

# Fourth Biennial Update Report of the Republic of Korea

under the United Nations Framework  
Convention on Climate Change





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

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## 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 14<sup>th</sup> in the world to turn the 2050 net zero commitment into law. Taking a step further, on the occasion of the 26<sup>th</sup> 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 Greenhouse Gas (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 (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbon (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) as specified by the Kyoto Protocol; the CO<sub>2</sub> equivalent (CO<sub>2</sub>eq.) 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 tCO<sub>2</sub>eq. of GHG, and the net emissions considering the GHG absorbed was 686.3 million tCO<sub>2</sub>eq.. 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 MtCO<sub>2</sub>eq.).


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 that extends into the sea. To the left of the tower, there is a modern, multi-story building with a grey facade and large windows. The building has some text on its side, including "KORSA" and "KORSA". The surrounding area includes a parking lot, a paved walkway, and some landscaping. The sea 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 km<sup>2</sup> 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 km<sup>2</sup>.<sup>1</sup>

[Figure 1–1] Geographic Location



Forest land accounts for 63.2%<sup>2</sup> 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.<sup>3</sup>

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°).<sup>4</sup> In summary,

<sup>1</sup> National Land Statistics (Korea Research Institute for Human Settlements, 2021)

<sup>2</sup> 2015 Basic Forest Statistics (Korea Forest Service, 2016)

<sup>3</sup> National Land Statistics (Korea Research Institute for Human Settlements, 2021)

<sup>4</sup> 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.<sup>5</sup>

## 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 mean<sup>6</sup> 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.<sup>7</sup>

<sup>5</sup> The National Atlas of Korea (National Geographic Information Institute, 2020)

<sup>6</sup> Based on 62 major regions of mainland excluding island areas

<sup>7</sup> 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.<sup>8</sup> In 2016, Typhoon Chaba, the 18<sup>th</sup> 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.<sup>9</sup> An analysis of the horizontal global radiation<sup>10</sup> 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)

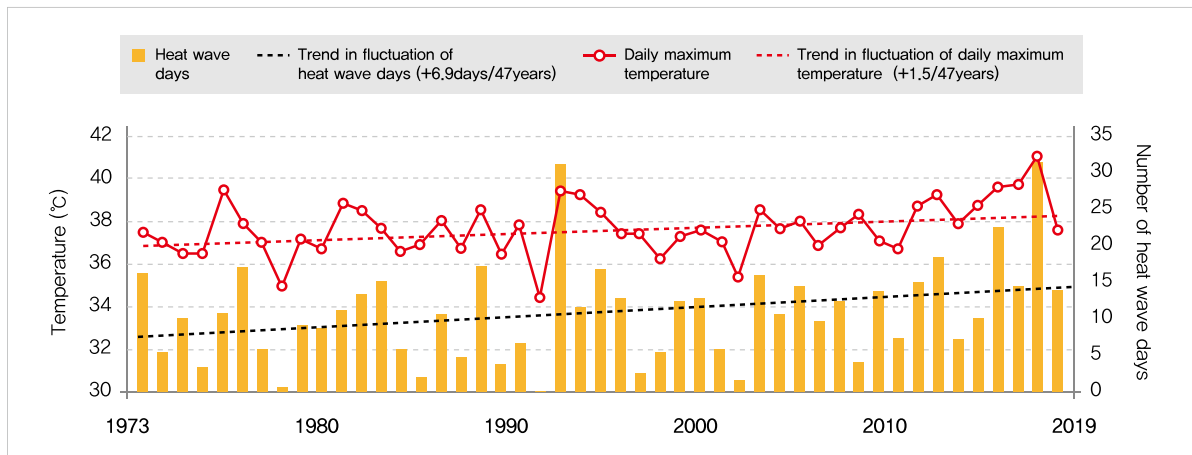
8 Abnormal Climate Report (Relevant government ministries, 2016–2018)

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.<sup>11</sup>

[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/km<sup>2</sup> which is the third highest in the world, except city states and small countries, following Bangladesh and Taiwan.<sup>12</sup>

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.<sup>13</sup>

<sup>11</sup> Abnormal Climate Report (Relevant government ministries, 2018)

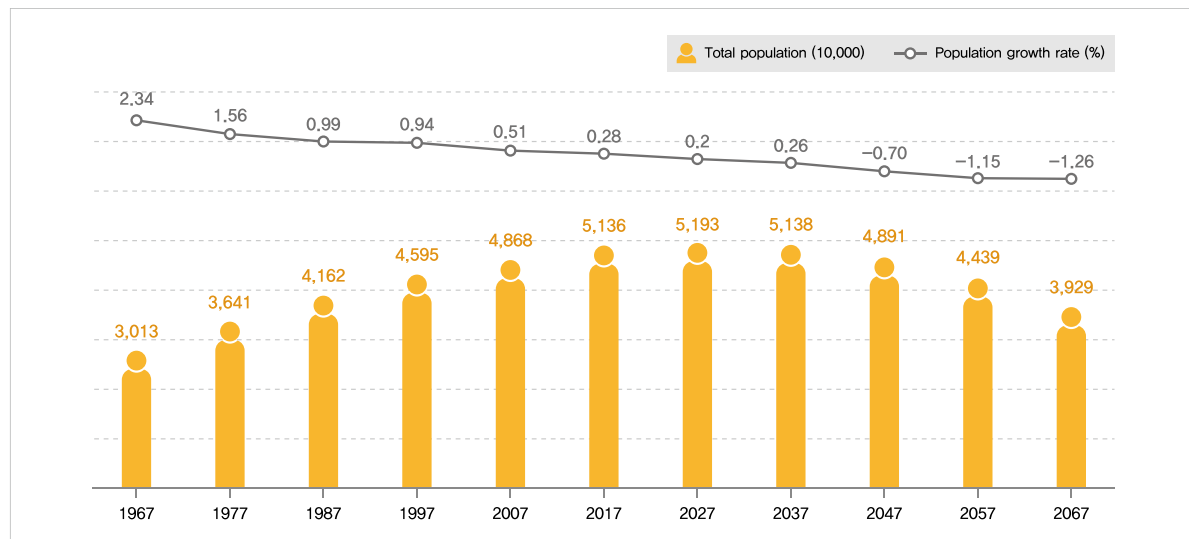
<sup>12</sup> World Population Prospects 2018 Revision, p46 (United Nations, 2018)

<sup>13</sup> 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.<sup>14</sup>

[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.<sup>15</sup> The ROK posted a nominal GDP of around KRW 1,898 quadrillion in 2018 and was ranked the 12<sup>th</sup> among 205 countries across the globe.<sup>16</sup>

〈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%.<sup>17</sup>

〈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.<sup>18 19</sup>

〈Table 1–6〉 Volume of Exports and Imports and Ratio of Exports and Imports to 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)

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

<sup>16</sup> World Bank (WB)

<sup>17</sup> Trade Dependence (Statistics Korea)

<sup>18</sup> Export- and Import-to-GDP Ratio (National Index System)

<sup>19</sup> 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"><li>– Presents the philosophy, vision, goals and implementation strategies of the mid- to long-term energy policy</li><li>– Presents the principles and direction of an energy plan by source and by sub-sector to make adjustments from a macroscopic perspective</li></ul>	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"><li>– Aims to efficiently and systematically implement the National Strategy for Green Growth with the initial plan started in 2009</li></ul>	Established and implemented every five years
Climate Change Response Master Plan (December 2016)	<ul style="list-style-type: none"><li>– Aims to achieve GHG reduction goal with regulations, markets and technologies to actively take part in global efforts to respond to climate change</li></ul>	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 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 Growth<sup>20</sup> 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

<sup>20</sup> 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"> <li>- (Industry) Fossil fuel→Electric power and Hydrogen<sup>21</sup></li> <li>- (Transportation) Internal combustion engine→Eco-friendly vehicles and vessels</li> <li>- (Building) City gas→Electrification</li> </ul>
② Improve innovative energy efficiency in connection with digital technologies	<ul style="list-style-type: none"> <li>- (Industry) Increased supply of highly efficient equipment, factory energy management systems, and build smart green industrial complexes</li> <li>- (Transportation) Intelligent transportation system (C-ITS), autonomous driving vehicles (car accidents ↓, efficiency ↑), drone cabs</li> <li>- (Building) Existing buildings→Green remodeling, new buildings→zero energy buildings, LED lighting, highly efficient appliances</li> </ul>
③ Facilitate the development and commercialization of carbon-free future technologies	<ul style="list-style-type: none"> <li>- (Future technologies) Steel→hydrogen direct reduction steelmaking / petrochemicals→innovative materials, bioplastics / electric power→CCUS</li> </ul>
④ Promote sustainable industrial innovation and circular economy (Input of raw material and fuel ↓)	<ul style="list-style-type: none"> <li>- Maximized recycling, reuse of raw materials (scrap metals, plastic wastes, used concretes) and minimized energy input</li> </ul>
⑤ Strengthen carbon sink functions of Nature and ecology including forests, mud flats and wetlands	<ul style="list-style-type: none"> <li>- Increased afforestation of idle land (mud flats, wetlands, urban forests), facilitate forest management (forest age ↓, lumber use ↑)</li> </ul>

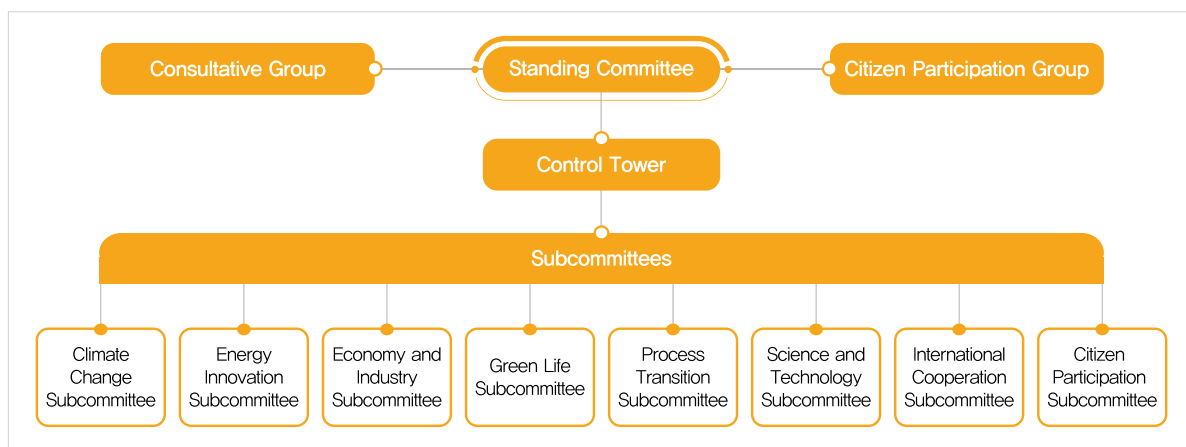
※ Source: ROK's NDC and LEDS (Ministry of Foreign Affairs, 2020)

<sup>21</sup> 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 2050<sup>22</sup>. 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 14<sup>th</sup> 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 goal<sup>23</sup>.

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

<sup>23</sup> 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 Greenhouse Gas Inventory and Research Center (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 statistics<sup>24</sup>. 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 ministries<sup>25</sup> from five sectors subject to GHG inventory measurement oversee the management of the GHG inventory. A measurement agency<sup>26</sup> 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).

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

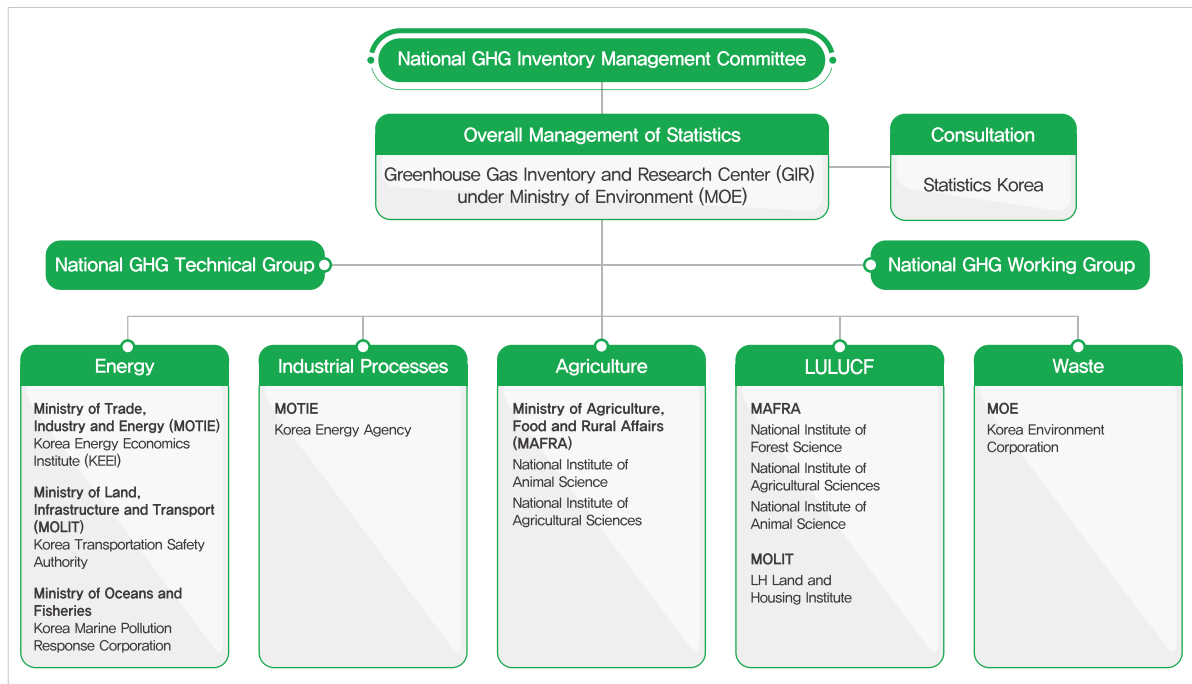
<sup>25</sup> Ministries responsible for each sector are (1) Energy: Ministry of Trade, Industry and Energy (fuel combustion (power generation, industry) and fugitive emissions), Ministry of Land, Infrastructure and Transport (transportation (aviation, roads, and railways) and buildings), and Ministry 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

<sup>26</sup> (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](http://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 (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF<sub>6</sub>). 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 (CO<sub>2</sub>eq.) calculated using the Global Warming Potential (GWP)<sup>27</sup> for the purpose of understanding and comparing the emissions level between gases. The ROK calculated CO<sub>2</sub>eq. of CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs and SF<sub>6</sub> 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.

<sup>27</sup> Based on CO<sub>2</sub> 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



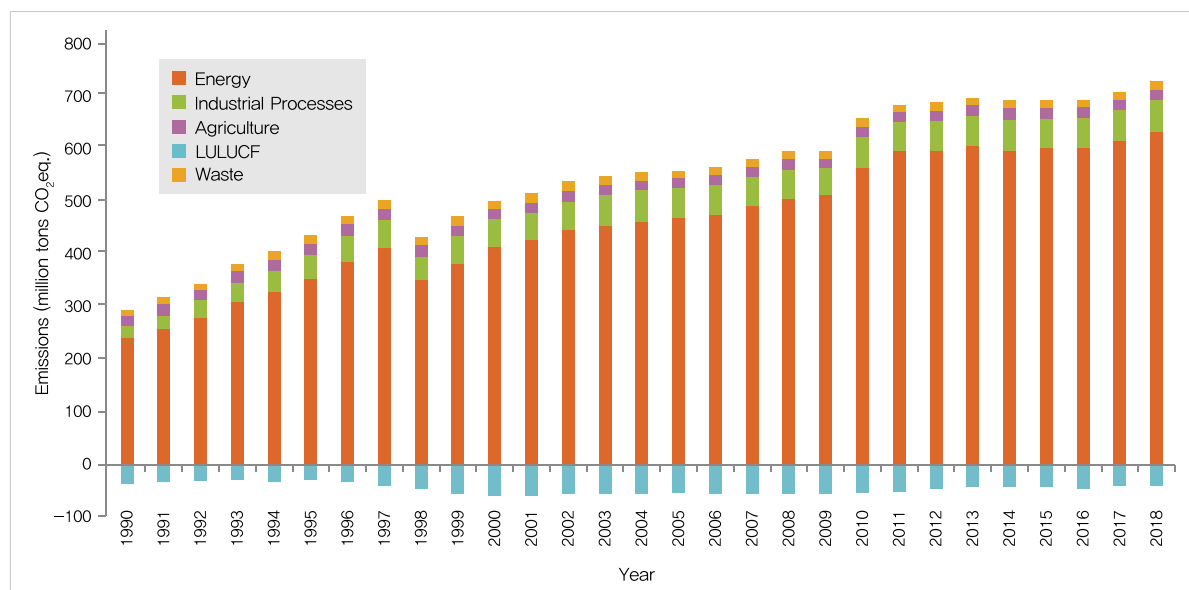
Industrial Processes sector, ③ agriculture soil in the Agriculture sector, ④ forest land and wetlands in the LULUCF sector and ⑤ others in the Waste sector.

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 tCO<sub>2</sub>eq. and net emissions including sinks were 686.3 million tCO<sub>2</sub>eq. Total emissions in 2018 increased by 2.5% compared with 2017. The biggest contributor to emissions growth in 2018 was the energy sector<sup>28</sup> which accounted for the largest share of national emissions. Emissions in the energy sector increased by 16.7 million tCO<sub>2</sub>eq. 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)



<sup>28</sup> 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 tCO<sub>2</sub>eq.)

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 tCO<sub>2</sub>eq., 615.7 million tCO<sub>2</sub>eq. and 632.4 million tCO<sub>2</sub>eq. 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 tCO<sub>2</sub>eq. in 2016, 55.9 million tCO<sub>2</sub>eq. in 2017 and 57.0 million tCO<sub>2</sub>eq. 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 tCO<sub>2</sub>eq., and an increase of 14.1% in 2018 from 2017, recording 2.6 million tCO<sub>2</sub>eq. 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 tCO<sub>2</sub>eq. in 2016, 21.0 million tCO<sub>2</sub>eq. in 2017 and 21.2 million tCO<sub>2</sub>eq. 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 tCO<sub>2</sub>eq. in 2016, -41.5 million tCO<sub>2</sub>eq. in 2017 and -41.3 million tCO<sub>2</sub>eq. 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 tCO<sub>2</sub>eq. in 2016, 17.2 million tCO<sub>2</sub>eq. in 2017 and 17.1 million tCO<sub>2</sub>eq. 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 CO<sub>2</sub> (excluding LULUCF) reached 637.4 million tCO<sub>2</sub>eq. in 2016, 650.2 million tCO<sub>2</sub>eq. in 2017 and 664.7 million tCO<sub>2</sub>eq. in 2018 which account for 91% of total national GHG emissions in 2018. The year-on-year change in CO<sub>2</sub> emissions was 0.5%, 2.0% and 2.2% respectively in 2016, 2017 and 2018. Most of CO<sub>2</sub> emissions were observed in the energy sector.

Total emissions of CH<sub>4</sub> (excluding LULUCF) were 27.0 million tCO<sub>2</sub>eq. in 2016, 27.4 million tCO<sub>2</sub>eq. in 2017 and 27.7 million tCO<sub>2</sub>eq. in 2018 which account for 3.8% of total national GHG emissions in 2018. The year-on-year change in CH<sub>4</sub> emissions was 0.3%, 1.5% and 1.1% respectively in 2016, 2017 and 2018. CH<sub>4</sub> emissions in the agriculture sector take up 44% of total CH<sub>4</sub> emissions.

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

Emissions of HFCs, PFCs and SF<sub>6</sub>, which are fluorinated greenhouse gases, are produced in the industrial processes sector. Total emissions of HFCs were 7.4 million tCO<sub>2</sub>eq. in 2016, 9.6 million tCO<sub>2</sub>eq. in 2017 and 9.3 million tCO<sub>2</sub>eq. 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 tCO<sub>2</sub>eq. in 2016, 2.1 million tCO<sub>2</sub>eq. in 2017 and 3.2 million tCO<sub>2</sub>eq. 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 SF<sub>6</sub> were 6.8 million tCO<sub>2</sub>eq. in 2016, 6.5 million tCO<sub>2</sub>eq. in 2017 and 8.4 million tCO<sub>2</sub>eq. in 2018 which account for 1.2% of total national emissions in 2018. The year-on-year change in SF<sub>6</sub> 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 tCO<sub>2</sub>eq.)

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 <sub>2</sub>	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 <sub>4</sub>	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 <sub>2</sub> 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 <sub>6</sub>	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

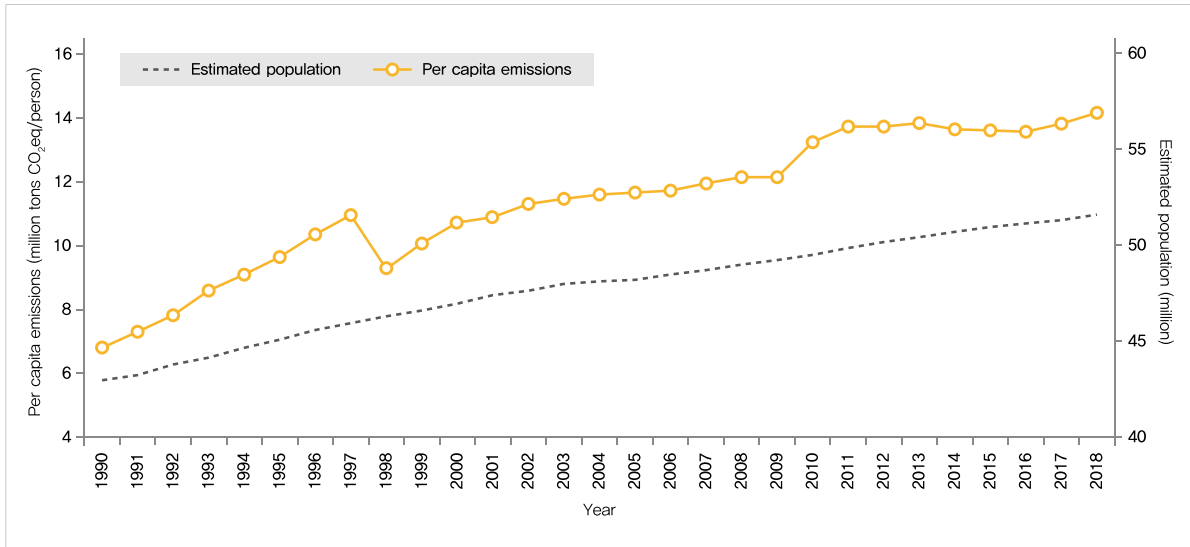
#### – Greenhouse Gas Emissions per Capita

In 2018, the ROK's total greenhouse gas emissions per capita amounted to 14.1 tCO<sub>2</sub>eq., 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 tCO<sub>2</sub>eq. 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)

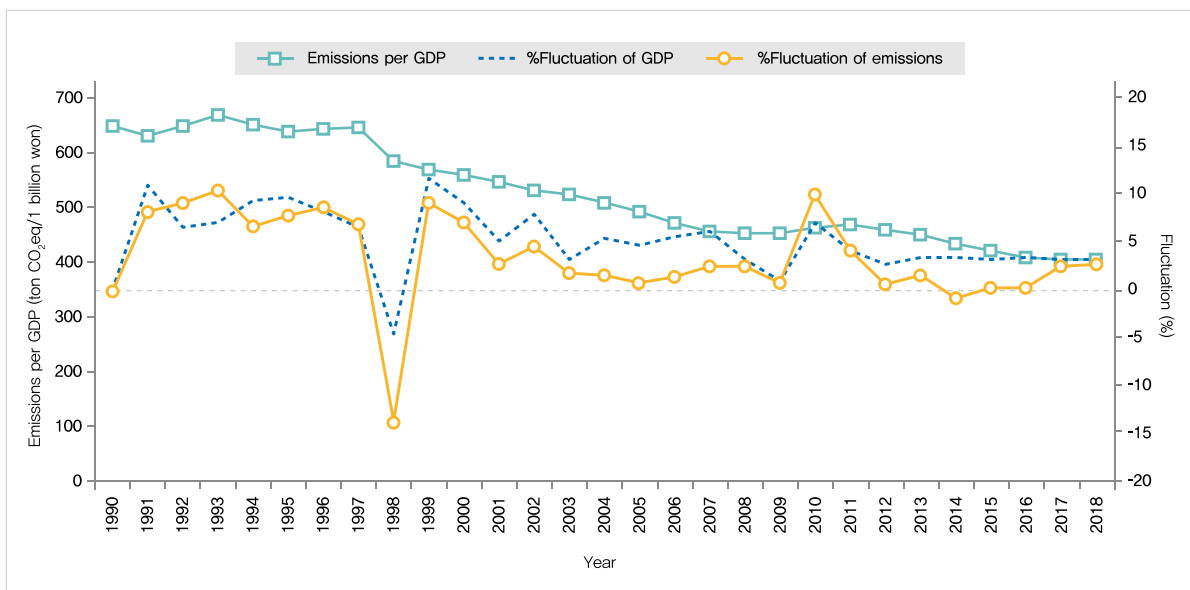


※ Source: Population Projections for the ROK (Statistics Korea, 2018)

### – Emissions per Real GDP

Total GHG emissions per GDP in 2018 based on the Bank of Korea’s GDP data were 401.6 tCO<sub>2</sub>eq./billion won, representing a drop of 37.6% from 643.4 tCO<sub>2</sub>eq./billion won in 1990 and 0.4% from 403.1 tCO<sub>2</sub>eq./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 strengthened transparency system 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 <sup>st</sup> Plan(July 2015)	2 <sup>nd</sup> 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 1<sup>st</sup> National GHG Inventory Management Plan (2015–2019) (July 2015) focused on building a national GHG inventory preparation system. The goal of the 2<sup>nd</sup> 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 1<sup>st</sup> plan. The ROK is segmenting and advancing relevant systems through the 2<sup>nd</sup> 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 strengthened transparency system of the Paris Agreement requires parties to report indirect GHG (CO, NO<sub>x</sub>, NMVOCs, SO<sub>x</sub>) 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 strengthened transparency system 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 strengthened transparency system 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.



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#### 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 system 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.





A modern building with a large glass facade and solar panels is shown against a clear blue sky. The building has a grid-like pattern of solar panels on its exterior. In the foreground, there are some green trees. The overall scene is bright and clear.

# CHAPTER 3

## Reduction Policies and Measures



## 1. Reduction Target

According to the Paris Agreement, all parties must establish the national greenhouse gas (GHG) reduction target periodically. As most of the parties submitted the Intended Nationally Determined Contribution (INDC) in 2015 as per the Lima decision and ratified the Paris Agreement in 2016, the INDC was converted to Nationally Determined Contributions (NDC). Parties are required to update or re-submit the NDC by 2020 in accordance with the Paris Agreement.

The Republic of Korea (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, the 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 committed to the international community. While the first NDC targeted to reduce GHG emissions by 37% from the BAU levels by 2030, the updated NDC which was submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2020 adopts an absolute reduction target which is to reduce emissions by 24.4% from the total national GHG emissions in 2017. In August 2021, the Framework Act on Carbon Neutrality was enacted to define the minimum NDC target for 2030 which is at least 35% reduction from the 2018 level, and accordingly in October 2021, the NDC was updated again with the target of reducing emissions by 40% from the 2018 level which was 727.6 MtCO<sub>2</sub>eq.

Basic plans are developed for each sector to set the mid- to long-term goals and directions while specific systems and measures are utilized to reach the target. 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 buildings sector, Mandatory Energy Efficiency Improvement System and Zero-energy Building Certification are introduced while policies to increase the supply of eco-friendly vehicles and improve the transport system are being developed 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.



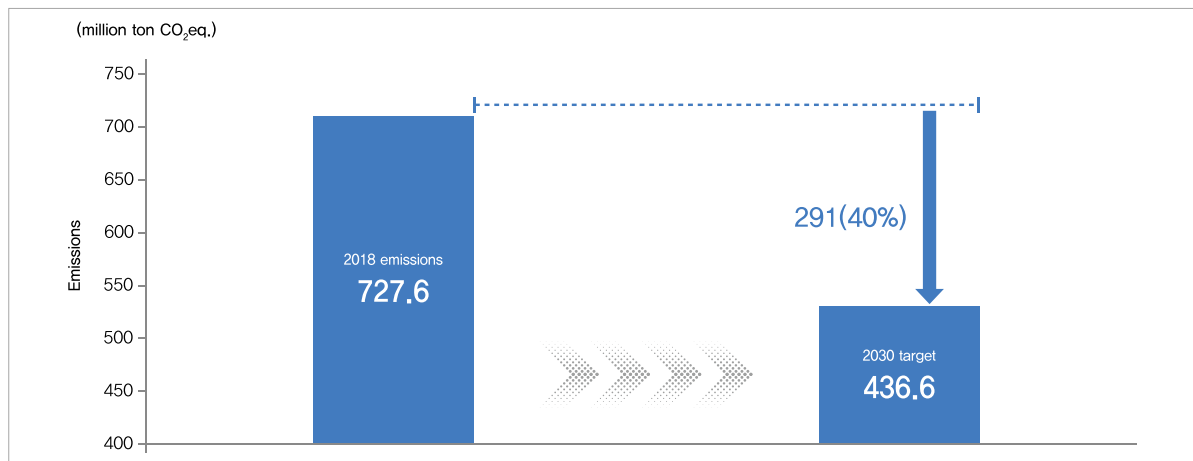
<Table 3-1> Progress of 2030 Reduction Target Updates

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)
Analysis Scope	31 sub-sectors in 8 sectors	8 sectors		
Reduction Target	By 37% from 2030 BAU level (domestic 25.7%, overseas 11.3%)	By 37% from 2030 BAU level (domestic 32.5%, others 4.5%)	By 24.4% from 2017 level (709.1MtCO <sub>2</sub> eq.) by 2030	By 40% from 2018 level (727.6MtCO <sub>2</sub> eq.) by 2030
Mitigation Pathway	Amount of emission reduction in 2030	Amount of emission reduction every 3 years from 2013 to 2030		Amount of emission reduction in 2030 <sup>29</sup>

Remark: The targeted figure of 32.5% in domestic reduction as per the Revised 2030 Roadmap reflects the potential reduction that can be additionally achieved by energy transition while 4.5% includes the potential reduction 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

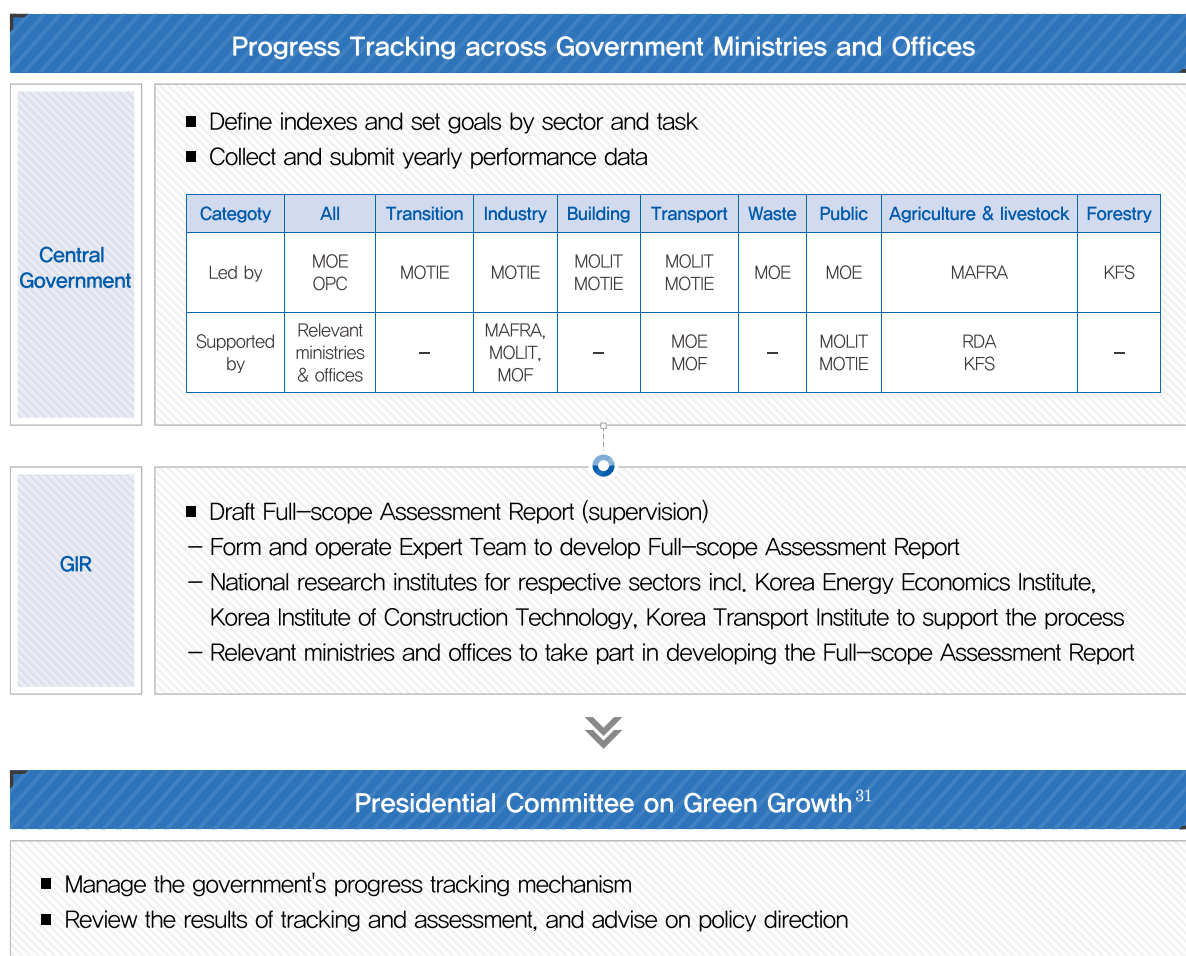
For the purpose of establishing a prompt and transparent progress tracking and assessment system across the government, the Office for Government Policy Coordination (OPC) and the Ministry of Environment (MOE) analyze and evaluate the progress of GHG reduction by each government ministry and office according to four principles of transparency, timeliness, accountability and feedback before releasing the results. Objective and quantifiable indexes are defined for each sector, and comprehensive evaluations are conducted to review performance in 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.

<sup>29</sup> Reduction goals for each year and sector are yet to be determined but 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. The submitted data is used by the Expert Team supervised by the Greenhouse Gas Inventory and Research Center (GIR) to draft the 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.<sup>30</sup>

[Figure 3-2] Progress Tracking and Assessment Mechanism



<sup>30</sup> To ensure that tracking and assessment are conducted in a timely manner, GHG emissions data in 2018 from the National Inventory Report and provisional emissions in 2019 were used.

<sup>31</sup> 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 tracks the progress and publishes the results.

## 3. Reduction Progress by Sectors

### 3.1 Overarching Reduction Policy

#### – Emissions Trading System

The ROK decided to introduce the 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. With the agreement from the National Assembly, the Act on Allocation and Trading of Greenhouse Gas Emissions Allowances which is also called Emissions Trading Act was enacted in May 2012 after hearing opinions from the 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 five basic principles<sup>32</sup> 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 from 2015 which is the year of implementation of K-ETS. For Phase I and Phase II, the plan was established every three years to identify and solve issues occurred at the initial stage of implementation. The basic 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 basic plan and the allocation plan for K-ETS were developed for Phase II with relevant guidelines amended.

Under the Second Basic Plan for Emissions Trading System established in January 2017, three strategies were presented as follows: 1) promoting the 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 following the trading principles of the market; and ⑤ Policy operation that abides by the international standards considering the linkage 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"> <li>• <b>Compliance with United Nations Framework Convention on Climate Change and consideration of international negotiations</b></li> <li>– <b>(Achievement of Reduction Target)</b> Contribute to responding to the global climate crisis by achieving the national GHG reduction target</li> <li>– <b>(BAU Projection)</b> Maintain the principle of transparency and accountability for BAU projection</li> <li>– <b>(Coordination with International Negotiations)</b> Operate K-ETS in harmony with the latest international negotiations and discussions under the new climate regime introduced by the Paris Agreement</li> </ul>
2	<ul style="list-style-type: none"> <li>• <b>Consideration of the implication on the global economic competitiveness</b></li> <li>– <b>(Economic Growth and Employment)</b> Minimize the negative effect of K-ETS on economic growth and employment</li> <li>– <b>(Maintaining Global Competitiveness)</b> Develop support measures considering trade and carbon intensity so that companies can maintain global competitiveness</li> </ul>
3	<ul style="list-style-type: none"> <li>• <b>Increased use of market function to effectively achieve the national GHG reduction target</b></li> <li>– <b>(Infrastructure Development)</b> Reduce the entry barrier to facilitate the emissions trading market and build infrastructure to enable accurate MRV (measurement, reporting and verification)</li> <li>– <b>(Principle for Free Allocation and Allocation by Auction)</b> Maintain the share of auction as prescribed by the Enforcement Decree to utilize the market function</li> <li>– <b>(Guarantee of Reduction Means)</b> Guarantee diverse and flexible means of reduction for the companies such as carryover, borrowing or offsetting</li> </ul>
4	<ul style="list-style-type: none"> <li>• <b>Fair and transparent emissions trading following the trading principles of the market</b></li> <li>– <b>(Fairness)</b> Ensure the responsibilities of GHG reduction is equally taken by both sectors that adopt and that do not adopt K-ETS</li> <li>– <b>(Minimizing Market Distortion)</b> Ensure that K-ETS does not distort the economics among companies</li> </ul>
5	<ul style="list-style-type: none"> <li>• <b>Abiding by the international standards considering the linkage with the global carbon market</b></li> <li>– <b>(International Carbon Offset)</b> Enhance flexibility and decrease reduction cost by facilitating international carbon offsetting by linking emissions trading systems</li> <li>– <b>(Minimizing Exclusions)</b> Minimize exceptional clauses that exempt certain sectors and industries from K-ETS</li> <li>– <b>(Incorporation of International Standards)</b> Incorporate international regulations and standards such as the new international carbon market mechanism which is introduced to follow up with the Paris Agreement</li> </ul>

※ 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 allowance allocation based on its emissions for past years while preliminary allowance allocation was provided to the remaining three sub-sectors, namely cement, oil and aviation, based on the efficiency of their facilities (benchmarking method). In Phase I, emission allowances were allocated to all sub-sectors free of charge to minimize the economic burden on the companies and for the system to stabilize. Offset credits acquired by entities through external reduction projects including Clean Development Mechanism (CDM) were also recognized. Total emissions allowance in Phase I was 1,687 million Korean Allowance Units (KAUs)<sup>33</sup>.

33 Korean Allowance Unit: allocated to entities subject to allocation 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 the additional allowances in reserve of 19 million KAU according to the Revised 2030 Roadmap which was revised in 2018. The second allocation plan allocated 97% of allowances to 26 out of 62 target sub-sectors for free and 3% to be 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 the 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"> <li>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</li> <li>Allocate by auctioning (at least 10% of the allowance allocated to the target entity)</li> </ul>
Overseas Reduction Project	<ul style="list-style-type: none"> <li>Pursue overseas projects after objectively evaluating the impact on achieving the GHG reduction target</li> <li>Allow conversion and use of overseas reductions which are recognized as ROK's reduction achievement to KCU</li> </ul>
Trade Market	<ul style="list-style-type: none"> <li>Allow participation of financial institutions, securities companies and individuals</li> <li>Allow futures to be traded at KRX to promote emissions trading</li> </ul>
Industry Support	<ul style="list-style-type: none"> <li>Support domestic companies' reduction activities</li> <li>Reinforce the development of reduction technologies in Korea using domestic technologies for overseas reduction activities</li> </ul>

※ Source: 「Third Basic Plan on Emissions Trading System」(Dec 2019) and 「The Phase 3 Allocation Plan」(Sept 2020)



During the trading period in Phase I (January 1, 2015~August 9, 2018), a total volume of all the allowances traded at KRX and over-the-counter (OTC) ((KAU15 · KAU16 · KAU17 · KAU18, KCU15 · KCU16 · KCU17 · KCU18, KOC)<sup>34</sup> was 86.2 million tCO<sub>2</sub>eq. of which 37.5 million tCO<sub>2</sub>eq. was traded at KRX and 48.7 million tCO<sub>2</sub>eq. 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 66.6 million tCO<sub>2</sub>eq., 3.4 million tCO<sub>2</sub>eq. and 16.2 million tCO<sub>2</sub>eq., accounting for 77%, 4% and 19% respectively. Trade volume by year was: 5.7 million tCO<sub>2</sub>eq. in 2015, 11.9 million tCO<sub>2</sub>eq. in 2016, 29.3 million tCO<sub>2</sub>eq. in 2017, and 39.2 million tCO<sub>2</sub>eq. in 2018. The volume increased by 208%, 246% and 134% year-on-year.

During the same period, the average KRX and OTC trading price of total allowances continued to increase from 11,007 won per tonne in 2015 to 17,179 won in 2016, and from 20,879 won in 2017 and 22,127 won 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 high 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).

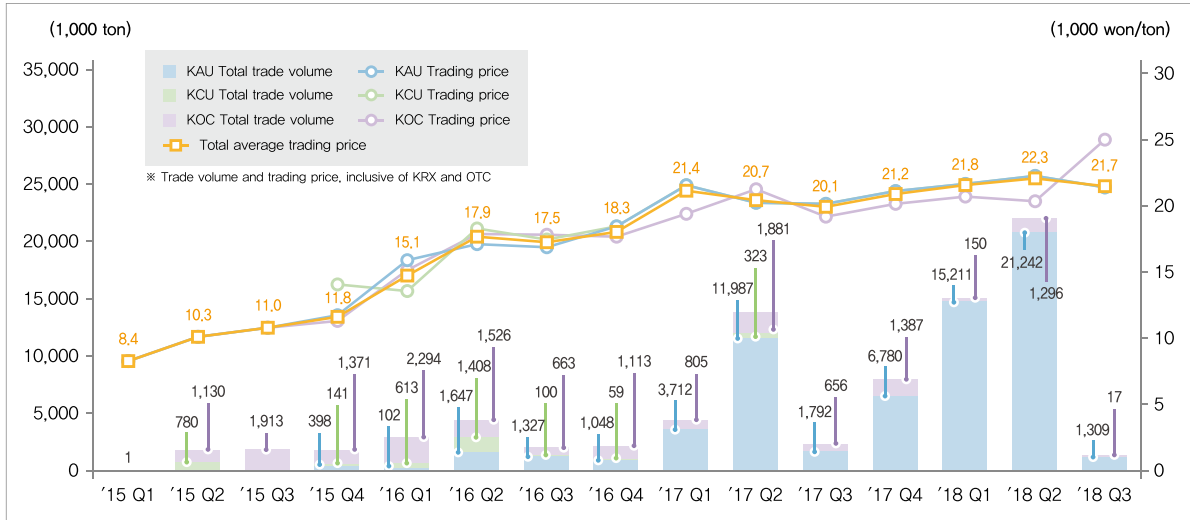
A continued rise of trading price and increased volume of traded emissions affected the trading price. Total trading volume was 63.1 billion won in 2015 which increased to 204.4 billion won in 2016, 612.3 billion won in 2017 and to 868 billion won in 2018 which indicates a growth rate of 324%, 300% and 142% every year. The aggregate trading volume was 1,747.7 billion won. The total trading volume of KAU, KCU and KOC was 1,423.1 billion won, 54 billion won and 270.6 billion won respectively which account for 81%, 3% and 15%. The aggregate KRX and OTC trading volumes were 781 billion won and 966.7 billion won, proportionately accounting for 45% and 55% of the total transactions.<sup>35</sup>

**34** 1 tCO<sub>2</sub>eq. = 1KAU = 1KCU = 1KOC

KCU (Korean Credit Unit): allowances converted from certified reduction from external projects according to Article 29 of the Act.  
KOC (Korean Offset Credit): certified reduction from external projects; GHG reduction achieved from external projects, where the entity reduced, absorbed or removed GHG as per the international standards outside its business site, which was certified by the government 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, the total emissions traded during the respective trading period (January 1, 2018~September 30, 2019) was 39.6 million tCO<sub>2</sub>eq. 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)

The ROK has implemented the GHG & Energy Target Management System (TMS) according to the Framework Act on Low Carbon, Green Growth (January 2010). The objective of TMS is to support the achievement of the national GHG reduction target, by designating those entities and business sites that emit GHG and consume energy above a certain level as controlled entities, and setting and managing their GHG and energy consumption reduction goals. Following the implementation of K-ETS in 2015, large-scale business sites with high GHG 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 supervising institutions, in consideration of each controlled entity's plan to newly or additionally build facilities and the reduction potential, etc, establishes the annual reduction targets to support the achievement of the national GHG reduction target. They evaluate the reduction target delivery plan and the progress, and thereby continuously manage the entities' GHG reduction and energy conservation. The controlled entities comply with TMS through several stages: the entities should submit a detailed statement on their GHG emissions and energy consumption (March), consult with the government to determine the following year's target (September), establish their delivery plan (December) and deliver the



target for one year (throughout the following year), and then submit the outcome to the government (March, year after the following year).

The controlled entities under TMS are distinguished by entities (corporation) and business sites. Those entities whose average annual GHG emissions of the past three years is 50,000 tCO<sub>2</sub>eq. or above and energy consumption is 200 Terajoules (Tj) or above, and those business sites whose GHG emissions is 15,000 tCO<sub>2</sub>eq. or above and energy consumption is 80 Tj or above are subjected to be regulated of their GHG emissions.

(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 <sub>2</sub> 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

774 entities in the public sector that are subject to TMS emitted total 4.21 million tCO<sub>2</sub>eq. in 2018, which was 19.6% or 980,000 tCO<sub>2</sub>eq. less than the baseline emission of 5.02 million tCO<sub>2</sub>eq. When compared with the total emissions of 4.73 million tCO<sub>2</sub>eq. in 2011 when TMS was first introduced in the public sector, 11% or 520,000 tCO<sub>2</sub>eq. was reduced to reach 4.21 million tCO<sub>2</sub>eq. in 2018.

### 3.2 Reduction Policies and Measures by Sector

#### – Energy Transition

In order to support GHG reduction in the transition sector, the Renewable Energy 3020 Plan (draft) (December 2017), which sets out the plan to increase the share of renewable energy to 20% by 2030, was finalized, and the detailed enforcement measures were developed through the 8th Basic Plan for Long-term Electricity Supply and Demand (December 2017).



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

Category	Description
Second Energy Master Plan <sup>36</sup> (January 2014)	<ul style="list-style-type: none"> <li>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</li> </ul>
Renewable Energy 3020 Plan (draft) (December 2017)	<ul style="list-style-type: none"> <li>Raise the share of renewable energy in power generation to 20% by 2030</li> <li>Power 95% or more of new facilities with clean energy such as photovoltaic and wind energy</li> <li>Achieve the target leveraging development projects with participation of local communities and large-scale projects</li> </ul>
8th Basic Plan for Long-term Electricity Supply and Demand (December 2017)	<ul style="list-style-type: none"> <li>To secure economic feasibility and create a safe and clean power system together with the implementation of the Energy Transition Roadmap (October 2017)<sup>37</sup>, nuclear power (share in power generation, peak contribution basis) will be gradually reduced (16.5% by 2030) and the share of new and renewable energy will be increased (20.0% by 2030)</li> <li>Unlike the previous supply and demand plans that focused on stabilizing demand and supply and the economic feasibility, the 8th Basic Plan was established with emphasis on the environment and the safety, considering the objective of the revised Electric Utility Act</li> <li>Plan to readjust the power generation cost taking into account early closure of old coal power plants<sup>38</sup> and the environmental cost</li> <li>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</li> </ul>

In 2018, the target share of new and renewable energy under the Renewable Portfolio Standard (RPS) was 5% and the actual achievement was 5.2%, 0.2% higher than the target. 3,435MW of renewable energy was newly supplied, which was almost double the target of 1,738MW. In 2019, while the RPS target was 6%, 0.4% was over-achieved, reaching 6.4%. 4,363MW of renewable energy was newly supplied, nearly double the target of 2,402MW. However, the breakdown of target and performance by types of renewable energy shows that while photovoltaic and bio exceeded the targets, wind and water power were below the respective targets.

<sup>36</sup> 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.

<sup>37</sup> The Roadmap that stipulates the mid- to long-term goals and the direction of the overall energy transition policy, which includes: ① gradual phase-out of nuclear power plants; ② increasing the share of renewable energy; and ③ supplementary measures for respective regions and industries.

<sup>38</sup> Early closure of old coal power plants refer to the policy aiming to close 10 coal power plants that have been used for over 30 years by 2022; three have been closed in July 2017, and one, two and four coal power plants will be closed respectively in 2019, 2020 and 2021.



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

Category	2018		2019 (provisional)		2030
	Actual	Target	Actual	Target	Target
RPS Requirement(%) <sup>1)</sup>	5.2	5	6.4	6	10 (2022)
<b>Supplied Renewable Energy (new) (MW)</b>					
Total <sup>2)</sup>	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

For reference, the Fifth Basic Plan on Development, Utilization and Supply of new and renewable Energy (December 2020) prescribes that the RPS requirements are increased to the level that is necessary to achieve the targeted supply of new and renewable energy, that the scope of mandated suppliers is extended, and that the weights 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 source<sup>39</sup>.

<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)

<sup>39</sup> The weight is revisited every three years according to RPS and the management and operational guideline on RPS. Also, hydrogen fuel cell shall be separated to be managed by the (tentative) Hydrogen Energy Portfolio Standard (HPS), so that new energy and renewable energy could be managed separately.

Unused heat energy includes secondary heat from power generation, industrial waste heat and heat source for new and renewable energy. Recovery of unused energy and linking businesses for waste heat recovery were proposed as important means to reduce emissions from the district heating perspective in the Revised 2030 Roadmap (July 2018), which can be seen in the Third Energy Master Plan (June 2019). Currently, a project is in progress to develop the national heat map, which will serve as the platform for providing information on supply and demand of heat, the business model and the 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 the companies, and improving energy efficiency and demand management in an innovative manner to support GHG reduction, so that companies can be lifted of 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"> <li>• 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</li> <li>• (Introduction of New Technologies) Introduce new technologies and facilities in industrial processes to optimize energy consumption</li> <li>• (Enhancement of Energy Efficiency) Enhance the efficiency of common devices and extend provision of energy management system</li> <li>• (Waste Heat Recovery) Enhance the efficiency of heat energy utilization by recovering waste heat and steam generated during industrial processes and reusing unused heat, etc</li> </ul>
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> <li>• Reduce GHG through enhancement of energy utilization efficiency by improving the efficiency of common devices, providing Factory Energy Management System (FEMS), and streamlining processing facilities</li> <li>• Support development of eco-friendly refrigerant technology for refrigerators and air conditioners, and promote use of alternative refrigerants</li> <li>• Replace bituminous coal or bunker-C fuel oil used for manufacturing and independent power generation with LNG and biomass fuel</li> <li>• Increase introduction of waste heat power generation facilities, thereby cutting energy consumption by recovering the heat generated from the facilities and using them to produce steam</li> </ul>

The Energy Consumption Efficiency Rating Indication System, which mandates the indication of energy efficiency rating of the target product according to the Energy Use Rationalization Act (December 2019), promotes production of high-efficiency products, technological development and purchase of energy-saving products by the consumers.



Furthermore, by supporting the establishment of the Factory Energy Management System (FEMS), the system helps maximize productivity and energy efficiency through comprehensive management of a factory's production and non-production facilities. FEMS is not about simply enhancing the efficiency of the facility, but refers to the innovative emissions reduction technology which is applied at the operating system level. So, it can be applied broadly, regardless of the nature of the business. FEMS was applied to total 15 business sites in 2018, and will continuously be extended until 2030.<sup>40</sup>

In accordance with the Regulation on Demand Management and Investment Project Implementation by Energy Provider (May 2018) that has been amended for the objective of GHG reduction in the industrial sector, the pilot implementation of the Energy Efficiency Resource Standards (EERS) began in 2018. Under EERS, an annual energy saving target is imposed on an energy provider, for which the energy provider is mandated to implement an investment project aiming to enhance the energy efficiency. Pilot projects are implemented by 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 energy sales volume of the previous year. As per the business plan, 328.5 billion won is scheduled to be invested in 101 projects, including motors, boilers and freezers, and 301,948 toe is expected to be saved.

Since 2020, Korea Energy Agency (KEA) has been conducting pilot voluntary energy efficiency target-setting projects with business sites whose annual energy consumption is 2,000 toe or more. If a business site voluntarily achieves its target by implementing activities to improve energy efficiency such as facility investment or process improvement, KEA awards a certificate acknowledging its excellence or provides incentives such as extending the interval of energy diagnosis. As of September 2020, KEA entered into the pilot project agreement with 45 high energy consuming business sites (31 companies).<sup>41</sup>

The Revised 2030 Roadmap (July 2018) clearly stipulates that emissions reduction must be achieved in the steel industry through development and supply of new technologies and innovative technologies, and shifting toward high value-added products, considering that steel accounts for a large share of emissions in the industrial sector. Hydrogen-based ironmaking is a key innovative technology in the steel industry. Hydrogen, instead of bituminous coal that generates large amount of carbon dioxide (CO<sub>2</sub>) in the steelmaking process, is used to reduce iron ore. Government-led R&D project has been in progress since

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

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

2017 to develop the low-CO<sub>2</sub> hybrid steelmaking technology, which is the hydrogen-based ironmaking technology that uses shaft furnace.

Approximately 46% of total emissions generated by the petrochemical industry, one of the representative high-emissions industries, is produced during fundamental oil material production stage, so considerable GHG reduction can be anticipated if the energy intensity of fundamental oil material production can be improved. Major oil raw material produces in Korea are trying to improve the energy intensity through process improvement and energy efficiency enhancement.

The cement industry emits a large quantity of CO<sub>2</sub> while producing clinker<sup>42</sup> using limestones. Currently, a feasibility study is in progress regarding raw materials to create low-emissions cement, and capturing and utilizing CO<sub>2</sub> in order to identify how to reduce CO<sub>2</sub> emissions in the cement production processes. Additionally, R&D projects are in the planning pertaining to production of eco-friendly cement, production of secondary products, CO<sub>2</sub> capturing and utilization system, and special cement application technology. In the mid- to long-term, diverse types of admixtures and diverse ratios of admixtures will be studied in order to increase the ratio of admixture in the Portland cement, together with the development of eco-friendly cements.

#### – Buildings Sector

The ROK enacted the Green Buildings Construction Support Act (February 2012) to achieve the national GHG reduction target by the buildings sector and to increase green buildings. As part of the official plan, the Green Building Master Plan (December 2014) is established and implemented every five years, since 2014.

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



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

Category	Description
First Green Building Master Plan <sup>43</sup> (December 2014)	<ul style="list-style-type: none"> <li>• Establish the vision to Supply and Foster Green Buildings to Create Low-emissions Environment and Eco-friendly Living and Culture</li> <li>• Develop 4 promotion strategies to realize the vision: (① Enhance green building criteria; ② Enhance energy performance of existing buildings; ③ Nurture green construction industry; and ④ Expand the base of green construction)</li> <li>• Major achievements: securing the industrial infrastructure for green buildings through advancement of criteria for implementation outcomes and new constructions, enhancement of existing buildings' performance, disclosure of energy performance to facilitate operation and management, and green modeling business registration (total 425 registered during 2014~2018)</li> </ul>
First National Climate Change Adaptation Plan (December 2016)	<ul style="list-style-type: none"> <li>• (New Buildings) Increase zero energy buildings (ZEB) by gradually strengthening permits for buildings</li> <li>• (Existing Buildings) Encourage energy performance improvement of existing old buildings</li> <li>• (Operation) Develop technology and institutional ground to expand Building Energy Management System (BEMS)</li> </ul>
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> <li>• (New Buildings) Strengthen energy criteria for buildings such as application of insulation requirement of passive buildings and mandate ZEBs by stages; use such strengthened policies as means to reduce GHG</li> <li>• (Existing Buildings) Mandate conversion of high energy consuming public buildings to green buildings and facilitate green remodeling; develop such measures to enhance energy performance as means to reduce GHG</li> <li>• (Others) Expand the target scope of energy consumption efficiency rating and high-efficiency energy machinery/equipment certification system regarding home appliances, office equipment and facilities, and strengthen efficiency standard in stages</li> </ul>

The government is developing diverse institutional measures to quantify and assess the eco-friendliness of new and existing buildings and to promote green buildings. Submission of Energy Saving Plan, based on the design concept applied to the respective building to save energy, has been mandated to enable the assessment of the building's energy performance. The Zero Energy Building Certification System (ZEB Certification System) is used to primarily evaluate the energy consumption of the building, so that energy saving buildings can be certified and be rated for its energy efficiency in a quantifiable and objective manner.

Green Buildings Construction Support Act (February 2012) defines a zero energy building as "a green building in which energy requirement is minimized by minimizing the energy load needed for the building and by utilizing new and renewable energy." According to the Korea New Deal, Ministry of Land, Infrastructure and Transport (MOLIT) is seeking to obligate the conversion of public and private buildings to ZEBs in stages. In order for early

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

implementation of the Zero Energy Building Roadmap for New Buildings (ZEB New Building Roadmap), MOLIT mandated that all public buildings with 1,000m<sup>2</sup> or wider floor area to be constructed in 2020, public buildings with 500m<sup>2</sup> or wider floor area to be constructed by 2023, private buildings with 1,000m<sup>2</sup> or wider floor area to be constructed by 2025, multi-unit dwelling buildings for 30 or more households, and all buildings with 500m<sup>2</sup> or wider floor area to be constructed by 2030 should be built as ZEB.

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

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

<ul style="list-style-type: none"> <li>• Criteria for ZEB Certification                             <ul style="list-style-type: none"> <li>– 1++ or higher energy efficiency rating</li> <li>– 20% or higher energy self-sufficiency rate</li> <li>– Installation of BEMS or digital power meter</li> </ul> </li> <li>• Grades of ZEB Certification</li> </ul>					
ZEB Grades	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Energy self-sufficiency (%)	100% or above	80% ~ less than 100%	60% ~ less than 80%	40% ~ less than 60%	20% ~ less than 40%
<ul style="list-style-type: none"> <li>• Status of ZEB Certification</li> </ul>					
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 the activities pertaining to converting existing buildings to green buildings by enhancing energy performance and improving energy 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 residential environment, MOLIT and Korea Land & Housing Corporation (LH) support the payment of interests incurred by green remodeling. They partially subsidize the payment of interest on the loans intended to cover the expenses for improving the energy performance of private buildings, and thereby



seek to promote green remodeling. The scope of green remodeling is planned to be gradually expanded to include national and public daycare centers that were built more than 10 years ago, around 2,000 public health centers and medical facilities, and public rental houses, as a means to deliver Korea's Green New Deal.

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

Category		2016	2017	2018	2019	2020
Projects	Number of Projects	7,742	8,551	9,278	11,428	12,005
	Amount (million won)	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 Green Standard for Energy and Environmental Design (G-SEED) for Houses is to develop standards and performance criteria for construction of energy saving and environmentally friendly houses as a means to respond to climate change and support low-carbon, green growth. An eco-friendly house indicates that it uses new and renewable energy such as photovoltaic power, solar heat and geothermal heat, high-efficiency lighting and boiler, and eco-friendly insulation, in order to refrain from using fossil fuels as much as possible and thereby reduce energy consumption and GHG emissions. While the goal was to build eco-friendly houses for 400,000 households, the goal was overachieved by 90,000, reaching 490,000.

The Carbon Point Program is designed to provide Carbon Points to households and commercial and apartment complexes according to how much they have reduced their use of electricity, water and gas, so that GHG emitted from electricity, water and gas consumption can be reduced. It is a nationwide GHG reduction program that provides incentives corresponding to the Carbon Points earned. As of 2018, 2.87 million households and 7,894 commercial entities are participating in the program.



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

Category		Description
Individual	Scope	• Householder (or member) of each family or actual users of school, commercial facilities etc
	Incentive	• Paid every half–year based on GHG reduction rate • 4+ times consecutive reduction: points provided for reduction above 0%~less than 5% from next half–year
Group	Scope	• Apartment management office, school principal, building manager who maintains, respectively, apartments housing 150+ households, schools and the common space (streetlamp, industrial electricity etc) of general buildings (size of complex can be adjusted according to the circumstance of the local government)
	Incentive	• Paid once a year according to the assessment of each complex * For complexes with 5+% GHG reduction rate; incentive is paid by factoring in GHG reduction rate 60% and individual participation rate 40% • 4+ times consecutive reduction: points provided for reduction above 0%~less than 5% from next half–year

• (Carbon Points)  
For each type of energy targeted for GHG reduction (electricity, water, gas), monthly average consumption of past two years starting from the settlement period (baseline) and current consumption are compared, and Carbon Points are provided based on the reduction rate for each energy type

• (Incentives)  
Local governments' choice of incentive such as cash, gift voucher, standard plastic garbage bag and green card point (for green cardholders only)

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

The Advanced Metering Infrastructure (AMI) is the core infrastructure to manage energy consumption through remote, real–time inspection of energy consumption and interactive exchange of information using fixed and mobile communication. AMI consists of interactive communication based digital meter, and other equipment for transmitting electricity usage data and control. AMI transmits information on electricity price and utilization on real–time basis, enabling demand response (DR) by the consumers, and accurate demand prediction and load control by the providers. AMI was applied to 7 million households in 2018, and will be applied to 15 million households by 2030. Korea Electric Power Corporation (KEPCO) has been steadily increasing the application of AMI since 2010, and is seeking to apply it to 22.5 million households by 2020.

Lighting devices are also a major target for management, together with home appliances and office devices, to reduce energy consumption and GHG emissions by buildings. Reinforcing the management of efficiency of lighting devices can contribute to expanding the supply of high–efficiency lighting devices and encouraging technology development. MOTIE plans to gradually strengthen the minimum consumption efficiency threshold for fluorescent lights, of which the energy efficiency is lower than LED, until 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 Automobiles (April 2020), the Fourth Development and Distribution of Environment-friendly Automobiles Promotion Master Plan (February 2021) has been implemented, based on which the development of hybrid, electric and hydrogen fuel cell vehicles with high energy efficiency will be supported, and the distribution of eco-friendly vehicles will be increased until 2030 by supporting demonstration projects and providing subsidies.<sup>44</sup>

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

Policies and means to reduce GHG in the transportation sector can be divided into road, marine, rail and aviation. Recently, mitigating fine dust is also considered in association with GHG reduction. GHG in the transportation sector is mostly emitted on the road. Therefore, improving the average fuel efficiency of automobiles is integral to reduce GHG in the transportation sector. The ROK manages the average fuel efficiency of all the vehicles either produced in 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 after applying the credit, which marked 97% achievement of the target.

<sup>44</sup> According to the Fourth Environment-friendly Automobile Master Plan (2021~2025) (February 2021), the market size of ROK's eco-friendly automobiles by type was 8th and 1st in the world, respectively, for electric vehicles and hydrogen vehicles in 2019. ROK's global competitiveness has been proven by increased supply of eco-friendly vehicles and growing exports, and more charging facilities are being built following the rise of demand for eco-friendly vehicles. Going forward, more eco-friendly vehicles will be supplied 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 for eco-friendly vehicles.

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

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

\* Average Fuel Efficiency Credit System

- Average fuel efficiency and average CO<sub>2</sub> emissions for new vehicles are conducted by incorporating a certain portion of eco-friendly vehicles, compact cars and manual transmission cars, including plug-in hybrid vehicles, hybrid vehicles, electric vehicles and hydrogen vehicles (additional credit for LPG cars is applied for average fuel efficiency)
- Encouraging the respective car manufacturers to sell cars with high average energy consumption efficiency, while allowing them to comply with the average energy consumption efficiency regulation more easily

※ 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 promotion strategies were proposed for the vision of establishing 2022 as the first year for widespread use of future cars and developing a future car oriented social ecosystem by 2025. To ensure widespread use of future cars, refueling stations are being built in line with the citizens' living and driving patterns; the goal is to build 500,000 slow chargers and 15,000 fast chargers by 2025.

#### Establishment of Future Car Charging Infrastructure by Year

Category	~2016	2017	2018	2019	2020	Q1 2021	Total
Electric	2,014	11,662	13,676	17,440	19,396	2,508	66,696
Fast	919	2,424	1,870	2,183	2,409	1,396	11,201
Disclosed	881	1,264	1,760	2,031	2,065	994	8,995
Undisclosed	38	1,160	110	152	344	402	2,206
Slow	1,095	9,238	11,806	15,257	16,987	1,112	55,495
Disclosed	471	2,639	3,236	5,715	14,577	10,355	36,993
Undisclosed	624	6,599	8,570	3,592	8,360	–9,243	18,502
Hydrogen	8	2	4	22	34	10	80

※ Source: Status of Supply of Electric and Hydrogen Vehicles and Establishment of Charging Infrastructure (Ministry of Environment, 2021)



For the objective of reducing GHG emissions, the ROK government and oil companies have voluntarily entered into agreements to mix 0.5% of bio-diesel in diesel fuel since 2006. In this regard, mid- to long-term plan has been developed in 2007 to increase the mix of bio-diesel by 0.5% every year, to reach 3.0% by 2012. Accordingly, the share of bio-diesel increased to 1% in 2008, 1.5% in 2009, and 2% in 2010. However, as it was decided as part of the Second Mid- to Long-term Bio-diesel Supply Plan (December 2010) to maintain the ratio at 2%, the mix was kept at 2% until 2015. In 2013, the Renewable Fuel Standards (RFS) was introduced, mandating the provider of transport fuel (party obligated to mix bio-diesel) to mix a certain percentage of bio-diesel in the conventional fossil fuel (diesel fuel). RFS was implemented in 2015, and the mandatory mix ratio is to be reviewed every three years. The mandatory mix ratio, which started at 2.5% at the end of July 2015, was revised to 3% in 2018 and 3.5% in July 2021; the ratio is scheduled to be raised by 0.5%p every three years to reach 5% by 2030.<sup>45</sup>

GHG emissions in the transportation sector can also be significantly reduced by minimizing time on the road, by leveraging the information communication technology (ICT) based real-time traffic update, extending the use of low-carbon transportation means and changing the driving habits. The Intelligent Transport System (ITS) applies information, communication and control technologies to transportational means and facilities, thereby optimizing and automating traffic operations, and providing traffic information to travellers, and enhances the mobility, safety and the convenience of the transport system. If ITS can be extended particularly to congested areas, traffic congestion can be relieved through real-time traffic management, and the overall energy efficiency of the roads can be improved. By implementing the Intelligent Transport System Master Plan 2020 (December 2011) and the ITS Plan 2020 for Automobile and Road Transportation Sector (June 2012), the government has defined the strategy to expand ITS nationwide, together with the targets for the respective areas.

GHG in the marine transportation sector can largely be reduced by increasing the supply of new eco-friendly ships<sup>46</sup> and abandoning or replacing existing old ships. To this end, the government is seeking to increase the supply of environmentally friendly ships in the public and the private sectors, by establishing a marine powerhouse through co-existence of marine and shipbuilding, which is one of the 100 government projects. In the private sector, since 2018, the government has been seeking to increase the demand for eco-friendly ships, by

<sup>45</sup> When updating the 2030 NDC, the ratio was agreed to be increased from 5% to 8% by 2030.

<sup>46</sup> The government 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 marine industry. During the first basic planning period (2021~2030), the focus will be on developing GHG reducing technologies and expanding the use of developed technologies to create the basis for reducing GHG generated by ships, in linkage with such major policies related to the Green New Deal and carbon neutrality. Specific goals are to: ① develop technologies to reduce GHG by 70%, and ② convert 15% of public and private sector ships to eco-friendly ships.

providing subsidy to old outbound vessels when they are being disposed of, and by subsidizing companies who replace their old domestic vessels aged over 20 years with eco-friendly vessels or build new vessels (approximately 10% of new shipbuilding cost). In the public sector, as per the Act on the Promotion of Development and Distribution of Environment-friendly Ships, public ships that are built after 2020 must be built as Green Ships, and the Ministry of Oceans and Fisheries (MOF) is taking pre-emptive measures, seeking to make all government-runner ships in possession (143 ships) 100% environmentally-friendly by 2030.

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

Category	2020	2021	2022	2023	2024
Shipbuilding for Replacement (#ships)	8	9	8	3	2

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

The Alternative Maritime Power supply (AMP) supplies the electricity required by a ship anchored at the port for its ballast water, freezer or air conditioning equipment with electricity from land, instead of using a power generator that uses bunker C oil. To reduce the fine dust and GHG generated by docked ships, target has been set 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 of AMP Installation

Category	2020	2025	2030
Target AMP Installation (#)	43	131	74

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

The domestic aviation industry is targeting to improve its efficiency by 1% each year. The performance has not yet achieved the target, but flag carriers are exerting efforts to utilize the technical aspects such as shortening the air routes or regularly cleaning the engines. Since 2010, the global aviation industry has been entering into the Agreement on Voluntary Greenhouse Gas Reduction in Aviation, encouraging airlines to voluntarily take part in GHG reduction. And every three years since 2012, the National Action Plan for GHG Reduction by International Airlines is being developed, aiming to increase the fuel efficiency of international airlines by average 1.3% per annum until 2025. The national reduction target does not apply to international airlines. However, the reduction efforts displayed by international airlines can have positive impact on domestic airlines. In addition, reduction of GHG emissions in the aviation industry is expected to further accelerate through participation in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSA) which will be implemented in 2021.



At the local government level, plans to promote the use of bicycles is being developed and executed. Other efforts by the local governments to ensure energy saving and GHG reduction include: planning for infrastructure development such as connecting severed bicycle roads; providing Carbon Point (eco mileage) incentives to bicycle users; partially reimbursing transportation expenses with mileages (Altteul Transportation Card System) when walking or cycling; and encouraging the use of public transportation and bicycles. Furthermore, pedestrian environment improvement projects are conducted at the national level. Implementing bicycle promotion policies customized to regions and users, and supporting the creation of safe bicycle environment are some of the various efforts that are in progress to improve the walking and cycling environment, with the view to promoting low-carbon transportation means.

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

Category	2018		2019
	Performance	Target	Target
Roads with ITS (km)	15,712	15,712	16,112
Extension of Railway (km)	4,274	4,274	4,410
Extension of Bicycle Roads (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 (10,000 tCO <sub>2</sub> eq.)	237	237	211
Freight Transport Converted from Road → Marine (10,000t)	262	262	248
Aircraft 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; not only are the policies promoting recycling, they now focus on economic and social circulation of resources. Particularly in 2016, the ROK is driving the transition to a plastic-free society by, such as, enacting the Framework Act on Resource Circulation (May 2016). GHG can be reduced in the waste sector largely by reducing the quantity of wastes and increasing recycling, and through recovery of methane from landfills. The Revised 2030 Roadmap (July 2018) suggests that 4.2 million tCO<sub>2</sub>eq. of GHG would be reduced through the former, and that 0.5 million tCO<sub>2</sub>eq. of GHG would be reduced by the latter 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"> <li>• Create a sustainable society supported by resource circulation by reducing landfill and maximizing recycling, leveraging resource circulation mechanism</li> <li>• Create the resource circulation mechanism leveraging various systems introduced with the Framework Act on Resource Circulation (May 2016) to build the infrastructure for resource circulation</li> <li>• Use the collected waste disposal charges to build the infrastructure for resource circulation mechanism necessary to expand recycling and reduce landfill</li> </ul>
First Resource Circulation Master Plan (2018~2027) (September 2018)	<ul style="list-style-type: none"> <li>• ROK is highly dependent on import due to scarce resources, and has difficulty securing additional landfills due to small area; transition to circular economy is urgent</li> <li>• Hence, the National Resource Circulation Master Plan has been implemented which specifies the country's mid- to long-term policy direction and detailed strategies to build circular economy</li> <li>• Based on the vision to create sustainable circular economy based on virtuous circulation of resources: ① enable resource circulation in all four steps of production–consumption–management–recycling; ② primarily reduce waste generation and promote reuse of high-quality materials; ③ develop core strategy such as optimizing waste disposal by region, based on governance with people's participation etc</li> </ul>

The First Framework Act on Resource Circulation (2018~2027) (September 2018) represents the national strategy established by the Ministry of Environment (MOE) to last for 10 years (2018~2027) for the purpose of encouraging efficient use of resources, suppressing waste generation and promoting circular utilization. The resource circulation policy can be largely broken down into: ① reduction and reuse policy; ② recycling policy; and ③ energy recovery policy.

The reduction and reuse policy deals with regulating the use of single-use items, regulating over-packaging, volume-rate garbage disposal system, reducing wastes produced at business sites, and refundable containers and so forth. The system to reduce wastes produced at business sites is designed to fundamentally suppress the generation of wastes not only during product distribution and consumption, but also at the production stage. Resource Circulation Performance Management System was introduced to enable the creation of the resource circulation system (2018); multi-layer performance of resource circulation is measured and evaluated at the national, regional and sectoral level.

The Resource Circulation Performance Management System (2018) determines the target of resource circulation and manages the progress at the city and the province level, and by 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 the 18 divisions as per the Korea Standard Industry Code (KSIC) that produced average 100 tons or more designated wastes per annum for the past three years or that produced



1,000 tons or more wastes other than designated waste. In order to verify waste reduction and the performance from the perspective of resource circulation, final disposal rate and recycling rate targets are assigned. Measures will be taken if the targets are not met, such as disclosing the name of the company or ordering a technology diagnosis.

As part of the recycling policy, waste disposal charge program, obligating separation of recyclable waste, Extended Producer Responsibility (EPR), Recycling Environmental Impact Assessment and various other advanced mechanisms have been introduced to promote recycling of wastes. In particular, the evaluation of materials and structures of all packaging materials subject to EPR has become mandatory, tiered disposal charges were introduced, the materials and the structures of electronic products have been improved, and a guideline was developed to provide information on resource circulation, enabling production by product groups. After the introduction of EPR, recycled waste from 43 items subject to EPR increased from 642,500 tons in 2003 to 1,204,000 tons in 2018, growing by 200%, and the recycling rate 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 (1,000 tons)	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>)

The waste disposal charge program is designed to charge the parties who have the obligation to dispose of the wastes by incinerating or burying (local governments and waste producing business sites), to encourage as much waste to be recycled as possible. The charge amount is determined in proportion to the quantity of incinerated or buried waste, and the charge rate differs according to the type of waste and how it is disposed of (buried or incinerated). In the case of business site wastes, charges were imposed on incinerated waste in 2018 and landfill waste in 2019; as for construction waste, charges were imposed and collected in 2018 for those construction projects that ended in 2018. The progress of operating the waste disposal charge program will be assessed in the mid- to long-term, and the program will be continuously improved by, for example, ensuring that charging payments to minimize waste incineration and landfill has actual effect.

Lastly, the focus of the energy recovery policy is to recover energy from waste resources, by such as generating energy from organic waste, producing Solid Refuse Fuel (SRF) and creating an environmentally-friendly energy town. Recycling is primarily pursued considering



the priority in waste disposal (reduction>reuse>recycling>energy recovery), and measures to promote energy recovery including the SRP quality grading system (2018) are introduced and promoted. Furthermore, to allow eco-friendly handling of wastes and to encourage that wastes are disposed of in an eco-friendly manner with the cooperation of the residents in the respective regions, the waste that is produced in one region needs to be disposed of in the same region of production, and direct burial of inflammable domestic waste is prohibited.

### – Public and Other Sectors

The ROK is exerting pre-emptive and proactive efforts to reduce GHG in the public and other sectors, and is taking the lead in GHG reduction by implementing the public sector TMS in around 780 institutions including the central administrative agency, local governments, public institutions, and national and public universities since 2011. Most of the major reduction measures devised for the buildings sector are applied to public buildings; in order for the public sector to lead GHG reduction, reduction policies are applied to public buildings before 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"> <li>• Reduce GHG by increasing investment in public sector</li> </ul>
First National Climate Change Adaptation Plan (December 2016)	<ul style="list-style-type: none"> <li>• Improve energy efficiency by increasing LED usage in public institutions and remodeling old buildings; enhance TMS</li> </ul>
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> <li>• Increase LED lighting supply from 90% to 100% by 2030</li> <li>• Replace all streetlamps to LED and renewable energy by 2030</li> <li>• Remodel buildings that are aged 15+ in the public facilities including elementary/middle/high schools and universities</li> </ul>

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 the public institutions are obligated to use new and renewable energy. In the case a government institution under the central or local government constructs a new building or extends or reconstructs an existing building whose floor area is 1,000m<sup>2</sup> or above, the building must be installed with the facility that enables a certain share of the energy consumption to be sourced from new and renewable energy. The annual share of mandatory use of new and renewable energy will be increased to 40% by 2030, in stages. As of 2018, the share of mandatory use of new and renewable energy is 24.6%, overachieving the target of 24%. The target for 2019 is 27%.<sup>47</sup>

<sup>47</sup> According to the New and Renewable Energy Act (October 2020), the mandatory share of new and renewable energy for 2020~2021 was 30% and the actual achievement was 30.7%, above the target of 30%.



Following the amendment of the Clean Air Conservation Act (November 2017), when the government agencies, local governments and public institutions that possess 10 or more vehicles purchase or lease new vehicles, all the new vehicles must be low-emissions vehicles, and penalty will be imposed on any violation from 2020. This policy was first implemented in the Seoul metropolitan area and has been subsequently expanded nationwide, and the target ratio had been increased from 70% in 2017 to 100%.

– Agriculture and Fisheries Sector

For the objective of reducing GHG in the agriculture and fisheries sector, the Detailed Master Plan for Climate Change Adaptation in Agriculture, Fisheries and Food Sector (2011~2020) (May 2011) and the Plan for Climate Change Implications and Response have been developed. Additional efforts are also in place such as developing low-carbon agricultural technologies aiming to reduce GHG, and introducing voluntary GHG reduction projects for the agricultural industry and farming villages (2012~) and the Low-carbon Agricultural and Fisheries 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"> <li>• Create sustainable agricultural and food foundation via GHG reduction and adapting to climate change</li> <li>• Transition to eco-friendly stockbreeding to reduce GHG</li> <li>• Improve agricultural production base, e.g. stable supply of agricultural water</li> </ul>
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> <li>• Most reduction in the agricultural sector is made through policy projects, since small-sized, unspecified mass of households emit GHG due to the nature of the industry</li> <li>• Create the environment for farmers to manage the agricultural water by providing training through Agricultural Technology Center and improving the irrigation facilities including waterway</li> <li>• Enhance efficiency of livestock excretions treatment and efficiency of bio-gas production by improving purification system and preprocessing procedure and developing digestion tank operation technology etc</li> <li>• Use bio-technology to develop technology to reduce methane emitted by livestock and supply low-methane feed</li> <li>• Enhance energy efficiency of fishing boats by replacing old littoral fishing boats etc</li> </ul>

As part of the voluntary GHG reduction projects, external companies are invited to manage K-ETS in the agricultural sector since 2015. Also, Smart Farms are increasingly created as a means to save energy, reduce GHG and enhance productivity in agriculture and stockbreeding.

Furthermore, in order to accurately identify the quantity of GHG emitted at fishing sites, sample littoral fishing boats representing nine sub-sectors including offshore longline fishing has been used since 2014 to examine the quantity of GHG emissions. To ensure that GHG is actually reduced, fishing communities are supported with fuel consumption reduction devices to enhance the efficiency of fishing boats together with energy-saving LED lights, and inefficient, old engines, equipment and systems are replaced for littoral fishing boats. R&D is underway since 2021 to develop energy-efficient, eco-friendly fishing boats, and the developed eco-friendly boats will start to be used from 2026.

According to the Rural Development Administration, when the rice paddy is filled with lesser water of 2~5cm depth after the cycle of drying up the rice paddy, three years' average annual GHG emissions decreases by 63.% compared to when the rice paddy is again flooded with water after the dry cycle, as oxygen is naturally supplied to the land. 50.6% less GHG is emitted when compared with the simple intermittent irrigation method. The area of rice farms decreased by 2.2% in 2018, compared to 2017, and the percentage of the area that is being dried up for over two weeks has increased (33%→38%). However, adoption rate of this method has been stagnant at around 84~87% since 2015. The Revised 2030 Roadmap (July 2018) set the target of increasing the area adopting the dry cycle method to 97% by 2030.

Under the voluntary GHG reduction project for agricultural industry and farmhouses that began in 2012, incentive is paid corresponding to the amount of GHG reduced by engaging in GHG reduction activities, such as saving agricultural resources based on resource circulation by farming entities and saving energy by installing energy reduction facilities. As of 2018, total 778 farming households have reduced 75,856 tCO<sub>2</sub>eq. of GHG.

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

Year	#Registration	#Registered Farmhouses	#Certification	#Certified Farmhouses	Quantity of Reduction (tCO <sub>2</sub> 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)



The Low-carbon Agricultural and Livestock Goods Certification System is a national certification system that is applied to the scope of 61 items; it attests that eco-friendly or GAP (Good Agricultural Practices)-certified agricultural and livestock goods have reduced GHG emissions during the course of their production by using low carbon agricultural technology. The Operational Rules for Low-carbon Agricultural and Livestock Goods Certification (March 2014) was implemented to provide the grounds for its operation, and the mark to indicate government-certified agricultural and livestock goods has started to be placed on certified agricultural and livestock goods since 2014.

A smart farm refers to a farm that can be maintained and managed by minimizing the use of unnecessary inputs (fuel, fertilizer, water, etc) by leveraging ICT and renewable energy. The government prepared measures to expand smart farms in 2018, based on which four Smart Farm Innovation Valleys are being built to serve as the hubs for dispersing smart farms by 2022. As of 2018 (cumulative basis), smart farms have been built at 1,425 stockbreeding farmhouses, and the area of horticultural smart farm reached 4,900ha. The plan is to expand the application to 5,750 farmhouses and 7,000ha by 2022.

Livestock smart farm uses a combination of ICT including communication, sensor, CCTV, IoT, big data, robotics and artificial intelligence so as to manage the environment of the sheds and the livestock in a remote and automated manner, thereby reducing manual labor and enhancing productivity. To create the basis for sustainable agricultural and food industry, one of the 100 policy tasks, Ministry of Agriculture, Food and Rural Affairs (MAFRA) is targeting 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 : tCO<sub>2</sub>eq.)

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 emissions by fishing boats. It is currently developing a high-efficiency standard vessel model for littoral fishing boats, that could reduce carbon emission by 7% per ton. In addition, it is continuously driving the replacement of old engines in order to keep reducing carbon emissions by fishing boats and the fisheries industry.

### – Forest Carbon Sink Sector

The ROK has been establishing the Forestry Master Plan since 1973 for every 20 years for forest management. To enable the forest carbon sinks to absorb more GHG, forests are continuously maintained by planting trees after lumbering, and afforestation. The Comprehensive Plan for Improvement of Carbon Sinks (2015~2019) (December 2014) was established to respond to climate change by maintaining and enhancing the GHG absorption by the forests; the progress is checked 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"> <li>• Contribute to GHG reduction by enhancing the adaptation of carbon sinks (e.g. forest) to climate change</li> <li>• Manage forests systematically and intensively through commercial forest complexes</li> <li>• Enhance carbon absorption by forests by replacing afforestation tree species and creating forests by function</li> <li>• In regions where water yield function, maintaining scenery and disaster prevention are important, create multi-layered forests to ensure ecological health and sustainable carbon absorption</li> <li>• 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</li> </ul>
Sixth Forestry Master Plan (2018~2037) (January 2018)	<ul style="list-style-type: none"> <li>• Strengthen the role of forests to achieve Sustainable Development Goals (SDG)</li> <li>• Promote eco-friendly forestation projects and increase forest welfare service</li> <li>• Rational use of mountain land and conservation of ecosystem</li> </ul>
Second Comprehensive Plan for Improvement of Carbon Sinks (January 2018)	<ul style="list-style-type: none"> <li>• Promote carbon absorption, storage, reduction via forests</li> <li>• Strengthen capacity of forestry and forests to adapt to climate change</li> <li>• Enhance GHG statistics and expand forest carbon offset program</li> <li>• Enhance global cooperation for the new climate regime</li> <li>• Expand climate technology R&amp;D</li> </ul>
Revised 2030 Roadmap (July 2018)	<ul style="list-style-type: none"> <li>• Virtuous carbon cycle based forest management by creating commercial forest complex, developing forest management plan considering carbon absorption capacity and forest trail system; increasing carbon absorption by forest tree species; creating multi-layer/mixed forest and functional forests</li> <li>• Create new carbon sinks by expanding urban forests in residential areas, converting idle land (marginal land) to forest, creating coastal forest belt</li> <li>• Improve carbon storage effect by managing domestic lumber history and expanding lumber production, developing lumber processing technology to prolong carbon storage period</li> </ul>



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

The Sixth Forestry Master Plan (January 2018) seeks to strengthen the role of the forests to achieve Sustainable Development Goals (SDGs). The management system for forest resources and mountain land will further be advanced, lumber industry will be nurtured, and the value-added of domestic wood will be improved so that such efforts lead to fostering the forest industry and creating jobs. 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 on forestry and seeking to complete forestation in the Korean peninsula.

〈Table 3–25〉 Forest Carbon Absorption Status and Target

(Unit: 1,000 tCO<sub>2</sub>eq.)

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 those entities that voluntarily conduct forest carbon offset activities for the amount of carbon absorbed by their efforts under the Forest Carbon Offset Scheme. To promote the Scheme, KFS provides information on the types of forest carbon offset projects available and supports the entities to fulfill the administrative procedure.

As per the Revised 2030 Roadmap (July 2018), 21.17 million tCO<sub>2</sub>eq., which accounts for 95.8% of the 22.1 million tCO<sub>2</sub>eq. that is absorbed by forests, shall be absorbed by forests by creating commercial forest complexes, developing forest management plan, considering carbon absorption capacity, and forest trail system, increasing carbon absorption by forest tree species, and creating multi-layer/mixed forests and functional forests by 2030. Since designating 2.92 million ha of 450 commercial forest complexes by grouping forests with good management conditions for the first time in 2005, the government is currently re-organizing the forests into plantations to optimize their management. In 2016, areas no

longer suitable for business after 10 years elapsed since the designation of commercial forest complexes were excluded, and new areas with forest trail facilities that are suitable for business were added, resulting in 387 commercial forest complexes of 2.34 million ha.

Offering tax benefit when developing forest management plans could be helpful, in that well-deliberated forest management could reinforce the function of the forests as carbon sinks. To encourage entities engaged in forestry to maintain their business for a long period, a new section has been added to the Special Tax Treatment Control Act (September 2017) to exempt capital gains tax on self-cultivated mountain land (Article 69.4). KFS developed the plan to expand the support system in connection with such tax laws and subsidies, and in the mid-to long-term, to strengthen the promotion of such benefits offered for forest management plans by producing and distributing brochures.

#### [Reference] Future Plans for the Forest Sector

The Revised 2030 Roadmap expects that 0.9 million tCO<sub>2</sub>e 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 lumber processing technology to prolong the carbon storage period. As forests in the ROK were mostly created in 1970s and their lumbering period is approaching, relevant agencies and departments plan to establish a special avenue dedicated to regionally produced wood, create jobs in the region by building wooden houses and daily SOC with timber, and developing eco-friendly wood city and timber buildings. In the mid-to long-term, a roadmap will be prepared by 2024, and total 8.4 billion won will be invested to implement the pilot wood city project and operate support groups for the wood city and so on.

Although not included in the 2030 GHG reduction target, there are carbon sinks other than forests, such as coastal wetlands. Blue carbon refers to the carbon captured by the world's coastal ecosystem: the carbon absorbed by salt plants in the coasts through photosynthesis, together with the carbon captured by the coastal ecosystem from the movement of deposits from the neighboring land and ocean ecosystems. And it is highlighted as a new GHG absorption option.

The speed of GHG absorption by the ocean ecosystem is up to 50 times faster than that of the land ecosystem. As it is submerged in water and is thus anaerobic, decomposition of the organism happens slowly, so the carbon captured inside the plant stays there for a long time. The ROK has the world's fifth largest tideland with the total area of 2,482km<sup>2</sup>, and has a huge potential in blue carbon. However, the loss of tidelands has been rapidly taking place recently due to coastal development and environmental pollution, so it is necessary to protect and restore the coastal habitat. To restore the natural state of polluted and damaged ocean ecosystem including closed salt farms, closed aquafarms and idle tideland, MOF established the First Master Plan for Management and Restoration of Tideland, etc (2021~2025) (August 2021), and plans to restore total 4.5km<sup>2</sup> of tideland by 2025.

Furthermore, through Blue Carbon Phase 1 (2017~2021), the technology to measure and validate the amount of carbon absorbed by salt marshes, tidelands and seagrasses is being developed; Blue Carbon Phase II (2022~2026) will begin in 2022 to develop the technology to discover and enhance new carbon sinks, so as to establish the basis for reducing carbon at the oceans.



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

Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>30</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
All sectors	Emissions Trading System	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O HFCs PFCs SF <sub>6</sub>	Use market function to effectively achieve national GHG reduction target	<ul style="list-style-type: none"> <li>Managing over 70% of national GHG emissions through K-ETS since January 2015</li> <li>Phase I (2015~2017) and Phase II (2018~2020), respectively, lasting 3 years; Phase III and on to last 5 years</li> <li>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)</li> </ul>	Regulation	<ul style="list-style-type: none"> <li>Ministry of Economy and Finance</li> <li>Ministry of Land, Infrastructure and Transport</li> <li>Ministry of Agriculture, Food and Rural Affairs</li> <li>Ministry of Trade, Industry and Energy</li> <li>Ministry of Oceans and Fisheries</li> <li>Ministry of Environment</li> </ul>	In progress	2015	GHG reduced (tCO <sub>2</sub> eq.)
	GHG · Energy Target Management System	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	GHG reduction and energy saving	<ul style="list-style-type: none"> <li>GHG emissions and energy consumption are regulated to achieve national mid-term long-term GHG reduction target and to save energy</li> <li>In 2015, 740,000 tCO<sub>2</sub>eq. of GHG were reduced from all controlled entities</li> </ul>	Regulation	<ul style="list-style-type: none"> <li>Ministry of Environment/ Korean Environment Corporation</li> <li>Ministry of Trade, Industry and Energy/Korea Energy Agency</li> <li>Ministry of Land, Infrastructure and Transport/ Korea Energy Agency, Korea Real Estate Board, Korea Transportation Safety Authority</li> <li>Ministry of Agriculture, Food and Rural Affairs/Foundation of Agricultural Technology Commercialization and Transfer/ Korea Tree Health Association</li> <li>Ministry of Oceans and Fisheries/ Korea Maritime Transportation Safety Authority</li> </ul>	In progress	2010	GHG reduced (tCO <sub>2</sub> eq.)



Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Transition	GHG Energy Target Management System in public sector	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	GHG reduction and energy saving	<ul style="list-style-type: none"> <li>GHG emissions and energy consumption of high GHG emissions &amp; high energy consuming companies are regulated to achieve national mid- to long-term GHG reduction target and to save energy</li> <li>In 2018, 410,000 tCO<sub>2</sub>e of GHG were reduced from all controlled entities (774 institutions)</li> </ul>	Voluntary Agreement	Ministry of Environment/ Korean Environment Corporation	In progress	2011	Public sector GHG reduced (tCO <sub>2</sub> e)
	Mix of low-carbon power supply	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Maintaining stable demand & supply of power, and GHG reduction	<ul style="list-style-type: none"> <li>Based on the Basic Plan for Long-term Power Supply and Demand (December 2017), to expand low-carbon power generation facilities to ensure stable power demand &amp; supply and to reduce GHG</li> </ul>	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 <sub>2</sub>	Create new & renewable energy market and reduce GHG by promoting stable investment environment in new & renewable energy industry	<ul style="list-style-type: none"> <li>To mandate entities that produce certain level of power (500+ MW) to supply a certain proportion of total power generation in new &amp; renewable energy</li> </ul>	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 <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	National energy saving and GHG reduction	<ul style="list-style-type: none"> <li>To supply energy (thermal or thermal and electricity) produced by 1 or more concentrated energy generation facilities such as combined heat power plant, heat-only boiler, resource recovery facility, etc. to regional heating and cooling companies, and district energy companies for industrial complexes</li> </ul>	Policy	Ministry of Trade, Industry and Energy/ District Heating Entities (74), Korea Energy Agency	In progress	1985	Quantity of heat sold & electricity sold (%)



Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Industry	Mandatory Energy Diagnosis System	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Enhancing efficiency of energy utilization of high energy consuming companies	<ul style="list-style-type: none"> <li>To mandate companies using 2,000toe or more per year to receive periodical energy diagnosis</li> </ul>	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	2007	Quantity of potentially saved energy (toe)
	Consultation on energy utilization plan	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Promoting rational energy utilization and energy saving	<ul style="list-style-type: none"> <li>To analyze the impact of projects subject to consultation and installation of facilities on demand &amp; supply of energy, and the impact of energy consumption on GHG emissions</li> <li>To draw up the plan to supply the energy in demand, and the plan on rational energy consumption and its evaluation</li> </ul>	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1993	–
	Investment support and tax support for energy saving facility	CO <sub>2</sub>	Acceleration of supply of energy-saving facilities, and enhancement of efficiency of energy saving and energy utilization	<ul style="list-style-type: none"> <li>To provide long-term low-interest loan to cover the investment made to rationalize energy utilization and to install energy-saving facilities for GHG reduction</li> </ul>	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1980	Quantity of energy saved (toe)
	Project expansion by companies specializing in energy saving	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Acceleration of supply of energy-saving facilities, and enhancement of efficiency of energy saving and energy utilization	<ul style="list-style-type: none"> <li>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</li> </ul>	Policy	– Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1992	–

Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Industry	Energy Consumption Efficiency Rating System	CO <sub>2</sub>	Promotion of development of technology to produce high-efficiency products and guiding consumers to purchase energy-saving products	<ul style="list-style-type: none"> <li>Labeling efficiency rating (grade 1~5) according to the product's energy consumption</li> <li>Products that do not meet the minimum efficiency requirement are banned from production and sales</li> </ul>	Policy	Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1992	Number of items in scope
	Standby Power Reduction Program	CO <sub>2</sub>	Expediting installation of standby power reduction function in electronic products and promoting distribution of products with good standby power reduction capacity	<ul style="list-style-type: none"> <li>Encouraging adoption of power saving mode during standby time and minimization of standby power</li> <li>Energy conservation mark can be optionally placed on products satisfying standby power reduction requirement; non-satisfaction of the requirement must be indicated on the product</li> </ul>	Policy	Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1999	—
	High-efficiency Equipment Certification System	CO <sub>2</sub>	Acceleration of supply of high-efficiency equipment with huge energy saving effect	<ul style="list-style-type: none"> <li>Government to certify products that exceed a certain level of energy consumption efficiency to promote development and distribution of technologies for high-efficiency products</li> <li>Hand out certificate for certified product, and label the product with high energy efficiency equipment mark</li> </ul>	Policy	Ministry of Trade, Industry and Energy/ Korea Energy Agency	In progress	1996	—



Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Industry	Factory Energy Management System (FEMS)	CO <sub>2</sub>	Maximizing productivity and energy efficiency through comprehensive management of factories' production and non-production facilities	<ul style="list-style-type: none"> <li>Revised 2030 Roadmap (July 2018) designated Factory Energy Management System (FEMS) as one of the major GHG reduction measures for the industry sector</li> <li>FEMS is installed in 227 business sites, cumulatively, as of 2021</li> </ul>	Policy	Ministry of Trade, Industry and Energy	In progress	2014	–
	Energy Efficiency Resource Standard (EERS)	CO <sub>2</sub>	Assigning specific energy efficiency improvement obligation to energy suppliers	<ul style="list-style-type: none"> <li>To distribute individual energy reduction duty to electricity, gas, heat suppliers and imposing penalty or providing incentive according to the performance, in order to achieve the energy efficiency enhancement target set by the government</li> <li>Korea Electric Power Corporation: 2019 target to save energy by 0.2%</li> <li>Korea Gas Corporation: 2019 target to save energy by 0.2%</li> <li>Korea District Heating Corporation: 2019 target to save energy by 0.15%</li> </ul>	Regulation	Ministry of Trade, Industry and Energy	In progress	2018	Quantity of energy saved
Buildings	Stronger energy performance criteria for such as insulation	CO <sub>2</sub>	Ensuring efficient energy utilization in buildings 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"> <li>Strengthening the standards on designing buildings to consider energy conservation, such as insulation requirement, to ensure efficient building energy management</li> <li>※ Windows &amp; doors (W/m<sup>2</sup>/K) : (July 2008) 3.0 → (2010) 2.1 → (2013) 1.5 → (2015) 1.2 → (2017) 0.9</li> <li>※ Exterior wall (W/m<sup>2</sup>/K) : (July 2008) 0.47 → (2010) 0.36 → (2013) 0.27 → (2015) 0.21 → (2017) 0.15</li> </ul>	Regulation	Ministry of Land, Infrastructure and Transport/ Korea Energy Agency	In progress	2001	Number of energy saving plan reviewed

Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Buildings	Zero Energy Buildings	CO <sub>2</sub>	Effectively achieving national GHG reduction target by building zero energy buildings that minimize energy load for the building upon new construction and minimize energy consumption by using new & renewable energy	<ul style="list-style-type: none"> <li>Since implementation of Zero Energy Building Certification system in January 2017, 1,233 buildings have been certified so far (June 30, 2021)</li> </ul>	Regulation	<ul style="list-style-type: none"> <li>Ministry of Land, Infrastructure and Transport / Ministry of Trade, Industry and Energy</li> </ul>	In progress	2017	Number of zero energy building certifications
	Support for interest payment for Green Remodeling	CO <sub>2</sub>	Encouraging private building owners to seek to improve the performance of their building without burden of initial expenses by providing financial support	<ul style="list-style-type: none"> <li>Supported around 58,000 cases to date (June 30, 2021) after starting to subsidize interest payments for private sector green remodeling in January 2014</li> </ul>	Fiscal	<ul style="list-style-type: none"> <li>Ministry of Land, Infrastructure and Transport</li> </ul>	In progress	2014	Number of interest payments supported for private sector green remodeling
	Certification for energy-saving eco-friendly Green Houses	CO <sub>2</sub>	Introducing new & renewable energy and using high-efficiency facilities and eco-friendly insulation etc. and refraining from using fossil fuels as much as possible, to supply houses that reduce energy consumption and GHG emissions	<ul style="list-style-type: none"> <li>Multi-dwelling buildings housing 30+ households must submit the Green Home performance evaluation and the proof documents to the approver (head of local government), after which the construction project will be approved or not according to the opinion of energy expert institutions such as KEA                             <ul style="list-style-type: none"> <li>Energy efficiency of the Green Home is assessed from diverse angles including performance evaluation, design criteria and efficiency rating certificate</li> <li>490,000 Green Homes built in 2018, 410,000 in 2019</li> </ul> </li> </ul>	Regulation	<ul style="list-style-type: none"> <li>Ministry of Land, Infrastructure and Transport</li> </ul>	In progress	2009	Number of certifications



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Buildings	Carbon Point Program	CO <sub>2</sub>	Nationwide GHG reduction program that provide Carbon Point and incentives, based on the reduction of use of electricity, water and gas	<ul style="list-style-type: none"> <li>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</li> <li>Based on number of households:               <ul style="list-style-type: none"> <li>2.87 million households and 2.99 million households took part in the Program, respectively, in 2018 and 2019</li> </ul> </li> </ul>	Others	– Ministry of Environment	In progress	2009	–
	Advanced Metering Infrastructure (AMI)	CO <sub>2</sub>	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"> <li>AMI is core infrastructure to manage energy consumption through remote, real-time inspection of energy consumption and interactive exchange of information using fixed and mobile communication</li> <li>AMI consists of interactive communication based digital meter, and other equipment for transmitting electricity usage data and control.</li> <li>– Cumulatively, 7 million AMIs were installed in 2018 and 848 in 2019</li> </ul>	Others	– Ministry of Trade, Industry and Energy/ Korea Electric Power Corporation	In progress	2010	Number of installations

Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Transportation	Reinforcing average fuel efficiency criteria for passenger cars and supply of eco-friendly vehicles	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	GHG reduction by strengthening passenger car fuel efficiency and increasing supply of eco-friendly vehicles	<ul style="list-style-type: none"> <li>Manage average fuel efficiency criteria for passenger cars</li> <li>Strengthen average fuel efficiency of passenger cars (33.1km/ℓ by 2030)</li> <li>Supply eco-friendly vehicles</li> <li>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 companies</li> <li>Supply hybrid vehicles (4 million by 2030)</li> <li>Supply electric vehicles (3 million by 2030)</li> <li>Supply hydrogen electric vehicles (850,000 by 2030)</li> <li>Average fuel efficiency of medium &amp; large vehicles</li> <li>2.0% improvement by 2023 compared to 2021~2022, 7.5% improvement by 2030</li> </ul>	Regulation, Research (Technology development)	<ul style="list-style-type: none"> <li>Ministry of Land, Infrastructure and Transport</li> <li>Ministry of Trade, Industry and Energy</li> <li>Ministry of Environment</li> </ul>	In progress	2017	Based on passenger car fuel efficiency
	Mix of bio-diesel for road sector	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Mandating the mix and supply of bio-diesel in diesel fuel for cars	<ul style="list-style-type: none"> <li>Mandating 3% of bio-diesel to be mixed in diesel fuel for cars by 2020</li> </ul>	Regulation	Ministry of Trade, Industry and Energy	In progress	2015	Percentage of bio-diesel mixed
	Introduction & operation of wired/wireless rechargeable electric buses	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Commercialization of wired/wireless chargeable electric buses to replace intra-city buses that run on diesel and CNG	<ul style="list-style-type: none"> <li>To supply 12,300 electric buses (battery exchange type, wireless charging) by 2030</li> </ul>	Others	<ul style="list-style-type: none"> <li>Ministry of Trade, Industry and Energy</li> <li>Ministry of Environment</li> </ul>	Planning stage	2017	Number of wired/wireless chargeable electric buses



Sector <sup>46</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Transportation	Reduced use of passenger cars and expansion of public transportation	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Expanding public transportation by suppressing the use of passenger cars via traffic demand management and by developing the transport system focusing on public transportation	<ul style="list-style-type: none"> <li>• Suppress use of passenger cars               <ul style="list-style-type: none"> <li>– Expand introduction and use of Allteul Transportation Card</li> <li>– Designate and operate special measure zones</li> <li>– Designate and operate zones restricting entry of old vehicles</li> <li>– Operate rotational driving system to reduce fine dust</li> </ul> </li> <li>• Expand public transportation               <ul style="list-style-type: none"> <li>– Expand Bus Rapid Transit (BRT) and build transfer facility</li> <li>– Improve services by expanding railway network including high-speed, metropolitan and urban railway, and providing faster transportation</li> <li>– Expand BIS (Bus Information System)</li> <li>– Improve bus system by expanding M-buses (express metropolitan) and metropolitan buses, etc</li> </ul> </li> </ul>	Regulation, (Technology development)	<ul style="list-style-type: none"> <li>– Ministry of Land, Infrastructure and Transport</li> <li>– Ministry of Environment</li> </ul>	In progress	2017	Share of public transportation used for transport (%)
	Streamlining green transport	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Accelerate shifting road transport to rail and coastal shipping	<ul style="list-style-type: none"> <li>• To provide subsidy for road freight being shifted to rail or marine transportation               <ul style="list-style-type: none"> <li>– (Rail) Total freight shifted to rail transportation between 2010~2020 reached 7.6 billion tons · km</li> </ul> </li> </ul>	Voluntary Agreement	<ul style="list-style-type: none"> <li>– Ministry of Land, Infrastructure and Transport</li> <li>– Ministry of Oceans and Fisheries</li> </ul>	In progress	2010	Transportation converted (ton · km.)
	Enhancing efficiency of air transport	CO <sub>2</sub>	GHG reduction in aviation sector by improving aircraft fuel efficiency	<ul style="list-style-type: none"> <li>• To strengthen technical management such as managing aircraft engine and weight to enhance their fuel efficiency</li> </ul>	Others	<ul style="list-style-type: none"> <li>– Ministry of Land, Infrastructure and Transport</li> </ul>	In progress	2018	Energy efficiency improvement (%)



Sector <sup>48</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>49</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Transportation	Intelligent Traffic System (ITS)	CO <sub>2</sub>	Automated and systematic operation and management of transportation system to promote people's transportation convenience and safety	<ul style="list-style-type: none"> <li>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 the components of transportation system including transportation facilities such as road, rail and airport, and transportation means such as automobile and trains                             <ul style="list-style-type: none"> <li>Examples of ITS: bus arrival notice system at bus stations, automatic intersection traffic control system based on the traffic volume, real-time traffic information on navigation systems, bypass</li> <li>Investment to reduce traffic congestion (traffic congestion costs) has been steadily rising by average 2.0% per year for the past 10 years</li> <li>Length of roads installed with ITS was 15,712km in 2018 and 16,112km in 2019</li> </ul> </li> </ul>	Others	<ul style="list-style-type: none"> <li>Ministry of Land, Infrastructure and Transport,</li> <li>National Transport Information Center</li> </ul>	In progress	2011	-
	Passenger car mileage	CO <sub>2</sub>	Providing mileage according to the amount of GHG reduced by citizens by voluntarily reducing the driving distance	<ul style="list-style-type: none"> <li>Implemented the Municipal Ordinance on Accumulation of Eco Mileage after the discontinuance of Daily Rotational Driving System                             <ul style="list-style-type: none"> <li>Providing 20,000~70,000 points (1 point corresponding to 1 won) of incentive according to reduction rate and distance; after comparing annual average driving distance and 1-year driving distance after joining the program; earned points can be used to pay car tax</li> <li>A member of Eco Mileage Program will receive 3,000 points every time he/she does not drive his/her car when emergency action against fine dust has been announced, after reviewing the submitted proof</li> </ul> </li> </ul>	Voluntary Agreement	Seoul City	In progress	2017	Contribution in GHG reduction



Sector <sup>46</sup>	Title of Action	Regulated Gas	Objective	Overview of Reduction Action and Progress (Key Achievements) <sup>48</sup>	Type of Means <sup>50</sup>	Ministry/Agency	Delivery Status <sup>51</sup>	Year of Implementation	Performance
Transportation	Alteul Transportation Card	CO <sub>2</sub>	Introduced to support the transportation cost of people 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"> <li>Alteul Transportation Card intends to cut transportation cost by up to 30%, by accumulating mileage proportionate to the distance of walking or riding bicycle               <ul style="list-style-type: none"> <li>Provides discount on public transportation by combining public transportation pass and mileage</li> <li>The policy aims to encourage use of public transportation, walking and riding bicycles, and suppress use of passenger cars to promote sustainable advancement of the transportation system, by accumulating mileages corresponding to the distance to the station or the destination moved via public transportation (20% of public transportation cost) and by the card issuer providing additional discount (10% of public transportation cost)                   <ul style="list-style-type: none"> <li>Currently implemented in 137 cities and districts, to be continuously extended</li> <li>Reduced average 12,862 won per month per capita (20.2% of public transportation cost)</li> <li>Boosted number of times of using public transportation by 7.6% (29.1→31.3 times)</li> <li>89% user satisfaction regarding the overall Alteul Transportation Card system</li> </ul> </li> </ul> </li> </ul>	Others	– Ministry of Land, Infrastructure and Transport	In progress	2019	–
Waste	Increasing domestic waste recycling and reducing waste landfill	CO <sub>2</sub> CH <sub>4</sub>	GHG emissions reduction by increasing recycling of domestic waste and decreasing landfills	<ul style="list-style-type: none"> <li>To reduce GHG emissions generated in the course of burying and incinerating wastes by increasing recycling of domestic wastes and decreasing landfills and incineration</li> </ul>	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2008	Recycling rate of domestic wastes (%)

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Waste	Increasing business site waste recycling and reducing waste landfill	CO <sub>2</sub> CH <sub>4</sub>	GHG emissions reduction by increasing recycling of business site waste and decreasing landfills	<ul style="list-style-type: none"> <li>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</li> </ul>	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2008	Recycling of business site wastes (%)														
	Increase recovery of methane gas from landfills	CH <sub>4</sub>	Reduce GHG emissions by recovering more methane gas through capturing and utilizing landfill gas	<ul style="list-style-type: none"> <li>To reduce a portion of GHG emitted by burying wastes through recovery of methane gas from landfills</li> <li>– In 2015, 118,000 tCO<sub>2</sub>eq. of methane gas was recovered from landfills nationwide</li> </ul>	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2010	Recovered methane gas (1,000 tCO <sub>2</sub> eq./year)														
	Extended Producer Responsibility (EPR)	CO <sub>2</sub>	The producer, who has the greatest decision power in product design and packaging selection, should play the integral role in the recycling system	<p>To mandate product manufacturers or manufacturers of products that use packaging to recycle a certain portion the wastes generated from the respective products or packaging; when violating this obligation, a fine that exceeds the amount required for recycling is charged to the manufacturer</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
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Waste	Waste Disposal Charge Program	CO <sub>2</sub>	Encouraging recycling as much as possible by charging those who dispose of wastes by incineration or landfill (local government and business sites that generate wastes)	<ul style="list-style-type: none"> <li>Charges are determined in proportion to the quantity of waste incinerated or buried; charge rate differs according to the type of waste and how the waste is disposed of (landfill or incineration)</li> <li>Wastes are categorized into domestic waste and business site waste; the program is operated via periodical and ad hoc reporting</li> </ul>	Regulation	– Ministry of Environment/ Korean Environment Corporation	In progress	2018	–
	Increase area applied with intermittent irrigation	CH <sub>4</sub>	GHG reduction through irrigation management	<ul style="list-style-type: none"> <li>To reduce GHG generated from rice paddy through development and distribution of technology to use less water for irrigation</li> <li>Promote intermittent irrigation by providing education for New Year's farming planning by Agricultural Technology Center and safely cultivating high-quality rice production management</li> <li>Enhance irrigation conditions by improving and repairing irrigation facilities such as waterways</li> <li>※ (2015) 551km / Cumulatively 8,111km → (2018) 122km / Cumulatively 9,036km</li> </ul>	Education, Fiscal policy	– Ministry of Agriculture, Food and Rural Affairs/ Rural Development Administration	In progress	2010	Percentage of area with Intermittent irrigation (%)
	Reduce use of chemical fertilizer	N <sub>2</sub> O	GHG emissions reduction through less use of chemical fertilizer	<ul style="list-style-type: none"> <li>To reduce use of chemical fertilizers through increased support for organic fertilizers and soil conditioners</li> <li>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</li> <li>※ Number of fertilizer prescriptions prescribed: (2015) 525,000 cases → (2018) 598,000</li> <li>– Providing education on the right use of farming equipment to reduce utilization of chemical fertilizer</li> </ul>	Technology development, Education	– Ministry of Agriculture, Food and Rural Affairs/ Rural Development Administration	In progress	2000	Quantity of chemical fertilizer used (kg/ha)

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Agriculture, livestock and fisheries	Expand facilities to treat livestock excretion	CH <sub>4</sub>	GHG reduction by using livestock excretion as a resource	<ul style="list-style-type: none"> <li>To reduce GHG by using livestock excretion for energy and increasing facilities to make composts and liquefied manure</li> <li>Reduce GHG by supporting continuous expansion of facilities to generate energy from livestock excretion and facilities to produce common resources</li> <li>Facilities to generate energy from livestock excretion: (2015) 3 venues → (2018) 6 venues</li> <li>Facilities to convert livestock excretion to resource: (2015) 76 venues → (2018) 86 venues</li> </ul>	Fiscal policy	Ministry of Agriculture, Food and Rural Affairs	In progress	2007	Number of livestock excretion treatment facilities
	Expand cultivation of high-quality forage	CH <sub>4</sub>	GHG reduction through increased supply of high-quality forage	<ul style="list-style-type: none"> <li>To reduce GHG by improving intestinal fermentation of livestock through cultivation of high-quality forage and increased supply to livestock</li> <li>Full implementation of "forage quality rating system" to facilitate production and utilization of high-quality forage (2016)</li> <li>Promoting stable expansion of forage production base by continuously expanding specialized forage production complexes by grouping the facilities and ensuring scale</li> <li>Specialized complexes: (2015) 19,314.1ha (40 venues) → (2018) 23,763.1ha (54 venues) / increased by 4,449ha</li> </ul>	Regulation, Fiscal policy	Ministry of Agriculture, Food and Rural Affairs	In progress	1998	Quantity of high-quality forage supplied (1,000 tCO <sub>2</sub> eq.)
	Expand supply of new & renewable energy facilities	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Reducing GHG generated by controlled agriculture by increasing the supply of new & renewable energy facilities	<ul style="list-style-type: none"> <li>To reduce the use of chemical fertilizers by increasing the supply of new &amp; renewable energy facilities for controlled agriculture</li> <li>Reducing GHG by supporting heating and cooling facilities that use new &amp; renewable energy such as geothermal heating/cooling facility and heaters using wooden pellets inside the greenhouse</li> <li>Increased supply of new &amp; renewable energy such as geothermal heat and wooden pellet (2015) 944ha → (2018) 991ha</li> </ul>	Fiscal policy	Ministry of Agriculture, Food and Rural Affairs	In progress	2010	Area supported with new & renewable energy facility (ha)



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Agriculture, livestock and fisheries	Expand supply of energy saving facilities	CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> O	Reducing GHG generated by controlled agriculture through increased supply of energy saving facilities	<ul style="list-style-type: none"> <li>To reduce the use of fossil fuels by increasing the supply of energy saving facilities for controlled agriculture               <ul style="list-style-type: none"> <li>Reducing GHG by using less fossil fuels through supply of energy saving heat-conservation materials such as multi-layer thermal curtains</li> <li>Increased installation of energy saving equipment such as thermal covers, multi-layer thermal curtains, etc.: (2015) 7,961ha → (2018) 11,304ha</li> </ul> </li> </ul>	Fiscal policy	Ministry of Agriculture, Food and Rural Affairs	In progress	2009	Area supported with energy saving facility (ha)
	Support for high-efficiency fuel-saving devices for fishing boats	CO <sub>2</sub>	GHG reduction by supporting the replacement of old engines of littoral fishing boats and supplying high-efficiency LED lamps (fishing lamp, lamp for other fishing boat related work)	<ul style="list-style-type: none"> <li>To reduce GHG by supporting fishing boats with high-efficiency fuel-saving equipment               <ul style="list-style-type: none"> <li>Been supplying energy-efficient LED lamps and fishing lamp reflector since 2009</li> <li>Supplying fuel saving equipment for fishing boats</li> <li>Replacing inefficient and old engines</li> </ul> </li> <li>To facilitate high-efficiency LED lamp supply and old engine replacement for littoral fishing boats               <ul style="list-style-type: none"> <li>Reduced 38,358 tCO<sub>2</sub>eq. between 2009~2015</li> <li>Reduced 15,500 tCO<sub>2</sub>eq. of GHG in 2016</li> <li>2017 target: to provide LED lamp to 65 boats and support 1,069 boats with engines, equipment and devices</li> </ul> </li> </ul>	Fiscal policy	Ministry of Oceans and Fisheries	In progress	2009	GHG emissions reduced (tCO <sub>2</sub> eq.)
Forest Carbon Sinks	Sustainable maintenance and management of forests	CO <sub>2</sub>	Continuous maintenance and enhancement of GHG absorption function	<ul style="list-style-type: none"> <li>To promote intensive forest management to create healthy forests by creating a package consisting of laying forest trail, planting trees and afforestation</li> <li>To increase GHG absorption capacity by planting strong seed orchards in the forest</li> </ul>	Economic/Fiscal policy	Korea Forest Service	In progress	2015	Utilization of seed orchard forest (%), collection of forestation products (%)

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Forest Carbon Sinks	Creation of new carbon sinks such as urban forest	CO <sub>2</sub>	Increasing GHG absorption by creating forest carbon sinks such as urban forest and school forest	<ul style="list-style-type: none"> <li>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</li> </ul>	Others	– Korea Forest Service	In progress	2003	Area of newly created carbon sinks such as urban forest (ha)
	Use of domestic wood	CO <sub>2</sub>	Promoting the use of wood that capture carbon dioxide	<ul style="list-style-type: none"> <li>To increase production of wood in ROK and develop processing technology to produce lumber with long carbon storage period</li> </ul>	Information Sharing	– Korea Forest Service	In progress	2015	Domestic wood produced (m <sup>3</sup> ), share of domestic lumber produced (%)
	Use of forest biomass energy	CO <sub>2</sub>	Increasing replacement of fossil fuels with forest biomass energy which is an eco-friendly fuel	<ul style="list-style-type: none"> <li>To increase production of domestic pellets and use of domestically produced fuels</li> </ul>	Information Sharing	– Korea Forest Service	In progress	2015	Quantity of domestic pellets produced (1,000 tCO <sub>2</sub> eq.)
	Forest Carbon Offset Scheme	CO <sub>2</sub>	Promoting voluntary GHG absorption activities by the private sector	<ul style="list-style-type: none"> <li>Scheme designed to provide economic incentive to private forest owners, who account for 67% of total forest area, to encourage proactive maintenance of their forest</li> </ul>	Economic/Fiscal policy	– Korea Forest Service	In progress	2013	Number of participation in Forest Carbon Offset Scheme and quantity of CO <sub>2</sub> absorbed (tCO <sub>2</sub> eq.)
	Nationwide forest fire prevention measure	CO <sub>2</sub>	Preventing forest fire to maintain GHG absorption capacity of the forests and minimizing damage from forest fire by establishing prompt extinguishment measures	<ul style="list-style-type: none"> <li>To develop various prevention measures and extinguishment plans to minimize the damage from fires in the forest which is a major carbon sink</li> </ul>	Information Sharing	– Korea Forest Service	In progress	2017	Area affected by forest fire vs. number of dry days



- 48** Sectors: all sectors, transition, industry, transportation, buildings, agriculture/stockbreeding and fisheries, forestry, and waste
- 49** Overview of reduction action and progress: providing the title of relevant policies and laws; describing the latest progress (highlighting major achievements and presenting official quantifiable data, if any)
- 50** Types of means: Regulation, economic/fiscal policy, voluntary agreement, information sharing, education (capacity building), research (technology development), others
- 51** Delivery status: in progress, adopted (to be implemented), planning stage
- ※ Compared to the year of implementation: (1) "In progress," if the year of implementation is before present (2021); (2) "Adopted," if the idea has been adopted but the implementation is after present (2021); and (3) "Planning stage," if the expected year of implementation (draft) has been decided but the policy has not yet been drafted
-







An aerial photograph of a coastal landscape. In the foreground, a dark, rocky coastline meets the ocean with white-capped waves. A sandy path leads from the shore towards a small white lighthouse on a grassy patch. Further inland, a large white wind turbine stands prominently. The background shows a mix of green fields, some buildings, and a distant horizon 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 report<sup>52</sup>.

## 1. Financial Support

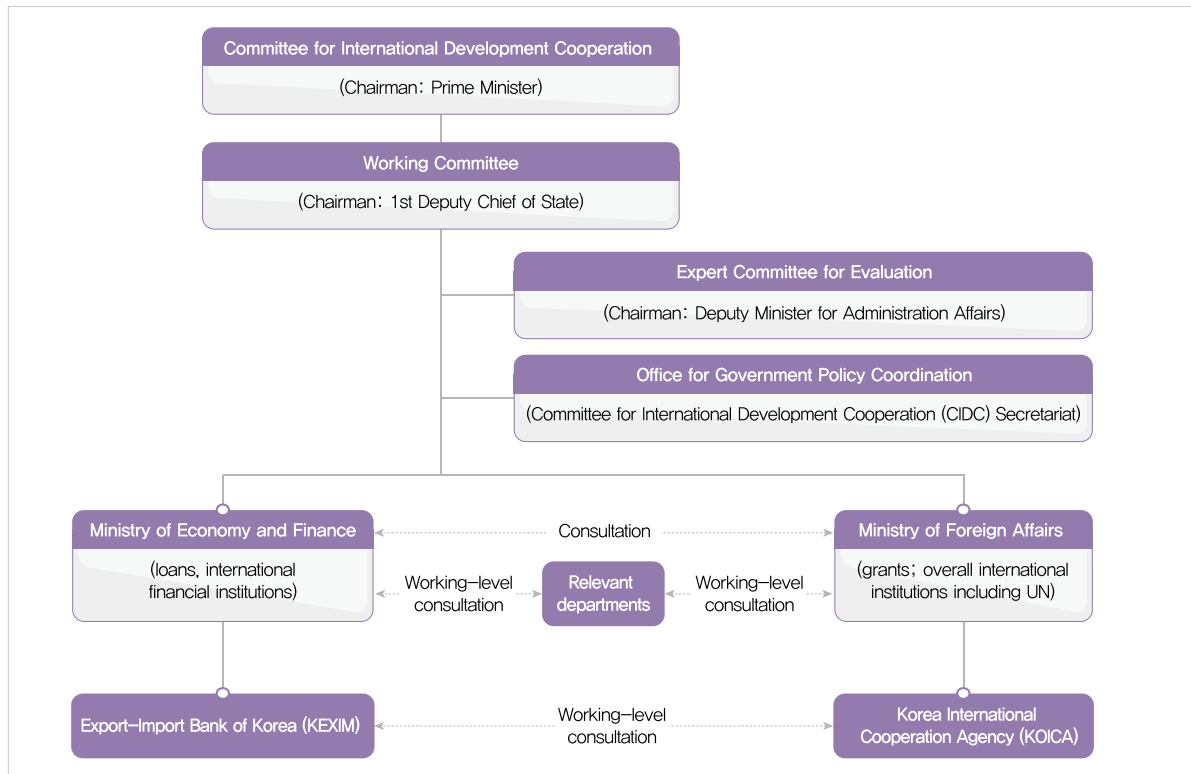
The ROK provides concessional loans and grant aid to developing countries through Official Development Assistance (ODA), and voluntarily carries out diverse assistance projects for technology development and transfer as well as capacity building.

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.

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<sup>52</sup> 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 Sustainable Development Goals (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 3<sup>rd</sup> 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)<sup>53</sup> member countries.<sup>54</sup> The ODA size recorded KRW 2,587.5 billion based on the 2020 grant equivalent (tentative), ranking 16<sup>th</sup> 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.

<sup>53</sup> 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.

<sup>54</sup> 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).



&lt;Table 4–1&gt; 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 4<sup>th</sup> 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 ‘P4G<sup>55</sup> Seoul Summit 2021’

<sup>55</sup> 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).

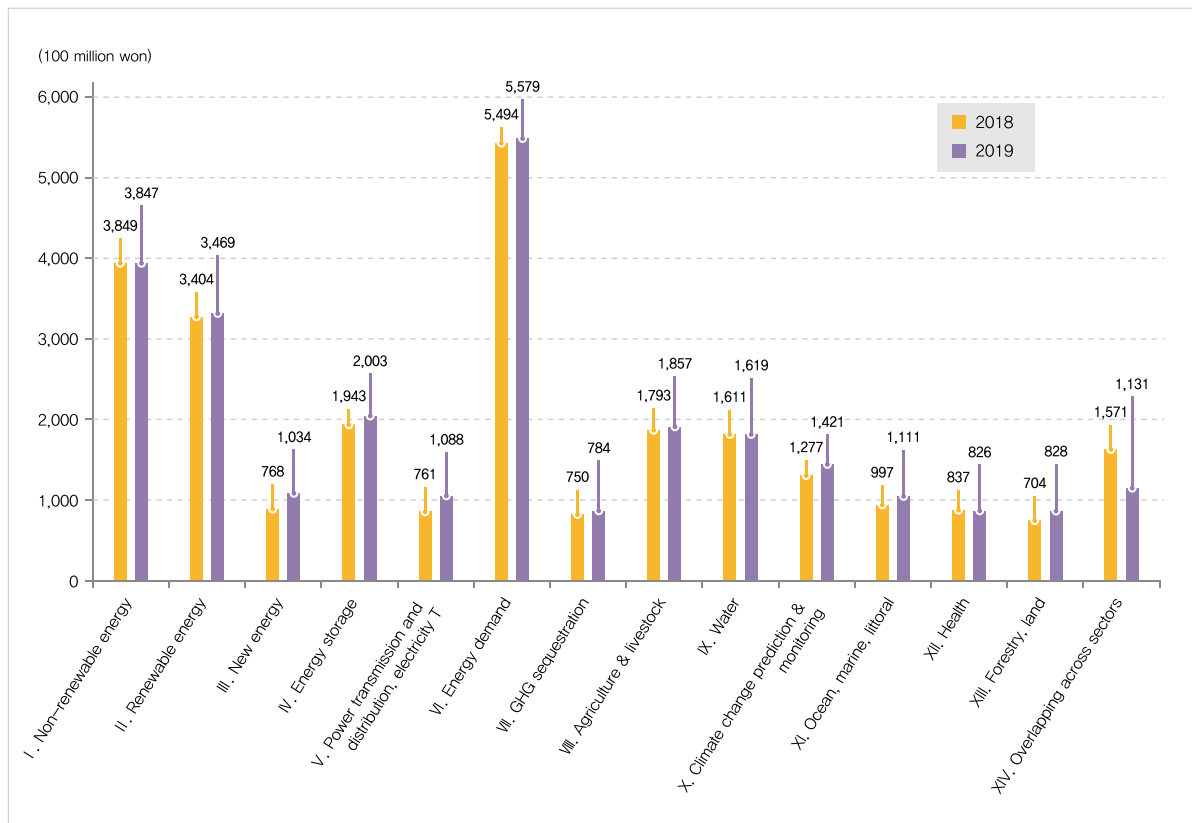


<Table 4-4> Climate Technology and National R&D Investments in 2019

	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 ten 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 25<sup>th</sup> Conference of Parties (COP) to the United Nations Framework Convention on Climate Change 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 countries<sup>56</sup> 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.

<sup>56</sup> 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 (1st: September 26, 2017, Bangkok, Thailand, 2nd: 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"> <li>Participated by 30 government officials and experts in the climate field from 14 developing countries in the Asia-Pacific region</li> <li>Strengthened competencies related to green city plan, green energy and waste management</li> <li>Workshop was held at the 3rd International Electric Vehicle Expo to introduce Korea's climate technologies</li> </ul>	<ul style="list-style-type: none"> <li>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</li> <li>Strengthened competencies in sustainable city development strategies, construction of a low-carbon and green city, and smart climate technology systems</li> <li>Shared ROK's experiences in the development of low-carbon building</li> </ul>	<ul style="list-style-type: none"> <li>Participated by 21 government officials and experts in the climate field from 12 developing countries in the Asia-Pacific region</li> <li>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</li> <li>Introduced a City Share Program that facilitates sharing of capacity-building experiences among participants</li> </ul>

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



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

※ 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



Greenhouse Gas Emissions <sup>a)</sup>	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	58,892.78	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
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	21,146.99	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 <sup>d)</sup>	-37,958.40	-33,355.73	-32,622.85	-33,871.40	-32,912.49	-30,927.74	-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	-49,997.37	-46,997.37	-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	17,292.21	16,046.39	16,884.03	18,832.10	19,732.24	19,720.11	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	15,654.43	16,552.88	16,832.26	17,204.47	17,032.40	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
Total (including LULUCF)	25,443.66	28,198.07	31,088.72	34,785.77	37,777.35	40,296.63	43,105.51	46,307.96	36,332.49	41,153.86	44,449.04	45,282.23	48,026.98	49,998.15	50,021.70	50,678.72	51,200.92	52,485.97	51,054.54	54,199.37	62,276.92	63,233.67	64,131.08	65,648.71	64,850.44	64,797.18	66,261.96	66,948.19	163.8	

- 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 CO<sub>2</sub>eq. is equal to 1 Gg CO<sub>2</sub>eq.
- 4) Includes net CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O from LULUCF
- 5) NA = Not Applicable
- 6) NE = Not Estimated
- 7) NO = Not Occurring



(Table 1-1) GHG Emissions Trends – CO<sub>2</sub>

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	499,193.21	505,998.95	538,142.77	586,599.12	597,476.09	595,949.83	598,570.12	592,056.49	593,888.26	606,933.20	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	499,193.21	505,998.95	538,142.77	586,599.12	597,476.09	595,949.83	598,570.12	592,056.49	593,888.26	606,933.20	622,753.83	188.8			
1. Energy industries	461,883.34	54,000.37	62,167.44	68,268.83	83,313.35	91,361.15	108,684.23	121,877.03	102,879.03	115,665.79	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	289,181.30	285,701.61	482.9			
2. Manufa-cturing 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. Transpo-rtation	35,269.63	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	80,026.50	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	60,286.36	58,951.69	57,033.99	54,478.12	55,234.02	54,816.09	54,493.05	53,012.22	48,423.46	49,544.59	51,138.09	51,881.06	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	2,922.86	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 emission 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	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	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	NEQ	NEQ
2. Industrial processes	18,920.06	22,561.88	24,967.69	29,078.35	31,259.47	32,855.15	33,126.78	34,328.45	27,594.63	28,632.88	29,843.82	30,933.79	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	18,922.69	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	3.171	3.086	3.045	3.033	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	NA	NA	
E. Production of halocarbons and SF <sub>6</sub>																																	
F. Consum-ption of halocar-bons and SF <sub>6</sub>																																	





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	6,551.07	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 <sub>2</sub> emissions including net CO <sub>2</sub> from LULUCF	213,727.67	240,875.11	266,730.96	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 <sub>2</sub> emissions excluding net CO <sub>2</sub> 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	38,228.39	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 <sub>2</sub> 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	7,813.52	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	397.95	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	1,363.62	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	1,353.88	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	1,288.19	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	
CO2 emissions from biomass																															



〈Table 1-1〉 GHG Emissions Trends – N<sub>2</sub>O

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 <sub>6</sub>																															
F. Consumption of halocarbons and SF <sub>6</sub>																															
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	0.21	0.20	0.17	0.15	0.11	0.08	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	0.10	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	4.68	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	0.64	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 <sub>2</sub> O emissions including N <sub>2</sub> 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 <sub>2</sub> O emissions excluding N <sub>2</sub> 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 <sub>2</sub> emissions from biomass																																

〈Table 1-1〉 GHG Emissions Trends – HFCs, PFCs, SF<sub>6</sub>

GHG Source and Sink Categories	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	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	Gg
Emissions of HFCs – (Gg CO <sub>2</sub> 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	7,382.99	6,881.07	5,846.15	8,087.59	7,907.00	8,694.42	8,094.74	8,537.55	7,931.23	7,365.92	9,648.99	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	0.03	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	0.01	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	6.46		
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 <sub>2</sub> eq.)	NO,NE	NO,NE	0.28	1.62	NO,NE	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	2,799.80	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 <sub>4</sub>	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0.09	0.09	0.10	0.09	0.07	0.08	0.10	0.13	0.14	0.19	0.22	0.21	0.17	0.19	0.17	0.22	0.23	0.26	0.14	0.14	0.21	0.32		
C <sub>2</sub> F <sub>6</sub>	NO,NE	NO,NE	0.00	0.00	NO,NE	0.00	0.06	0.12	0.11	0.14	0.17	0.14	0.11	0.11	0.12	0.11	0.11	0.12	0.11	0.07	0.08	0.07	0.06	0.06	0.06	0.03	0.02	0.02	0.02		
C <sub>3</sub> F <sub>8</sub>	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0.00	NO,NE	0.00	0.01	0.03	0.05	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		
C <sub>4</sub> F <sub>10</sub>	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 <sub>3</sub> F <sub>8</sub>	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.05	0.09		
C <sub>2</sub> F <sub>4</sub>	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 <sub>2</sub> F <sub>6</sub>	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 <sub>6</sub> – (Gg CO <sub>2</sub> eq.)	173.4	332.61	345.41	387.31	543.94	1,505.10	1,152.22	1,527.32	995.17	3,231.99	2,823.47	2,721.80	2,914.53	3,315.64	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	6,823.65	6,520.09	8,970.99	4727.3	
SF <sub>6</sub>	0.01	0.01	0.01	0.02	0.02	0.06	0.05	0.06	0.04	0.14	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	

&lt;Table 1–2&gt; 2018 Greenhouse Gas Emissions by Sector – Energy Sector

GHG Source and Sink Categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
	(Gg)		
<b>Energy</b>	<b>622,753.93</b>	<b>298.35</b>	<b>10.83</b>
<b>A. Fuel combustion</b>	<b>622,753.93</b>	<b>85.64</b>	<b>10.83</b>
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>B. Fugitive emission from fuels</b>	<b>NE,NO</b>	<b>212.71</b>	<b>NO</b>
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 <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
	(Gg)		
b. Natural gas	NE	186.39	
<b>Memo items</b>			
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 <sub>2</sub> 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

&lt;Table 1–2&gt; 2018 Greenhouse Gas Emissions by Sector – Industrial Processes Sector

GHG Source and Sink Categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs		PFCs		SF <sub>6</sub>	
				P	A	P	A	P	A
	(Gg)			(GgCO <sub>2</sub> 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 <sub>6</sub> consumption in magnesium production									0.00
D. Other industry	NA								
E. Production of halocarbons and SF <sub>6</sub>					NO		NO		NE, NO
1. By-product emissions					NO		NO		NO
2. Fugitive emissions					NO		NO		NE
F. Consumption of halocarbons and SF <sub>6</sub>				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 <sup>2)</sup> 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 CO<sub>2</sub> 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 <sub>4</sub>	N <sub>2</sub> O
	(Gg)	
<b>Agriculture</b>	<b>579.58</b>	<b>29.09</b>
<b>A. Enteric fermentation</b>	<b>212.90</b>	
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>B. Manure management</b>	<b>66.30</b>	<b>11.43</b>
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
<b>C. Rice cultivation</b>	<b>299.85</b>	
1. Irrigation	298.42	
2. Rain-fed paddy	1.43	
<b>D. Agricultural soils</b>	<b>NA</b>	<b>17.65</b>
1. Direct emissions	NA	9.74
2. Ranch, grazing and manure		NE
3. Indirect emissions	NA	7.92
<b>E. Prescribed burning of savannas</b>	<b>NO</b>	<b>NO</b>
<b>F. Field burning of agricultural residues</b>	<b>0.53</b>	<b>0.01</b>
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

&lt;Table 1–2&gt; 2018 Greenhouse Gas Emissions by Sector – LULUCF Sector

GHG Source and Sink Categories	Net CO <sub>2</sub> Emissions/ Removal	CH <sub>4</sub>	N <sub>2</sub> 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 <sub>2</sub> O emissions due to conversion to cropland			0.10
4. CO <sub>2</sub> 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

&lt;Table 1–2&gt; 2018 Greenhouse Gas Emissions by Sector – Waste Sector

GHG Source and Sink Categories	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> 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 <sub>4</sub> emission factor for coal	kg CH <sub>4</sub> /TJ	0.25
	CH <sub>4</sub> emission factor for oil	kg CH <sub>4</sub> /TJ	0.15
	CH <sub>4</sub> emission factor for natural gas and city gas (LNG)	kg CH <sub>4</sub> /TJ	0.41
	N <sub>2</sub> O emission factor for coal	kg N <sub>2</sub> O/TJ	1.66
	N <sub>2</sub> O emission factor for oil	kg N <sub>2</sub> O/TJ	1.75
	N <sub>2</sub> O emission factor for natural gas and city gas (LNG)	kg N <sub>2</sub> O/TJ	1.06
Energy sector(Fugitive emission from LNG)	Emission factor for transport venting of LNG	Gg CH <sub>4</sub> /10 <sup>6</sup> m <sup>3</sup>	2,028 × 10 <sup>-6</sup>
	Emission factor for transport leaks of LNG	Gg CH <sub>4</sub> /10 <sup>6</sup> m <sup>3</sup>	8,567 × 10 <sup>-6</sup>
	Emission factor for storage venting of LNG	Gg CH <sub>4</sub> /10 <sup>6</sup> m <sup>3</sup>	3,756 × 10 <sup>-6</sup>
	Emission factor for storage leaks of LNG	Gg CH <sub>4</sub> /10 <sup>6</sup> m <sup>3</sup>	6,835 × 10 <sup>-6</sup>
Industrial process sector(Cement production)	EFI	ton CO <sub>2</sub> /ton	0.5295
Agriculture sector(Rice cultivation sub-sector)	Methane baseline emission factor for rice cultivation (EF <sub>C</sub> )	kg CH <sub>4</sub> /ha/day	2.32
	Scaling factor for organic amendment applied (SF <sub>O</sub> ) for rice straw :When applying rice straw (dry matter) of 5–7 mg/ha	–	2.5
	Scaling factor for water management (SF <sub>w</sub> ) : Continuously flooded	–	1.00
	Scaling factor for water management (SF <sub>w</sub> ) : Intermittently flooded – 1 week	–	0.83
	Scaling factor for water management (SF <sub>w</sub> ) : Intermittently flooded – 2 weeks	–	0.66
	Scaling factor for water management (SF <sub>w</sub> ) : Intermittently flooded – 3 weeks	–	0.49
Agriculture sector(Agricultural soils sub-sector)	Direct N <sub>2</sub> O emission factor from synthetic fertilizer for potato (EF <sub>1i</sub> )	kg N <sub>2</sub> O–N/kg N	0.0049
	Direct N <sub>2</sub> O emission factor from synthetic fertilizer for pepper (EF <sub>1i</sub> )	kg N <sub>2</sub> O–N/kg N	0.0086
	Direct N <sub>2</sub> O emission factor from synthetic fertilizer for soybeans (EF <sub>1i</sub> )	kg N <sub>2</sub> O–N/kg N	0.0119
	Direct N <sub>2</sub> O emission factor from synthetic fertilizer for spring cabbage (EF <sub>1i</sub> )	kg N <sub>2</sub> O–N/kg N	0.0056
	Direct N <sub>2</sub> O emission factor from synthetic fertilizer for autumn cabbage (EF <sub>1i</sub> )	kg N <sub>2</sub> O–N/kg N	0.0058
	Direct N <sub>2</sub> O emission factor from synthetic fertilizer for field crops (EF <sub>1i</sub> )	kg N <sub>2</sub> O–N/kg N	0.00596
	Direct N <sub>2</sub> O emission factor from N leaching and runoff (EF <sub>1i</sub> )	kg N <sub>2</sub> O–N/kg N	0.0135
LULUCF sector(Forest land sub-sector)	Basic wood density (D) for coniferous forest	t d.m./m <sup>3</sup>	0.46
	Basic wood density (D) for broadleaf forest	t d.m./m <sup>3</sup>	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 <sub>4</sub> in landfill gas (F)	–	0.5629
	Methane generation rate constant (k)	–	0.05
Waste sector (Wastewater treatment sub-sector)	CH <sub>4</sub> factor by physical treatment	ton CH <sub>4</sub> /ton BOD	0.01532
	CH <sub>4</sub> factor by biological treatment	ton CH <sub>4</sub> /ton BOD	0.018
	CH <sub>4</sub> factor by advanced treatment	ton CH <sub>4</sub> /ton BOD	0.0071
	CH <sub>4</sub> factor for chemical industry	ton CH <sub>4</sub> /ton BOD	0.0012
	CH <sub>4</sub> factor for electric and electronic industry	ton CH <sub>4</sub> /ton BOD	0.0016
	CH <sub>4</sub> factor for food and beverage industry	ton CH <sub>4</sub> /ton BOD	0.010
	CH <sub>4</sub> factor for paper industry	ton CH <sub>4</sub> /ton BOD	0.0034
	CH <sub>4</sub> factor for leather and shoes industry	ton CH <sub>4</sub> /ton BOD	0.0036
	CH <sub>4</sub> factor for textile industry	ton CH <sub>4</sub> /ton BOD	0.00148
	CH <sub>4</sub> factor for non-metal industry	ton CH <sub>4</sub> /ton BOD	0.00020
	CH <sub>4</sub> factor for power and water supply industry	ton CH <sub>4</sub> /ton BOD	0.00028
	CH <sub>4</sub> factor for wastewater treatment business	ton CH <sub>4</sub> /ton BOD	0.0325
	CH <sub>4</sub> factor for metal	ton CH <sub>4</sub> /ton BOD	0.0033
Waste sector (Waste incineration sub-sector)	Municipal solid waste	g N <sub>2</sub> O/ton	52.1
	Industrial solid waste	g N <sub>2</sub> O/ton	129.7
	Sewage sludge	g N <sub>2</sub> O/ton	595.0



〈Table 1-4〉 Measurement Guidelines and Emission Factors

Sectors	CO <sub>2</sub>		CH <sub>4</sub>		N <sub>2</sub> O		HFCs		PFCs		SF <sub>6</sub>	
	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor	Methodology	Emission Factor
<b>1. Energy</b>												
A. Fuel combustion												
1. Energy industries	96D	96D, CS <sup>1)</sup>	96D	96D, 06D, CS <sup>2)</sup>	96D	96D, 06D, CS						
2. Manufacturing industries and construction	96D	96D, CS	96D	96D, 06D, CS <sup>3)</sup>	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 <sup>4)</sup>	96D	96D, 06D <sup>5)</sup>	96D	96D, 06D						
4. Other sectors	96D	96D, 06D, CS	96D	96D, CS <sup>6)</sup>	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 <sup>7)</sup>	NA	NA						
<b>2. Industrial processes</b>												
A. Mineral industry	96D, GPG T1 <sup>8)</sup>	06CS, GPG D, 96D <sup>9)</sup>	NA	NA	NA	NA						
B. Chemical industry	96D	96D	96 T1	96D	06 T2, 96 T1 <sup>10)</sup>	06D, 96D <sup>11)</sup>						
C. Metal industry	96D, IE <sup>12)</sup>	96D, IE	NA	NA	NA	NA					96 T1	
D. Other industry	NA	NA										

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

Sectors	CO <sub>2</sub>		CH <sub>4</sub>		N <sub>2</sub> O		HFCs		PFCs		SF <sub>6</sub>	
	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 <sup>31)</sup>	CS, 06 D <sup>32)</sup>	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-CO<sub>2</sub> emission from drainage, biomass combustion (prescribed burning)), NE(biomass combustion(forest fire))
- 23) NO(non-CO<sub>2</sub> emission from drainage, biomass combustion (prescribed burning)), NE(direct N<sub>2</sub>O 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-CO<sub>2</sub> emission from drainage, biomass combustion(prescribed burning)), NE(non-CO<sub>2</sub> 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 <sub>6</sub> 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

&lt;Table 1-6&gt; IPCC Good Practice Guidance for LULUCF Annex 3A.2

Land Use	Annual Carbon Storage Change (GgCO <sub>2</sub> )				CH <sub>4</sub> (Gg)	N <sub>2</sub> O (Gg)
	Growing tree biomass A	Dead organic matter B	Soil C	CO <sub>2</sub> 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			
<b>Total</b>	<b>-45,595.65</b>	<b>NE</b>	<b>3,994.76</b>	<b>-41,600.89</b>	<b>13.51</b>	<b>0.10</b>

- 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 tCO<sub>2</sub>eq.)

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	-
<b>Total</b>	<b>629,450.91</b>	<b>622,753.93</b>	<b>1.08</b>

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

GHGs	Sectors	Sub-sectors	Reasons for non-estimation
CO <sub>2</sub>	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 <sub>4</sub>	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 <sub>4</sub>	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 <sub>2</sub> O	5. LULUCF	5.I.A.1. Direct N <sub>2</sub> O emission from nitrogen fertilization (Forest land maintained)	No activity data
	5. LULUCF	5.I.A.2. Direct N <sub>2</sub> 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 <sub>6</sub> (Actual emissions)	2. Industrial processes	2.E.2. Production (fugitive) of halocarbons and SF <sub>6</sub>	No activity data
	2. Industrial processes	2.F.1. Consumption (cooling and refrigerant) of halocarbons and SF <sub>6</sub>	No activity data
	2. Industrial processes	2.F.2. Consumption (blowing agent) of halocarbons and SF <sub>6</sub>	No activity data
	2. Industrial processes	2.F.3. Consumption (fire extinguisher) of halocarbons and SF <sub>6</sub>	No activity data
	2. Industrial processes	2.F.4. Consumption (aerosol) of halocarbons and SF <sub>6</sub>	No activity data
	2. Industrial processes	2.F.5. Consumption (solvent) of halocarbons and SF <sub>6</sub>	No activity data
	2. Industrial processes	2.F.6. Consumption of halocarbons and SF <sub>6</sub> (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 <sub>2</sub> eq.)	Tier 1 Level Assessment (Total=1)	Tier 1 Level Assessment Accumulated Share
1	1A1	Energy industry: Solid fuel	CO <sub>2</sub>	202,499	0.26	0.26
2	1A2	Manufacturing industries and construction: Solid fuel	CO <sub>2</sub>	118,416	0.152	0.412
3	1A3b	Road transport	CO <sub>2</sub>	94,013	0.121	0.533
4	1A1	Energy industry: Gaseous fuel	CO <sub>2</sub>	61,011	0.078	0.612
5	5A1	Forest land maintained	CO <sub>2</sub>	-45,596	0.059	0.67
6	1A2	Manufacturing industries and construction: Liquid fuel	CO <sub>2</sub>	44,305	0.057	0.727
7	1A4	Other sectors: Gaseous fuel	CO <sub>2</sub>	30,984	0.04	0.767
8	2A1	Cement production	CO <sub>2</sub>	24,702	0.032	0.799
9	1A1	Energy industry: Liquid fuel	CO <sub>2</sub>	22,191	0.029	0.827
10	1A2	Manufacturing industries and construction: Gaseous fuel	CO <sub>2</sub>	22,096	0.028	0.856
11	1A4	Other sectors: Liquid fuel	CO <sub>2</sub>	18,854	0.024	0.88
12	2F9	Consumption, etc. of halocarbons and SF <sub>6</sub>	HFCs	8,822	0.011	0.891
13	6A	Waste landfill	CH <sub>4</sub>	7,834	0.01	0.901
14	2F7	Semiconductor production (LCD production)	HFCs, PFCs, SF <sub>6</sub>	7,131	0.009	0.91
15	6C	Waste incineration	CO <sub>2</sub>	6,808	0.009	0.919
16	2A3	Lime and dolomite consumption	CO <sub>2</sub>	6,410	0.008	0.927
17	4C	Rice cultivation	CH <sub>4</sub>	6,297	0.008	0.936
18	4D	Agricultural soils	N <sub>2</sub> O	5,472	0.007	0.943
19	2F8	Heavy electric equipment	SF <sub>6</sub>	4,812	0.006	0.949
20	4A	Enteric fermentation	CH <sub>4</sub>	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 <sub>2</sub> 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 <sub>2</sub>	17,604	202,499	0.46	0.203	0.203
2	1A4	Other sectors: Solid fuel	CO <sub>2</sub>	34,477	1,912	0.27	0.119	0.323
3	1A4	Other sectors: Liquid fuel	CO <sub>2</sub>	35,736	18,854	0.23	0.102	0.424
4	5A1	Forest land maintained	CO <sub>2</sub>	-38,227	-45,596	0.214	0.095	0.519
5	1A2	Manufacturing industries and construction: Liquid fuel	CO <sub>2</sub>	36,985	44,305	0.165	0.073	0.592
6	1A1	Energy industry: Gaseous fuel	CO <sub>2</sub>	4,802	61,011	0.143	0.063	0.655
7	1A1	Energy industry: Liquid fuel	CO <sub>2</sub>	25,782	22,191	0.141	0.062	0.717
8	1A4	Other sectors: Gaseous fuel	CO <sub>2</sub>	1,708	30,984	0.078	0.035	0.752
9	4C	Rice cultivation	CH <sub>4</sub>	10,533	6,297	0.066	0.029	0.781
10	1A2	Manufacturing industries and construction: Gaseous fuel	CO <sub>2</sub>	–	22,096	0.066	0.029	0.81
11	2A1	Cement production	CO <sub>2</sub>	15,873	24,702	0.054	0.024	0.833
12	1A2	Manufacturing industries and construction: Solid fuel	CO <sub>2</sub>	39,145	118,416	0.038	0.017	0.85
13	1B1	Solid fuel	CH <sub>4</sub>	4,833	337	0.038	0.017	0.867
14	6A	Waste landfill	CH <sub>4</sub>	7,492	7,834	0.037	0.016	0.883
15	1A3b	Road transport	CO <sub>2</sub>	30,690	94,013	0.033	0.015	0.898
16	2F9	Halocarbons and SF <sub>6</sub> consumption, etc.	HFCs	NO, NE	8,822	0.026	0.012	0.909
17	2F7	Semiconductor production (LCD production)	HFCs, PFCs, SF <sub>6</sub>	NO	7,131	0.021	0.009	0.919
18	4D	Agricultural soils	N <sub>2</sub> O	4,606	5,472	0.021	0.009	0.928
19	1A4	Other sectors: Solid fuel	CH <sub>4</sub>	2,135	78	0.017	0.007	0.935
20	1A3d	Shipping	CO <sub>2</sub>	2,432	1,015	0.016	0.007	0.943
21	2F8	Heavy electric equipment	SF <sub>6</sub>	173	4,812	0.013	0.006	0.948
22	4A	Enteric fermentation	CH <sub>4</sub>	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-related<sup>1)</sup> Financial Support Details

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

(Exchange rate<sup>2)</sup> : KRW 1,053,064/USD)

Multilateral institutions	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 rate<sup>2)</sup> : KRW 1,131,309/USD)

Multilateral institutions	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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〉

&lt;Table 2-1&gt; Financial Support Provided via Multilateral Institutions (2016)

 (Exchange rate<sup>2)</sup> : KRW 1,160.589/USD)

Multilateral institutions	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 &lt;Table 2-2&gt;



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

(Exchange rate<sup>2)</sup> : KRW 1,130,635/USD)

Multilateral institutions	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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〉

&lt;Table 2-1&gt; Financial Support Provided via Multilateral Institutions (2018)

 (Exchange rate<sup>2)</sup> : KRW 1,100,1859/USD)

Multilateral institutions	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 &lt;Table 2-2&gt;

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

(Exchange rate<sup>2)</sup> : KRW 1,165,2938/USD)

Multilateral institutions	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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〉

&lt;Table 2–2&gt; Financial Support Provided through Bilateral, Regional and Other Channels (2014)

 (Exchange rate<sup>2)</sup> : KRW 1,053.064/USD)

Multilateral institutions	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 &lt;Table 2–2&gt;

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

(Exchange rate<sup>2)</sup> : KRW 1,131,309/USD)

Nation/Region	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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〉

&lt;Table 2–2&gt; Financial Support Provided through Bilateral, Regional and Other Channels (2016)

 (Exchange rate<sup>2)</sup> : KRW 1,160.589/USD)

Nation/Region	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 &lt;Table 2–2&gt;

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

(Exchange rate<sup>2)</sup> : KRW 1,130,635/USD)

Nation/Region	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	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

※ 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



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

(Exchange rate<sup>2)</sup> : KRW 1,100.1859/USD)

Nation/Region	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 rate<sup>2)</sup> : KRW 1,100.1859/USD))

Nation/Region	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 rate<sup>2)</sup> : KRW 1,165,2938/USD)

Nation/Region	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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 rate<sup>2)</sup> : KRW 1,100.1859/USD)

Nation/Region	Total amount <sup>3)</sup>		Status	Funding sources	Financial instruments	Support type <sup>4)</sup>	Sectors <sup>5)</sup>
	KRW million	USD thousand					
Total <sup>6)</sup>	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	1597	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
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

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

## 3. Capacity Building Support Provided

&lt;Table 3-1&gt; 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"> <li>GHG inventory: Base of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, agriculture, waste and LULUCF)</li> <li>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)</li> <li>Small group sessions: Measurement by sector (agriculture, LULUCF, waste and industrial processes), projection and mitigation by sector (building, transport, power generation and industry)</li> </ul>
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"> <li>Steering Committee: Present each nation's GHG policy, inventory status and related issues</li> <li>Technical Working Group: Present progress report and discuss building and waste sectors</li> </ul>
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"> <li>Selected best reports (Nepal and Cambodia) and held discussion for improving the forum</li> </ul>
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"> <li>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</li> </ul>
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"> <li>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</li> </ul>



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"> <li>Enhancing adaptation capacity with training on the socioeconomic damages suffered by Asia Pacific nations due to climate change, related assessment and decision-making</li> </ul>
Indonesia, Cambodia, Myanmar, Laos	Forest Training Institute of the Korea Forest Service	4th and 5th REDD+ Capacity Building Program	Mitigation and Adaptation	<ul style="list-style-type: none"> <li>Support training on REDD+ governance and safety system to public officials of countries selected as targets of REDD+ pilot project for capacity building</li> </ul>

〈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"> <li>GHG inventory: Base of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, agriculture, waste and LULUCF)</li> <li>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)</li> </ul>
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"> <li>Discuss climate damages suffered by each nation and introduce the related project and ways to use the financial funds of the Green Climate Fund</li> </ul>
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"> <li>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</li> </ul>
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"> <li>Introduce the ROK's natural gas vehicle policy and transfer technology for capacity building aimed at establishing sustainable environmental policies</li> </ul>
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"> <li>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</li> </ul>
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"> <li>The ROK's environmental policy and management, sustainable development and planning, forest resources and ecological restoration</li> </ul>



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"> <li>• Introduce theory and tools for establishing the national climate change adaptation plan and share best practices for capacity building</li> </ul>
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"> <li>• Support training on REDD+ governance and safety system to public officials of countries selected as targets of REDD+ pilot project for capacity building</li> </ul>



〈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"> <li>GHG inventory: Base of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, agriculture, waste and LULUCF)</li> </ul>
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"> <li>Launch of Capacity Building Initiative and joint research on four sectors (power generation, transport, residential and forestry)</li> </ul>
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"> <li>Theory and practical training and introduction of best practices for the establishment of GHG inventory management system and use of the 2006 IPCC Guidelines</li> </ul>
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"> <li>The ROK's environmental policy and management, sustainable development and planning, forest resources and ecological restoration</li> </ul>
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"> <li>Share the ROK's experience and knowhow on resource circulating policies to contribute to the participating nations' establishment of environmental policies for sustainable development</li> </ul>
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"> <li>Discuss the success and difficulties of each nation's NAP establishment process and share experience to enhance capacity for NAP establishment</li> </ul>
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"> <li>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</li> </ul>

&lt;Table 3-1&gt; Capacity Building Support Provided (2017)

Recipient Country/Region	Implementing Agency	Name of Project/Program	Targeted Area	Additional Information
28 countries including Armenia, Bhutan, Chile, Eritropia 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"> <li>GHG inventory: Basics of inventory measurement, uncertainty measurement, industrial methods by sector (energy, industrial processes, AFOLU and waste)</li> </ul>
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"> <li>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</li> </ul>
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"> <li>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</li> </ul>
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"> <li>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</li> </ul>
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"> <li>Training related to mainstreaming of climate change adaptation in the water resource sector</li> </ul>

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"> <li>• Korea's environmental policies and management, sustainable development and plan, water resource development and management</li> </ul>
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"> <li>• 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</li> </ul>
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"> <li>• 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</li> </ul>
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"> <li>• Advance overseas and build a network by discovering companies with domestic climate technologies and creating developing country support programs</li> </ul>

〈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"> <li>• 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</li> </ul>
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"> <li>• Strategies on countering climate change, outline of air quality improvement technologies and company field visits</li> </ul>
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"> <li>• 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</li> </ul>
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"> <li>• 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)</li> </ul>
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"> <li>• Training related to evaluation of measures and priorities for establishment of a climate change adaptation plan</li> </ul>

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"> <li>Explore bilateral cooperation and support measures with regards to countering climate change through capacity building of public officials of tentative REDD+ pilot program countries</li> </ul>
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"> <li>Advance overseas and build a network by discovering companies with domestic climate technologies and creating developing country support programs</li> </ul>

## 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 <sub>2</sub> 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, Verification
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



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