	0.012	0.909
17	2F7	Semiconductor production (LCD production)	HFCs, PFCs, SF ₆	NO	7,131	0.021	0.009	0.919
18	4D	Agricultural soils	N ₂ O	4,606	5,472	0.021	0.009	0.928
19	1A4	Other sectors: Solid fuel	CH ₄	2,135	78	0.017	0.007	0.935
20	1A3d	Shipping	CO ₂	2,432	1,015	0.016	0.007	0.943
21	2F8	Heavy electric equipment	SF ₆	173	4,812	0.013	0.006	0.948
22	4A	Enteric fermentation	CH ₄	2,960	4,471	0.01	0.005	0.953

※ NO (Not Occurring): In case there are no corresponding activities and processes in which emission and removal occur domestically, NE (Not Estimated): In case there are emission and removal activities and processes but are not measured

2. Climate-related¹⁾ Financial Support Details

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

(Exchange rate²⁾ : KRW 1,053,064/USD)

Multilateral institutions	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	38,657	36,709					
CGIAR (The Consortium of International Agricultural Research Centres)	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 〈Table 2-2〉

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

(Exchange rate²⁾ : KRW 1,131,309/USD)

Multilateral institutions	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	68,909	60,912					
UNESCAP (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 Program)	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 Program)	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 〈Table 2-2〉

<Table 2-1> Financial Support Provided via Multilateral Institutions (2016)

 (Exchange rate²⁾ : KRW 1,160.589/USD)

Multilateral institutions	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	101,438	87,657					
CGIAR (The Consortium of International Agricultural Research Centres)	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	Adaptation	All sectors
ITTO (International Tropical Timber Organization)	308	265	Completed	ODA	Contribution	Mitigation	Forestry
UN (United Nations)	1,585	1,366	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNCCD (United Nations Convention to Combat Desertification)	193	166	Completed	ODA	Contribution	Mitigation	Forestry
UNEP (United Nations Environment Program)	1,891	1,629	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WFP (World Food Program)	116	100	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	64	55	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IBRD (International Bank for Reconstruction and Development)	57,913	49,900	Ongoing	ODA	Contribution	Mitigation and Adaptation	All sectors
UNFCCC (United Nations Framework Convention on Climate Change)	886	763	Ongoing	ODA	Contribution	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of <Table 2-2>

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

(Exchange rate²⁾ : KRW 1,130,635/USD)

Multilateral institutions	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	103,675	91,696					
CGIAR (The Consortium of International Agricultural Research Centres)	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 Environment 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	Completed	ODA	Contribution	Mitigation and Adaptation	Agriculture
ITTO (International Tropical Timber Organization)	240	211	Completed	ODA	Contribution	Mitigation	Forestry
UN (United Nations)	10,467	9,257	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNCCD (United Nations Convention to Combat Desertification)	193	170	Completed	ODA	Contribution	Mitigation	Forestry
UNEP (United Nations Environment Program)	782	691	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	68	60	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IBRD (International Bank for Reconstruction and Development)	55,763	49,320	Ongoing	ODA	Contribution	Mitigation and Adaptation	All sectors
UNFCCC (United Nations Framework Convention on Climate Change)	458	404	Ongoing	ODA	Contribution	Mitigation and Adaptation	All sectors

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

<Table 2-1> Financial Support Provided via Multilateral Institutions (2018)

 (Exchange rate²⁾ : KRW 1,100,1859/USD)

Multilateral institutions	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	62,685	56,977					
UNCCD (United Nations Convention to Combat Desertification)	196	178	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IFAD (International Fund for Agricultural Development)	2,937	2,670	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNEP (United Nations Environment Program)	630	573	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WFP (World Food Program)	110	100	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
FAO (Food and Agriculture Organization of the United Nations)	9,176	8,341	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UN (United Nations)	9,815	8,921	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	65	59	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNFCCC (United Nations Framework Convention on Climate Change)	636	578	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GCF (Green Climate Fund)	11,928	10,842	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IBRD (International Bank for Reconstruction and Development)	13,202	12,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
CGIAR (The Consortium of International Agricultural Research Centres)	327	297	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GEF (Global Environment Facility)	2,418	2,198	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
ITTO (International Tropical Timber Organization)	242	220	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GGGI (Global Green Growth Institute)	11,022	10,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors

※ The footnote description is at the bottom of <Table 2-2>

〈Table 2-1〉 Financial Support Provided via Multilateral Institutions (2019)

(Exchange rate²⁾ : KRW 1,165,2938/USD)

Multilateral institutions	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	81,690	70,103					
UNCCD (United Nations Convention to Combat Desertification)	197	169	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IFAD (International Fund for Agricultural Development)	3,839	3,294	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNEP (United Nations Environment Program)	903	775	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WFP (World Food Program)	110	94	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
FAO (Food and Agriculture Organization of the United Nations)	6,070	5,209	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UN (United Nations)	29,246	25,098	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
WMO (World Meteorological Organization)	60	51	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
UNFCCC (United Nations Framework Convention on Climate Change)	382	328	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GCF (Green Climate Fund)	12,418	10,656	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
IBRD (International Bank for Reconstruction and Development)	14,300	12,272	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
CGIAR (The Consortium of International Agricultural Research Centres)	316	271	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GEF (Global Environment Facility)	1,925	1,652	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
ITTO (International Tropical Timber Organization)	272	233	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors
GGGI (Global Green Growth Institute)	11,653	10,000	Completed	ODA	Contribution	Mitigation and Adaptation	All sectors

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

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

 (Exchange rate²⁾ : KRW 1,053.064/USD)

Multilateral institutions	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
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 <Table 2–2>

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

((Exchange rate²⁾ : KRW 1,131,309/USD)

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
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 〈Table 2-2〉

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

 (Exchange rate²⁾ : KRW 1,160.589/USD)

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
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 <Table 2–2>

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

(Exchange rate²⁾ : KRW 1,130,635/USD)

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
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 〈Table 2-2〉

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
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
	28,266	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
Indonesia	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

※ The footnote description is at the bottom of (Table 2-2)

〈Table 2-2〉 Financial Support Provided through Bilateral, Regional and Other Channels (2018)

(Exchange rate²⁾ : KRW 1,100.1859/USD)

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	162,073	147,314					
Ghana	464	422	Completed	ODA	Grant aid	Cross-cutting	All sectors
Gambia	30	27	Completed	ODA	Grant aid	Cross-cutting	All sectors
Guatemala	3,218	2,25	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Namibia	37	34	Completed	ODA	Grant aid	Mitigation	Educational
Nigeria	100	91	Completed	ODA	Grant aid	Cross-cutting	All sectors
Nepal	363	330	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Niger	1,43	1,130	Ongoing	ODA	Grant aid	Adaptation	Food aid / food security support
Nicaragua	1,184	1,076	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	447	407	Ongoing	ODA	Concessional loan	Cross-cutting	Energy
Dominican Republic	27	25	Completed	ODA	Grant aid	Adaptation	Disaster prevention and preparation
East Timor	310	282	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Laos	4,918	4,471	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Liberia	10	9	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
Rwanda	952	865	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Madagascar	43	39	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
Malawi	509	463	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Malaysia	31	29	Completed	ODA	Grant aid	Cross-cutting	Drinking water supply and sanitation
Mexico	200	182	Completed	ODA	Grant aid	Cross-cutting	Energy
Morocco	1,082	983	Ongoing	ODA	Grant aid	Adaptation	All sectors
Mauritania	10	9	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
Mozambique	577	524	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Mongolia	7,011	6,373	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Myanmar	3,040	2,763	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Bangladesh	2,531	2,300	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Venezuela	35	32	Completed	ODA	Grant aid	Mitigation	Energy
Vietnam	7,249	6,589	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	6,825	6,203	Ongoing	ODA	Concessional loan	Adaptation	All sectors
Belarus	18	16	Completed	ODA	Grant aid	Adaptation	Disaster prevention and preparation
Belize	9	8	Completed	ODA	Grant aid	Adaptation	Disaster prevention and preparation
Botswana	37	34	Completed	ODA	Grant aid	Mitigation	Educational
Bolivia	3,334	3,031	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Bhutan	104	94	Completed	ODA	Grant aid	Cross-cutting	All sectors
Samoa	36	33	Completed	ODA	Grant aid	Cross-cutting	All sectors
West Bank and Gaza Strip	158	144	Completed	ODA	Grant aid	Adaptation	All sectors
Senegal	1,683	1,530	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Solomon Islands	186	169	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Sudan	3	2	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
Sri Lanka	2,602	2,365	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
America (not allocated)	516	469	Completed	ODA	Grant aid	Cross-cutting	Forestry
Asia (not allocated)	8,545	7,767	Completed	ODA	Grant aid	Cross-cutting	All sectors
Azerbaijan	618	562	Completed	ODA	Grant aid	Cross-cutting	All sectors
Afghanistan	7,647	6,951	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Algeria	249	226	Completed	ODA	Grant aid	Cross-cutting	All sectors
Ecuador	2,456	2,233	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ethiopia	2,476	2,251	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
El Salvador	3,357	3,051	Ongoing	ODA	Grant aid	Cross-cutting	All sectors

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



(Exchange rate²⁾ : KRW 1,100.1859/USD))

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	162,073	147,314					
Oceania (not allocated)	1,210	1,100	Completed	ODA	Grant aid	Adaptation	All sectors
Honduras	96	88	Completed	ODA	Grant aid	Cross-cutting	All sectors
	8,316	7,559	Ongoing	ODA	Concessional loan	Cross-cutting	Energy
Jordan	304	276	Completed	ODA	Grant aid	Mitigation	All sectors
Uganda	2,304	2,094	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uzbekistan	336	305	Completed	ODA	Grant aid	Cross-cutting	All sectors
Ukraine	39	35	Completed	ODA	Grant aid	Cross-cutting	All sectors
Iraq	130	118	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Egypt	120	109	Completed	ODA	Grant aid	Cross-cutting	All sectors
India	130	118	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Indonesia	5,407	4,915	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	12,357	11,232	Ongoing	ODA	Concessional loan	Adaptation	Drinking water supply and sanitation
Zambia	1,167	1,061	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
China	500	454	Completed	ODA	Grant aid	Cross-cutting	Forestry
Zimbabwe	109	99	Completed	ODA	Grant aid	Cross-cutting	All sectors
Cameroon	438	399	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kazakhstan	940	854	Completed	ODA	Grant aid	Cross-cutting	All sectors
Cambodia	967	879	Completed	ODA	Grant aid	Cross-cutting	All sectors
	7,485	6,804	Ongoing	ODA	Concessional loan	Cross-cutting	All sectors
Kenya	1,759	1,599	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Costa Rica	89	80	Completed	ODA	Grant aid	Cross-cutting	All sectors
Ivory Coast	—	—	Ongoing	ODA	Grant aid	Adaptation	Drinking water supply and sanitation
Colombia	835	759	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Democratic Republic of the Congo	101	91	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kyrgyzstan	1,833	1,666	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kiribati	339	308	Completed	ODA	Grant aid	Cross-cutting	All sectors
Tajikistan	47	43	Completed	ODA	Grant aid	Adaptation	All sectors
Tanzania	2,254	2,048	Completed	ODA	Grant aid	Cross-cutting	All sectors
Thailand	23	21	Completed	ODA	Grant aid	Cross-cutting	All sectors
Togo	24	22	Completed	ODA	Grant aid	Adaptation	Agriculture
Tonga	50	45	Completed	ODA	Grant aid	Cross-cutting	All sectors
Tuvalu	27	24	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
Tunisia	678	616	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Panama	27	25	Completed	ODA	Grant aid	Adaptation	Disaster prevention and preparation
Paraguay	1,689	1,535	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Pakistan	372	338	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Papua New Guinea	124	113	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
Palau	610	554	Completed	ODA	Grant aid	Cross-cutting	All sectors
Peru	1,169	1,063	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Fiji	4,519	4,107	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Philippines	6,521	5,927	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	16,207	14,731	Ongoing	ODA	Concessional loan	Adaptation	Drinking water supply and sanitation
Other regions or multiple nations (not allocated)	3,940	3,581	Completed	ODA	Grant aid	Cross-cutting	All sectors

※ The footnote description is at the bottom of <Table 2-2>

〈Table 2-2〉 Financial Support Provided through Bilateral, Regional and Other Channels (2019)

(Exchange rate²⁾ : KRW 1,165,2938/USD)

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	188,532	161,789					
Ghana	227	195	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	79,517	68,238	Planned	ODA	Concessional loan	Mitigation	Energy
Gambia	8	6	Completed	ODA	Grant aid	Adaptation	Drinking water supply and sanitation
Guatemala	4,433	3,804	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Other regions or multiple nations (not allocated)	909	780	Completed	ODA	Grant aid	Cross-cutting	All sectors
Namibia	233	200	Completed	ODA	Grant aid	Cross-cutting	Emergency relief
Nigeria	192	165	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Southern Asia (not allocated)	200	172	Completed	ODA	Grant aid	Cross-cutting	Energy
Nepal	150	129	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	58,265	50,000	Planned	ODA	Concessional loan	Mitigation	Energy
Niger	734	630	Ongoing	ODA	Grant aid	Adaptation	Food aid / food security support
Nicaragua	766	657	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	11,163	9,579	Ongoing	ODA	Concessional loan	Cross-cutting	Energy
Dominican Republic	54	47	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
East Timor	594	509	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Laos	3,947	3,388	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	1,451	1,245	Ongoing	ODA	Concessional loan	Adaptation	Drinking water supply and sanitation
Rwanda	1,069	918	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	77,508	66,514	Planned	ODA	Concessional loan	Mitigation	Energy
Madagascar	9	7	Ongoing	ODA	Grant aid	Cross-cutting	Environmental protection
Marshall Islands	225	193	Ongoing	ODA	Grant aid	Adaptation	Environmental protection
Malawi	775	665	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Malaysia	17	14	Completed	ODA	Grant aid	Cross-cutting	Drinking water supply and sanitation
Morocco	1,502	1,289	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Mozambique	1,405	1,206	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Maldives	13	11	Completed	ODA	Grant aid	Adaptation	Communications
Mongolia	4,712	4,044	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	446,178	382,889	Planned	ODA	Concessional loan	Mitigation	Environmental protection
Myanmar	2,024	1,737	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Vanuatu	225	193	Ongoing	ODA	Grant aid	Adaptation	Environmental protection
Bangladesh	5,568	4,778	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Venezuela	9	7	Ongoing	ODA	Grant aid	Mitigation	Energy
Vietnam	2,907	2,494	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	6,418	5,508	Ongoing	ODA	Concessional loan	Cross-cutting	All sectors
Bolivia	3,598	3,087	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	9,513	8,163	Ongoing	ODA	Concessional loan	Adaptation	Drinking water supply and sanitation
Burundi	26	22	Completed	ODA	Grant aid	Adaptation	Public administration and civil society
Bhutan	20	17	Completed	ODA	Grant aid	Cross-cutting	All sectors
Samoa	499	429	Completed	ODA	Grant aid	Cross-cutting	Environmental protection
Sub-Saharan Africa (not allocated)	220	189	Ongoing	ODA	Grant aid	Mitigation	Finance and financial service
West Bank and Gaza Strip	125	108	Ongoing	ODA	Grant aid	Adaptation	All sectors
Senegal	2,085	1,789	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Saint Lucia	132	113	Completed	ODA	Grant aid	Cross-cutting	Public administration and civil society
Solomon Islands	283	243	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Sudan	2,861	2,455	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Sri Lanka	470	403	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Sierra Leone	436	374	Ongoing	ODA	Grant aid	Adaptation	Agriculture
America (not allocated)	516	443	Completed	ODA	Grant aid	Cross-cutting	Forestry
Asia (not allocated)	6,671	5,725	Completed	ODA	Grant aid	Cross-cutting	All sectors
Haiti	21	18	Completed	ODA	Grant aid	Cross-cutting	Environmental protection

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



(Exchange rate²⁾ : KRW 1,100,1859/USD)

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Total ⁶⁾	162,073	147,314					
Azerbaijan	13	11	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Afghanistan	2,893	2,483	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Albania	350	380	Completed	ODA	Grant aid	Adaptation	Emergency relief
Algeria	193	165	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Eswatini	17	15	Completed	ODA	Grant aid	Adaptation	Public administration and civil society
Ecuador	414	355	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Ethiopia	1,861	1,597	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	73,670	63,220	Planned	ODA	Concessional loan	Mitigation	Transportation and warehouse
El Salvador	1,176	1,009	Ongoing	ODA	Grant aid	Mitigation	Drinking water supply and sanitation
	93,806	80,500	Planned	ODA	Concessional loan	Adaptation	Transportation and warehouse
Yemen	887	761	Ongoing	ODA	Grant aid	Cross-cutting	Emergency relief
Oceania (not allocated)	1,282	1,100	Completed	ODA	Grant aid	Adaptation	All sectors
Honduras	38	33	Completed	ODA	Grant aid	Adaptation	Communication
	34,959	30,000	Completed	ODA	Concessional loan	Adaptation	Drinking water supply and sanitation
Jordan	142	122	Ongoing	ODA	Grant aid	Adaptation	Drinking water supply and sanitation
Uganda	3,494	2,998	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Uzbekistan	454	389	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Iraq	133	114	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Iran	816	700	Ongoing	ODA	Grant aid	Cross-cutting	Emergency relief
Egypt	61	53	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
India	185	159	Ongoing	ODA	Grant aid	Adaptation	Drinking water supply and sanitation
Indonesia	4,285	3,677	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	15,036	12,903	Ongoing	ODA	Concessional loan	Adaptation	Drinking water supply and sanitation
Zambia	1,100	944	Ongoing	ODA	Grant aid	Adaptation	Food aid / food security support
China	500	429	Completed	ODA	Grant aid	Cross-cutting	Forestry
Central America (not allocated)	150	129	Completed	ODA	Grant aid	Cross-cutting	Energy
Central African Republic	117	100	Completed	ODA	Grant aid	Mitigation	Emergency relief
Zimbabwe	601	516	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Caribbean Sea (not allocated)	150	129	Completed	ODA	Grant aid	Cross-cutting	Energy
Cameroon	185	159	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kazakhstan	17	15	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Cambodia	771	662	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	7,230	6,204	Ongoing	ODA	Concessional loan	Cross-cutting	All sectors
	66,654	57,199	Planned	ODA	Concessional loan	Adaptation	Transportation and warehouse
Kenya	3,456	2,966	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	116,937	100,350	Planned	ODA	Concessional loan	Mitigation	Communication
Ivory Coast	2,659	2,282	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Colombia	504	432	Completed	ODA	Grant aid	Adaptation	All sectors
Democratic Republic of the Congo	975	837	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kyrgyzstan	17	15	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Kiribati	560	481	Ongoing	ODA	Grant aid	Adaptation	All sectors
Tajikistan	694	595	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Tanzania	459	394	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Thailand	32	28	Completed	ODA	Grant aid	Cross-cutting	Drinking water supply and sanitation
Tuvalu	225	193	Ongoing	ODA	Grant aid	Adaptation	Environmental protection
Tunisia	664	570	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Paraguay	1,658	1,423	Ongoing	ODA	Grant aid	Adaptation	All sectors

Nation/Region	Total amount ³⁾		Status	Funding sources	Financial instruments	Support type ⁴⁾	Sectors ⁵⁾
	KRW million	USD thousand					
Pakistan	806	692	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Papua New Guinea	258	221	Ongoing	ODA	Grant aid	Cross-cutting	Environmental protection
Palau	449	385	Completed	ODA	Grant aid	Cross-cutting	All sectors
Peru	468	402	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Fiji	3,658	3,139	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
Philippines	2,170	1,862	Ongoing	ODA	Grant aid	Cross-cutting	All sectors
	9,898	8,494	Ongoing	ODA	Concessional loan	Adaptation	Drinking water supply 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 and Research Center (GIR) of the Ministry of Environment	International GHG Expert Training Program	Mitigation	<ul style="list-style-type: none"> 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 and Research Center (GIR) of the Ministry of Environment	Cooperative Green Growth Modeling Forum 7th Steering Committee Meeting & 2nd Technical Working Group	Mitigation	<ul style="list-style-type: none"> 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 and Research Center (GIR) of the Ministry of Environment	2014 Cooperative Green Growth Modeling Forum 8th Steering Committee Meeting	Mitigation	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 and Adaptation	<ul style="list-style-type: none"> 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

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted Area	Additional Information
Nepal, Maldives, Mongolia, Bangladesh, Vietnam, Sri Lanka, Indonesia, Cambodia, Thailand, Fiji, Philippines	Korea Adaptation Center for Climate Change (KACCC)/ United Nations Environment Program (UNEP)	International Training Workshop on Climate Change Adaptation and Evaluation	Adaptation	<ul style="list-style-type: none"> 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 and Adeptation	<ul style="list-style-type: none"> 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 and Research Center (GIR) of the Ministry of Environment	International GHG Expert Training Program	Mitigation	<ul style="list-style-type: none"> 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 and Research Center (GIR) of the Ministry of Environment	2015 Cooperative Green Growth Modeling Forum 9th Steering Committee Meeting	Mitigation	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 16th International Specialized Course on Environmental Technology: Water and Sewage Treatment and Waste Management	Mitigation	<ul style="list-style-type: none"> 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 policy	Various sectors	<ul style="list-style-type: none"> The ROK's environmental policy and management, sustainable development and planning, forest resources and ecological restoration

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted Area	Additional Information
Guinea, Nepal, Burkina Faso, Cambodia, Comoros, Tuvalu	Korea Adaptation Center for Climate Change (KACCC)/ United Nations Environment Program (UNEP)	National Training Workshop/ Poorest Countries' Adaptation Planning Good Practice for Climate Change	Adaptation	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 and Research Center (GIR) of the Ministry of Environment	International GHG Expert Training Program	Mitigation	<ul style="list-style-type: none"> 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 and Thailand	Greenhouse Gas Inventory and Research Center (GIR) of the Ministry of Environment	The 10th Cooperative Green Growth Modeling Forum	Mitigation	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 policy	Various sectors	<ul style="list-style-type: none"> The ROK's environmental policy and management, sustainable development and planning, forest resources and ecological restoration
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	<ul style="list-style-type: none"> 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 Program (UNEP)/United Nations Development Program (UNDP)	Asia-Pacific National Adaptation Plans Training Workshop	Adaptation	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 and Research Center (GIR) of the Ministry of Environment	International GHG Expert Training Program	Mitigation	<ul style="list-style-type: none"> 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 and Research Center (GIR) of the Ministry of Environment	The 11th Cooperative Green Growth Modeling Forum	Mitigation	<ul style="list-style-type: none"> Discuss the progress of joint research by sector (power generation, transport, 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 and Research Center (GIR) of the Ministry of Environment	The 12th Cooperative Green Growth Modeling Forum	Mitigation	<ul style="list-style-type: none"> 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
11 environment-related public officials and experts from 5 countries including Indonesia, Malaysia, Pakistan, Sri Lanka and Vietnam	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 20th International Specialized Course on Environmental Technology: Water and Sewage Management and Waste Management to Counter Climate Change	Mitigation	<ul style="list-style-type: none"> Outline of Korea's waste, water and sewage policies and technologies and cases of policy execution and technology application, sharing of resource utilization measures and companies' outstanding environmental technologies
9 environment-related public officials and experts from 5 countries including Egypt, Ethiopia, Sudan, Tanzania and Uganda		The 21st International Specialized Course on Environmental Technology: Water and Sewage Management and Waste Management to Counter Climate Change		
19 countries in the Asia-Pacific including Bangladesh, Bhutan, Brunei, China, India, Indonesia, Iran, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Philippines, Sri Lanka, Thailand, Vietnam, Yemen and Cambodia	Korea Adaptation Center for Climate Change (KACCC)/ United Nations Environment Program (UNEP)/United Nations Development Program (UNDP)/ Global Environment Facility (GEF)/United Nations Office for Sustainable Development (UNOSD)/United Nations Institute for Training and Research (UNITAR) and others	International Training on Capacity Building for Developing Countries to Adapt to Climate Change	Adaptation	<ul style="list-style-type: none"> Training related to mainstreaming of climate change adaptation in the water resource sector



Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted Area	Additional Information
29 public officials from 17 countries including Kenya and Indonesia	Korea Environmental Industry & Technology Institute (KEITI) of the Ministry of Environment	Global Environment Scholarship Program (GESP) Master's Program for capacity building in environmental policy	Various sectors	<ul style="list-style-type: none"> • Korea's environmental policies and management, sustainable development and plan, water resource development and management
Africa (Sudan, Lesotho, Zambia, Kenya) Southeast Asia (Cambodia, Myanmar) Latin America (Argentina, Uruguay)	Forest Training Institute of the Korea Forest Service	10th to 12th REDD+ Capacity Building Program	Mitigation and Adaptation	<ul style="list-style-type: none"> • Explore bilateral cooperation and support measures with regards to countering climate change through capacity building of public officials of countries selected as targets of REDD+ pilot project
15 environment-related public officials from 3 countries including Colombia, Paraguay and Bolivia	National Institute of Environmental Human Resources Development of the Ministry of Environment Korea Environment Institute (KEI)	The 13th International Training Course on Environmental Policy: Improving the Waste Management System	Mitigation	<ul style="list-style-type: none"> • Through lectures and field trips on waste treatment, resource recovery and safe treatment, establish an execution plan that is appropriate for the respective country's circumstances and explore institutional improvement measures through expert feedback
Namibia, Fiji, Marshall Islands, Indonesia, Myanmar, Vanuatu	Korea Environmental Industry & Technology Institute (KEITI) of the Ministry of Environment	Support Program for Development of Developing Country Climate Change Response Projects (1st) (Including GCF project proposal development)	Mitigation and Adaptation	<ul style="list-style-type: none"> • Advance overseas and build a network by discovering companies with domestic climate technologies and creating developing country support programs

〈Table 3-1〉 Capacity Building Support Provided (2018)

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted Area	Additional Information
30 countries including Afghanistan, Maldives, Senegal and Sri Lanka	Greenhouse Gas Inventory and Research Center (GIR) of the Ministry of Environment	International GHG Expert Training Program	Mitigation	<ul style="list-style-type: none"> • Training program on measurement and verification per sector for establishment of national inventory, method of using Intergovernmental Panel on Climate Change (IPCC) guidelines, national report and review obligation under the Paris Climate Agreement, emissions outlook and others
12 persons, including environment-related public officials and industry officials from Mongolia, Uzbekistan and Ukraine	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 22nd International Specialized Course on Environmental Technology: Atmospheric Environment Management to Counter Climate Change	Mitigation	<ul style="list-style-type: none"> • Strategies on countering climate change, outline of air quality improvement technologies and company field visits
12 water-related experts from local companies and who are public officials of India's Ministry of Water Resources and Ministry of Environment, Forest and Climate Change	National Institute of Environmental Human Resources Development of the Ministry of Environment	The 23rd International Specialized Course on Environmental Technology: Water Environment Management for Sustainable Development	Mitigation	<ul style="list-style-type: none"> • Outline of Korea's outstanding water management technologies including quantity and hydrological analysis and advanced water and sewage treatment technologies; holding of the Korea-India Environmental Cooperation Workshop
21 government officials and persons who work in the climate field in 12 developing countries in the Asia Pacific (Bhutan, Cambodia, India, Switzerland, Laos, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam)	Green Technology Center (GTC) of the Ministry of Science and ICT United Nations Institute for Training and Research (UNITAR)	Governance-Strengthening Workshop for Integrated Low Carbon Solid Waste Management and Circular Economy	Mitigation	<ul style="list-style-type: none"> • Competency-building related to Korea's waste policies and technologies, UNEP's sustainable production and consumption and Japan's waste management and international cooperation, competency-building experience-sharing program among participants (adoption of City Share Program)
16 countries including Fiji, Haiti, Cook Islands, Solomon Islands, Nauru, Kiribati, Marshall Islands, Samoa, Tuvalu, Tonga, Vanuatu, Niue, Micronesia, Palau, Papua New Guinea and Tokelau Islands	Korea Adaptation Center for Climate Change (KACC)/United Nations Environment Program (UNEP)/United Nations Development Program (UNDP)/Global Environment Facility (GEF)/United Nations Office for Sustainable Development (UNOSD)/United Nations Institute for Training and Research (UNITAR) and others	International Training on Capacity Building for Developing Countries to Adapt to Climate Change	Adaptation	<ul style="list-style-type: none"> • Training related to evaluation of measures and priorities for establishment of a climate change adaptation plan



Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted Area	Additional Information
Southeast Asia (Cambodia, Myanmar) Latin America (Argentina, Chile, Ecuador, Uruguay)	Forest Training Institute of the Korea Forest Service	13th and 14th REDD+ Capacity Building Program	Mitigation and Adaptation	<ul style="list-style-type: none"> Explore bilateral cooperation and support measures with regards to countering climate change through capacity building of public officials of tentative REDD+ pilot program countries
Kenya, Morocco, Mongolia, Philippines	Korea Environmental Industry & Technology Institute (KEITI) of the Ministry of Environment	Support Program for Development of Developing Country Climate Change Response Projects (2nd) (Including GCF project proposal development)	Mitigation and Adaptation	<ul style="list-style-type: none"> Advance overseas and build a network by discovering companies with domestic climate technologies and creating developing country support programs

4. Abbreviations

AF	Adaptation Fund
AMI	Advanced Metering Infrastructure
AMP	Alternative Maritime Power supply
BAU	Business-As-Usual
BEMS	Building Energy Management System
BIS	Bus Information System
BM	Benchmark
BRT	Bus Rapid Transit
CART	Climate Action Round Table
CCUS	Carbon Capture, Utilization and Storage
CDM	Clean Development Mechanism
CGIAR	The Consortium of International Agricultural Research Centres
C-ITS	Cooperative-Intelligent Transport Systems
CNG	Compressed Natural Gas
CO ₂ eq.	Carbon dioxide equivalent
COP	Conference of Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CTCN	Climate Technology Centre & Network
CTis	Climate Technology Information System
DAC	Development Assistance Committee
EDCF	Economic Development Cooperation Fund
EERS	Energy Efficiency Resource Standards
EnMS	Energy Management System
EPR	Extended Producer Responsibility
ESCO	Energy Service Company
FAO	Food and Agriculture Organization of the United Nations
FEMS	Factory Energy Management System
GAP	Good Agricultural Practices
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Green Environment Facility
GF	Grandfathering



GGGI	Global Green Growth Institute
GHG	Greenhouse Gases
GNI	Gross National Income
GPG	Good Practice Guidance
GPG 2000	Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000)
GPG–LULUCF	Good Practice Guidance for Land Use, Land–Use Change and Forestry
GTC	Green Technology Center
GWP	Global Warming Potential
IMO	International Maritime Organization
IBRD	International Bank for Reconstruction and Development
IFAD	International Fund for Agricultural Development
INDC	Intended Nationally Determined Contributions
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
ITTO	The International Tropical Timber Organization
ITS	Intelligent Transport Systems
KAU	Korean Allowance Units
KACCC	Korea Adaptation Center for Climate Change
KCU	Korean Credit Units
KEITI	Korea Environmental Industry & Technology Institute
KIRD	Korea Institute of Human Resources Development in Science and Technology
KOC	Korea Offset Credit
KOICA	Korea International Cooperation Agency
LEDs	Long–term low greenhouse gas Emission Development Strategy
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum GAS
LULUCF	Land Use, Land–Use Change and Forestry
MRV	Measurement(Monitoring), Reporting, Verificaton
NDC	Nationally Determined Contributions
NDE	National Designated Entity
NGV	Natural Gas Vehicle

NIR	National Inventory Report
NIRS	National GHG Inventory Reporting System
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
PPF	Project Preparation Facility
R&D	Research and Development
REDD+	Reducing Emissions from Deforestation and forest Degradation
RFS	Renewable Fuel Standard
REC	Renewable Energy Certificates
RPS	Renewable Energy Portfolio Standard
SDGs	Sustainable Development Goals
SRF	Solid Refuse Fuel
TA	Technology Assistance
toe	Ton of Oil Equivalent
UN	United Nations
UNEP	United Nations Environment Program
UNCCD	United Nations Convention to Combat Desertification
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	UNESCO World Heritage Centre
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research
WFP	United Nations World Food Programme
WMO	World Meteorological Organization

5. Publication Information

※ 「Fourth Biennial Update Report of the Republic of Korea under the United Nations Framework Convention on Climate Change」 was published through the cooperation and joint work of the relevant ministries and institutions, and the deliberation of the Presidential Committee on Green Growth (in alphabetical order).

An, Jin-Woo	Ministry of Oceans and Fisheries	Kim, Young-Hwan	National Institute of Forest Science
Baek, Jae-Kwan	Ministry of Agriculture, Food and Rural Affairs	Lee, Cheon-Hwan	Green Technology Center
Bang, Jong-Chul	Greenhouse Gas Inventory and Research Center	Lee, Han-Sol	Ministry of Trade, Industry and Energy
Cheong, Myeong-Kyoo	Greenhouse Gas Inventory and Research Center	Lee, In-Young	Ministry of Science and ICT
Choi, Eun-Jung	National Institute of Agricultural Sciences	Lee, So-Hyang	Greenhouse Gas Inventory and Research Center
Choi, Hyung-Wook	Greenhouse Gas Inventory and Research Center	Lee, Yoo-Kyung	National Institute of Animal Science
Choi, Sun-A	Korea Forest Service	Lee, Young-Hyun	Greenhouse Gas Inventory and Research Center
Chun, Young-Pil	Korea Environmental Industry and Technology Institute	Nam, Jae-Hyun	Korea Environmental Industry and Technology Institute
Jun, Duk-Woo	Green Technology Center	Noh, Dong-Woon	Korea Energy Economics Institute
Jung, Jae-Hyuk	Ministry of Foreign Affairs	Oh, Chae-Woon	Green Technology Center
Jung, Jeong-Sung	National Institute of Animal Science	Oh, Eun-Sook	Ministry of Land, Infrastructure and Transport
Jung, Myung-Pyo	Rural Development Administration	Oh, Mi-Lan	Greenhouse Gas Inventory and Research Center
Kang, Ji-Woo	Ministry of Foreign Affairs	Park, Ji-Young	Ministry of Environment
Kang, Moon-Jung	Green Technology Center	Park, Seung-Jin	National Institute of Agricultural Sciences
Kang, Myung-Seung	Ministry of Agriculture, Food and Rural Affairs	Park, Su-Hyun	Korea Meteorological Administration
Kang, Su-Il	Gwangju Institute of Science and Technology	Seo, Heung-Won	Greenhouse Gas Inventory and Research Center
Kim, Hee-Kyung	Ministry of Environment	Shin, Dong-Hyuk	Greenhouse Gas Inventory and Research Center
Kim, Mi-Ju	Korea Meteorological Administration	Shin, Hyun-Woo	Green Technology Center
Kim, Min-Chul	Green Technology Center	Son, In-Sung	Korea Energy Economics Institute
Kim, Yeon-Tae	Ministry of Economy and Finance	Son, Ji-Hee	Green Technology Center
Kim, Yi-Hyun	Rural Development Administration	Yim, Jong-Su	National Institute of Forest Science

Fourth Biennial Update Report of the Republic of Korea under the United Nations Framework Convention on Climate Change

Publication Date December 2021

Place of Publication



Ministry of Environment

Greenhouse Gas Inventory and Research Center

3F Osong Square, 210 Osongsaengmyeong-ro, Osong-eup, Heungdeok-gu, Cheongju-si, Chungcheongbuk-do, Republic of Korea, 28166

Telephone 82-43-714-7511

Fax 82-43-714-7510

Website <http://www.gir.go.kr>

Government Publication 11-1480906-000005-11

| Not for sale |

All rights reserved. Any reprinting, duplication, reproduction, etc. of this report or any portion thereof without prior written consent from the publisher is forbidden and punishable under copyright law

