

# Knowledge Exchange Sector Guidebook: Environment

**WORLD BANK GROUP  
KOREA GREEN GROWTH TRUST FUND**



## ABOUT THIS BOOKLET

This booklet serves as a companion to help you explore green growth in Korea's environment sector. It provides relevant information and a directory for reference, guidance and comprehension. Inside you will find details of past experiences that have shaped the sector, as well as recent green growth practices and the frameworks and government institutions that support Korea's advanced environment sector.

*All figures are current to the best of our knowledge at the time of publication, October 2020*

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# PART 1



# What is a Technical Knowledge Exchange

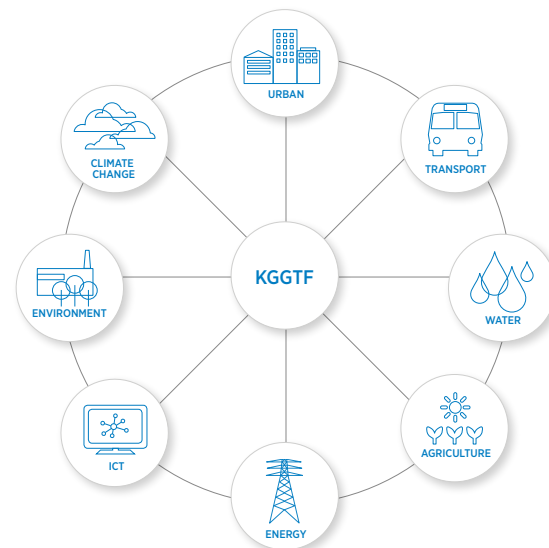
## And What You Will Experience?

### TECHNICAL KNOWLEDGE EXCHANGE

The KGGTF Technical Knowledge Exchange is where ideas, strategy and action come together. Facilitating the sharing of green growth best practice and technical expertise through on-site learning is part of what makes the Korea Green Growth Trust Fund unique.

This week brings together leading experts from the fields of: urban, transportation, environment and energy, agriculture, water and air. Their technical expertise includes everything from recent technological advances in smart grids, to monitoring and analysis, ICT integration, smart-card deployment to effective policy incentives and governance best practices and to facilitate wide-stakeholder engagement and support green economic growth policy and investment.

You will meet with key government ministries, institutes, multi-lateral organizations and companies relevant to your field. Site visits will provide a unique opportunity to see green growth in action first-hand, and to ask country specific and technical questions.



### Sector Integration and Multiple Wins

KGGTF is passionate about tackling infrastructure challenges with integrated Green Growth approaches and methodologies. We seek to support countries in their sustainable growth strategies and investments by promoting collaboration across multiple sectors, and when appropriate, multiple scales, to create a multiplier effect that positively impacts quality of life.

“The exchange itself was very insightful and carefully planned and directly relevant to our work program. We learnt a lot from Korean experience and hope to bring good lessons learned from there to India.”

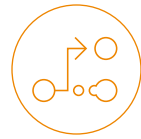
SURBHI GOYAL, WORLD BANK

## During This Knowledge Exchange You Will Experience:



### POLICY IDEAS

- In depth learning with policy makers and industry experts.
- Discussion on financial and policy incentives for innovative partnerships.
- Innovative governance structures that support transparency and interdepartmental collaboration.
- Policy development and coordination with municipal and central government, public institutions, private sector and local communities.



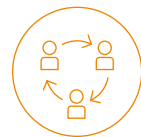
### IMPLEMENTATION STRATEGIES

- Policy safeguards to ensure project funding withstands changes in political party and priority shifts.
- New frameworks for decision-making and problem solving.
- Strategy sessions on financial and technical solutions.
- Role of technical and policy think-tanks in policy setting and technical dissemination.



### CAPACITY BUILDING

- Behind-the-scenes infrastructure site tours led by technical specialist.
- Learn how to avoid common and costly mistakes.
- Discover how synergies between the government, business and academia can speed the implementation of large projects.



### GREEN GROWTH COMMUNITY

- Develop a network of key thought leaders working on innovative projects.
- A network of key thought leaders working on innovative green growth projects.

**Be prepared to explore, ask questions and engage with leaders changing the world.**



# What We Do

The Korea Green Growth Trust Fund is a partnership between the World Bank Group and the Republic of Korea, established in 2011 to support client countries as they shift to green development path. Both partners share a common goal to reduce poverty and promote shared economic prosperity in an environmentally responsible and socially inclusive way.

## KGGTF AT A GLANCE

**\$138**  
MILLION FUND

**144**  
GRANTS TO DATE

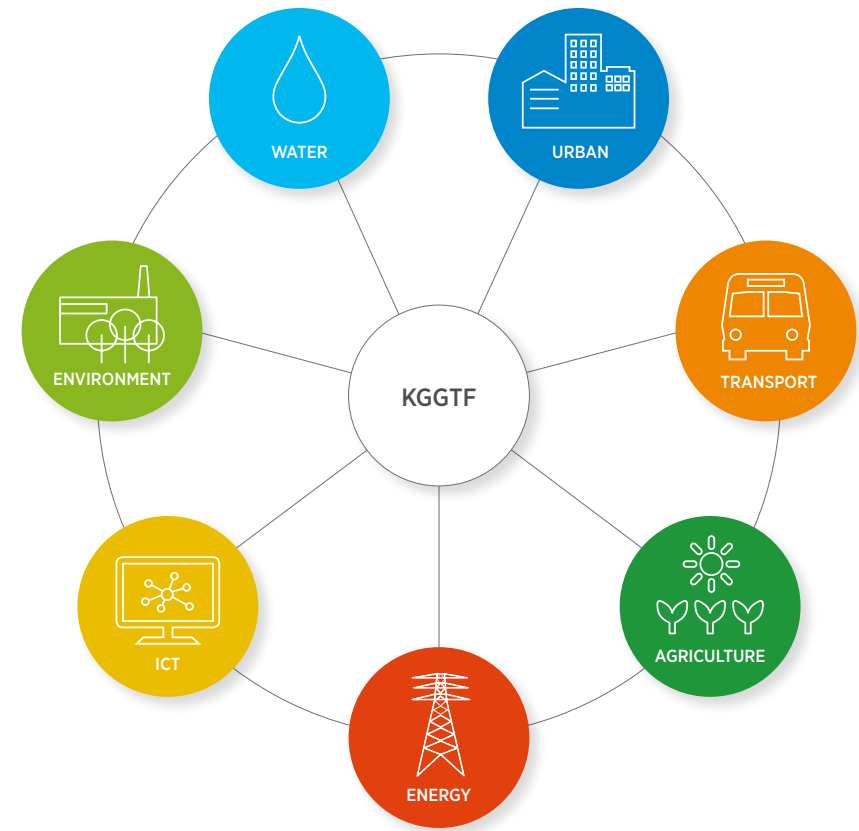
THROUGH 2026

SECTORS



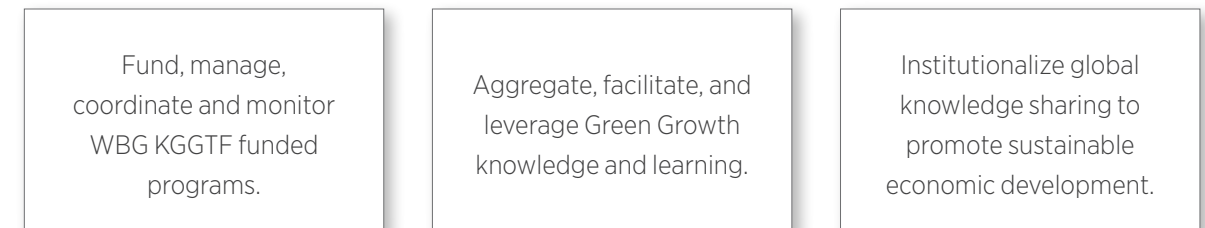
The Trust Fund finances on-the-ground programs as well as knowledge exchange activities, and to date has approved 144 programs in the urban, transport, digital development, energy, environment, water, climate and agriculture

sectors. Based on strong performance, as well as increasing demand for collaborative development implementation programs, the fund has grown from US\$40 million to US\$138 million WBG programs through 2026.



The trust fund facilitates green growth programs across the urban, transport, digital development, energy, environment, water and agriculture sectors. Many of its programs are multi-sector, integrating two or more sectors at both the planning and implementation stages. This provides opportunities that allow for cost savings, data collection, citizen engagement and new forms of transparency and governance.

Knowledge sharing and network building are an integral part of green growth implementation. Facilitating the sharing of green growth best practice and technical expertise through on-site learning, and through the development of practical learning tools is part of what makes the Korea Green Growth Trust Fund unique.



# PART 2

# Why Korea?

## Impact of War <sup>1</sup>

### CIVILIAN CASUALTIES

Around 1 million people

### DAMAGED INDUSTRIAL BUILDINGS

44%  
of the total industrial buildings  
(as of August 1951)

### DAMAGED ELECTRICITY GENERATION CAPACITY

80% of the capacity

### DEVASTATED SCHOOLS

4,800 schools

### GROSS NATIONAL INCOME PER CAPITA (1953) <sup>2</sup>

US \$67

### GROSS DOMESTIC PRODUCT <sup>2</sup>

US \$1.35 billion



South Korea's remarkable recovery from war and poverty provides case studies with specific solutions for economic advancement, creation of employment opportunities, and sustainable infrastructure development that is highly relevant for any country planning to transform or rebuild its economy.



## Currently

### RANKING <sup>3</sup>

12th

largest economy  
in the world

### GROSS NATIONAL INCOME PER CAPITA (2018) <sup>2</sup>

US \$33,564

### GROSS DOMESTIC PRODUCT (2018) <sup>2</sup>

US \$1.7 trillion

Source: Global Knowledge Exchange and Development Center (GKEDC), 2019

### 1953-1960

Post-war Korea faced varieties of hardships and challenges — a weak industrial base, dearth of natural resources, increasing population, and political instability. Foreign aid began to dwindle while poverty remained widespread.

### 1961-1979

The government embarked on an ambitious industrialization program as embodied in a series of Five-Year Economic Development Plans. The program relied on exchange rate reform, export subsidies, investment in economic infrastructure, expansion of schooling and training, and selective choice of strategic industries in later years.

### 1980-1996

Inflation and overcapacity created by the state-led industrialization in the 1970s were gradually resolved with stabilization policies in the early 1980s. The government pursued conservative fiscal and monetary policies to stabilize prices and rationalize the overly expanded industries. Economic liberalization gained speed in the 1990s.

### 1997-PRESENT

An extensive restructuring in the wake of the Asian financial crisis enabled Korea to avoid sovereign default, overhaul institutions and practices in its economy, and grow into one of the world's richest countries. Various efforts are now being made to meet the new challenges in the 21st century.



# Seoul's Transformation Over The Last 50 Years (1970-2020) <sup>4</sup>

Rising through the destruction and turmoil left by the Korean War, the city of Seoul has transformed to a global megalopolis in only 50 years. Seoul underwent several phases to overcome significant urban challenges and become a model smart city full of urban development best practices.



Photo: Seoul Photo Archives

## 1960S-1980s

To accommodate increasing population and address inadequate social infrastructure, the Seoul Metropolitan Government formulated urban development plans and implemented projects tailored to address the city's urban challenges.

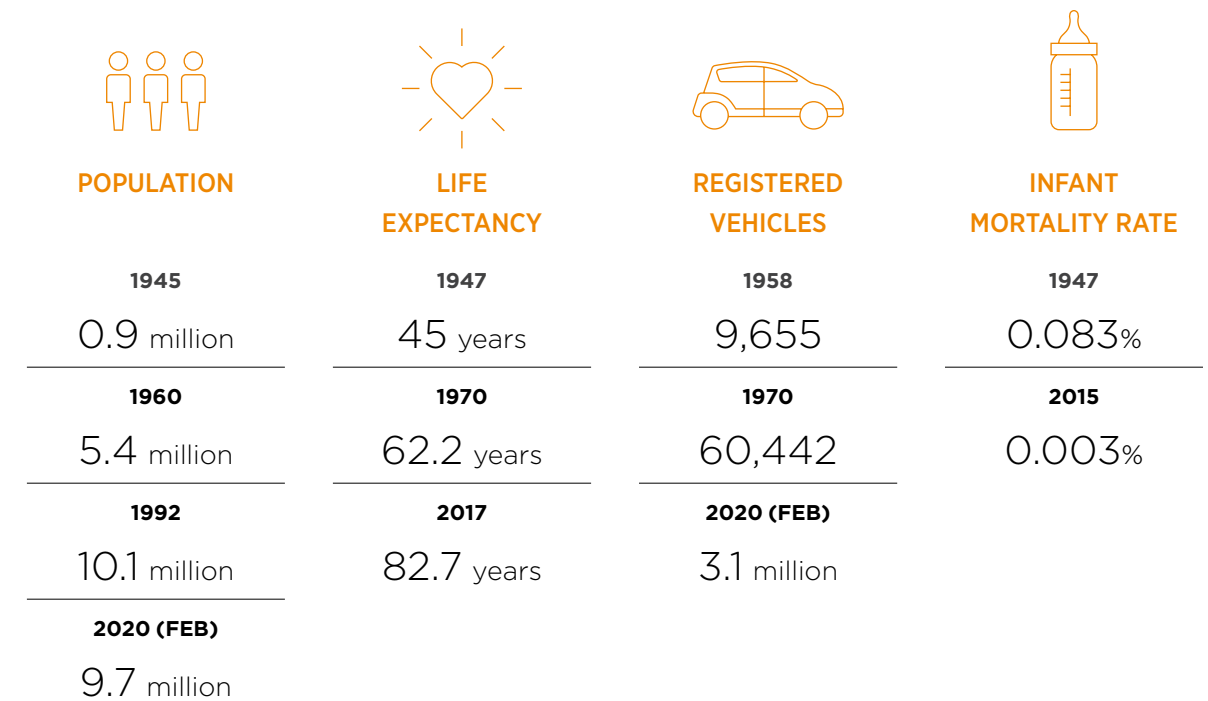
## 1980S-2000s

Extensive urban development planning continued, and policies were put in place to beautify the city. Subsequently, Seoul's infrastructure network flourished with quality transport, water and sewage systems.

## 2000-PRESENT

Seoul adapted a software-centered approach to its urban management policy. The use of advanced information technology helped Seoul facilitate a sustainable city and improve the well-being of its residents and visitors.

The implementation of extensive development projects spurred demographic change across the city of Seoul, providing a quality living environment for its nearly 10 million residents.



## Cheonggye-cheon Restoration Project (CRP)

Cheonggye-stream was once a symbol of the culture of the people of Seoul, a place where traditional celebrations were held, where women did their washing and where children played. Over time the poor built settlements and shanty

towns and pollution became an issue and serious problem. In 1958 the decision was taken to cover the stream for public safety and from 1968 to 1978 an expressway was constructed over the covered stream.

The area became the most overcrowded part of the city with 60,000 businesses, 200,000 shopkeepers and over 1 million people per day passing through causing severe congestion and crime. The business district underneath the expressway became synonymous with Seoul's deterioration. For 40 years the covering of the Cheonggye-stream to ensure public safety led to additional problems. The Cheonggye-stream

Restoration was a visionary approach to remake downtown Seoul. After city leaders held over 1500 meetings with local stakeholders the expressway was removed and the river restored. Now the river and pedestrian paths are a popular greenspace providing residents with a peaceful reprieve from city life. The project represents a new model for cities and city dwellers and the start of new evolution.



Photo (Left and Center): Seoul Museum of History; University of Seoul

**MAJOR OUTCOMES**

- Environment—average daytime temperature in the area dropped
- Economic vitalization
- Traffic—discouraged driving cars in the center, eased traffic flow, \$1 public transport system

**PROJECT SPANNED**

5.8 km



**IMPLEMENTED OVER**

1 year

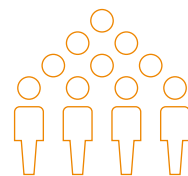
for planning and preparations

2 years & 3 months

for construction

**TOTAL LABOR FORCE OF**

700,000



**TOTAL COST**

\$305 USD million

Fully funded by Seoul Metropolitan Government (already owned most of the land used by the elevated highway redirected and earmarked funds for maintenance of deteriorated elevated highways).

**DESIGN**

\$1.7 USD million

**CONSTRUCTION**  
\$294 USD million

**LAND ACQUISITION**

\$2.3 USD million

**PROJECT MANAGEMENT**  
\$6.1 USD million

**ADMINISTRATION**

\$0.5 USD million

# Overview of Korea's Green Growth Approach



Initiated by the necessity to adopt sustainable practices, Korea underwent a development paradigm shift from quantity to quality-oriented growth, and from fossil fuel-dependent to energy independent growth and sustainability. Korea's green growth was propelled by the establishment of key institutional arrangements that created an enabling environment and laid the foundation for advancement through legislative, institutional and strategic frameworks. In 2008, Low Carbon, Green Growth was declared as a new vision and Green New Deal for the nation for the next 60 years, and the green growth action plan was promoted thereafter.

Countries around the world are finding the Green Growth model highly relevant.

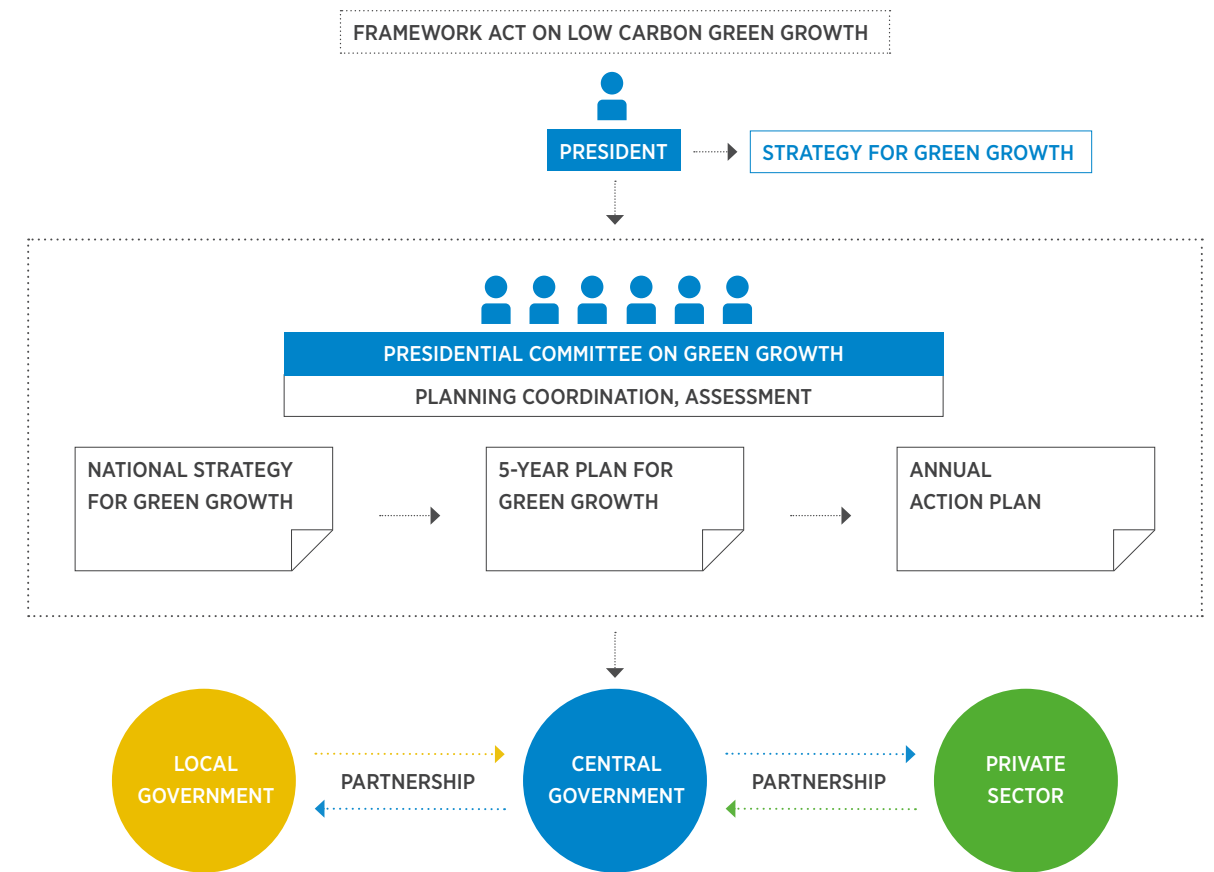
## INSTITUTIONAL FRAMEWORK

The Presidential Committee on Green Growth (PCCG) was established in 2009 to spearhead Korea's Green Growth Transformation. Specifically, the PCCG developed and mandated the legal framework, strategic planning, and budget allocation for the National Strategy.

The Committee on Green Growth was instituted several years later in 2013 with the main function of deliberating matters concerning Green Growth. The Committee was comprised of 38 people: 21 Private Experts and 17 ministers, Co-chairs: Prime Minister and one Private Expert and 4 Sub-Committees focused on:

- Green Growth Strategy
- Climate Response
- Green Technology and Industry
- Energy

Figure 2 Institutional Framework for Green Growth



## LEGISLATIVE FRAMEWORK

The Framework Act on Low Carbon Green Growth was enacted in 2010. It provided the legal basis for implementing measures to effectively address climate change and energy issues, promote sustainable development, build the implementation system for green growth (such as the establishment of the Committee on Green Growth), and revise a variety of institutional systems to promote low-carbon green growth in the region.

The major provisions in the Framework Act include:

- The realization of the green economic system, green technology and green industries.
- Policies on energy, sustainable development; the green life, the green homeland and the low-carbon traffic system.
- International negotiations and cooperation in relation to low carbon, green growth, including climate change.
- Procurement of financial resources, taxation, financing, training of human resources, education, and public relations activities necessary for low carbon, green growth.

## STRATEGIC FRAMEWORK

The National Strategy for Green Growth (2009-2050), provides a comprehensive policy framework towards green growth. Launched in 2009, the strategy aims to promote eco-friendly new growth engines, enhance people's quality of life, and contribute to international efforts to fight climate change. To achieve the goals set in the National Strategy, South Korea rolled out a series of five-year plans with the following objectives:

### Definition of Green Growth:

Growth that registers harmony between economy and environment that reduces climate change and environmental damage by saving and efficiently using energy and resources and creates jobs by exploiting new growth engines through R&D in clean energy and green technology.

\*Article 2, Section 2 of Low Carbon Green Growth Framework Act (hereafter the Framework Act)

The government set a budget target to allocate 2% of GDP for Phase 1 (2009-2013)  
Total: 107.4 trillion KRW (98.1 billion USD (1/1/2013))<sup>5</sup>

	Total	'09	'10-'11	'12-'13	Growth
<b>Public Investment (trillion KRW)</b>	107.4	17.5	48.3	41.5	10.2%
<b>Adaptation to climate change</b>	56.9	8.6	29.2	19.1	14.0%
<b>New growth engine</b>	28.6	4.8	10.8	13.1	9.4%
<b>Better life quality</b>	27.9	5.2	10.5	12.2	3.6%

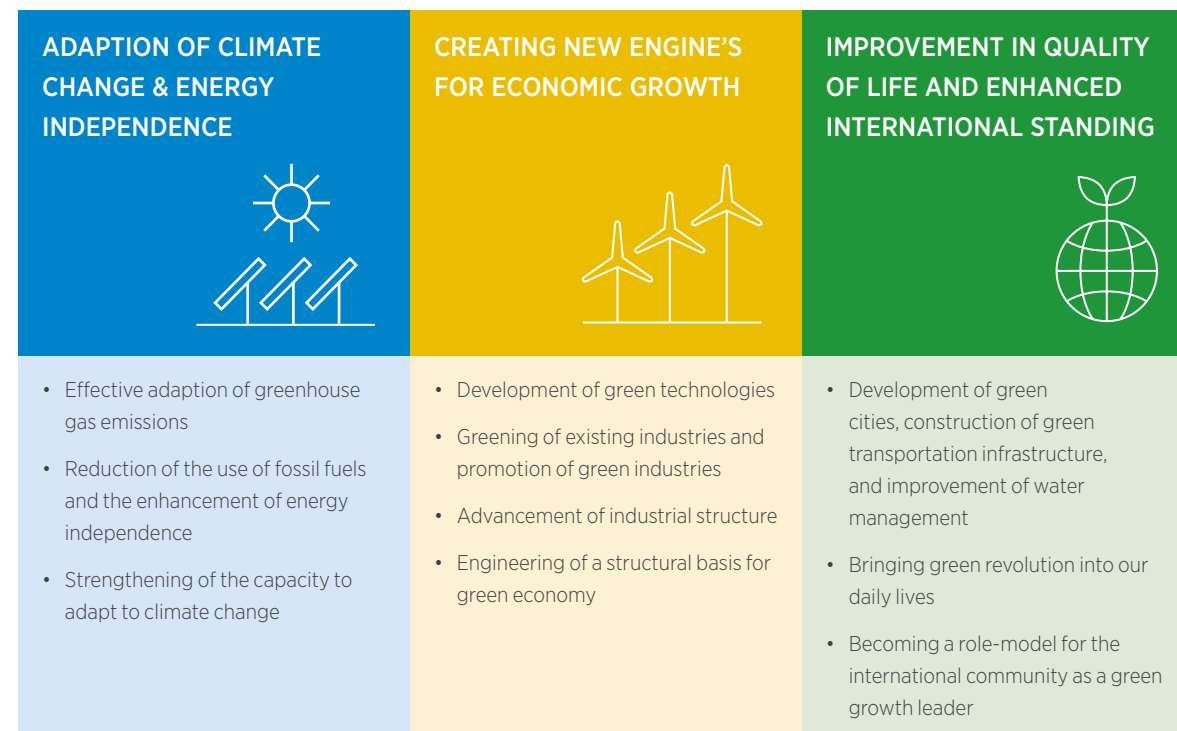
### The 1st Five-Year Green Growth Plan 2009-2013

- Adaptation to climate change and energy independence
- Creating new engines for economic growth
- Improvement in quality of life and enhanced international standing

### The 2nd Five-Year Green Growth Plan 2014-2018

- Establishing a low-carbon socio-economic infrastructure
- Achieving a creative economy through the convergence of green technology and ICT
- Building a pleasant living environment safe from the harms of climate change

Figure 1 Three Objectives and Ten Directions of Green Growth



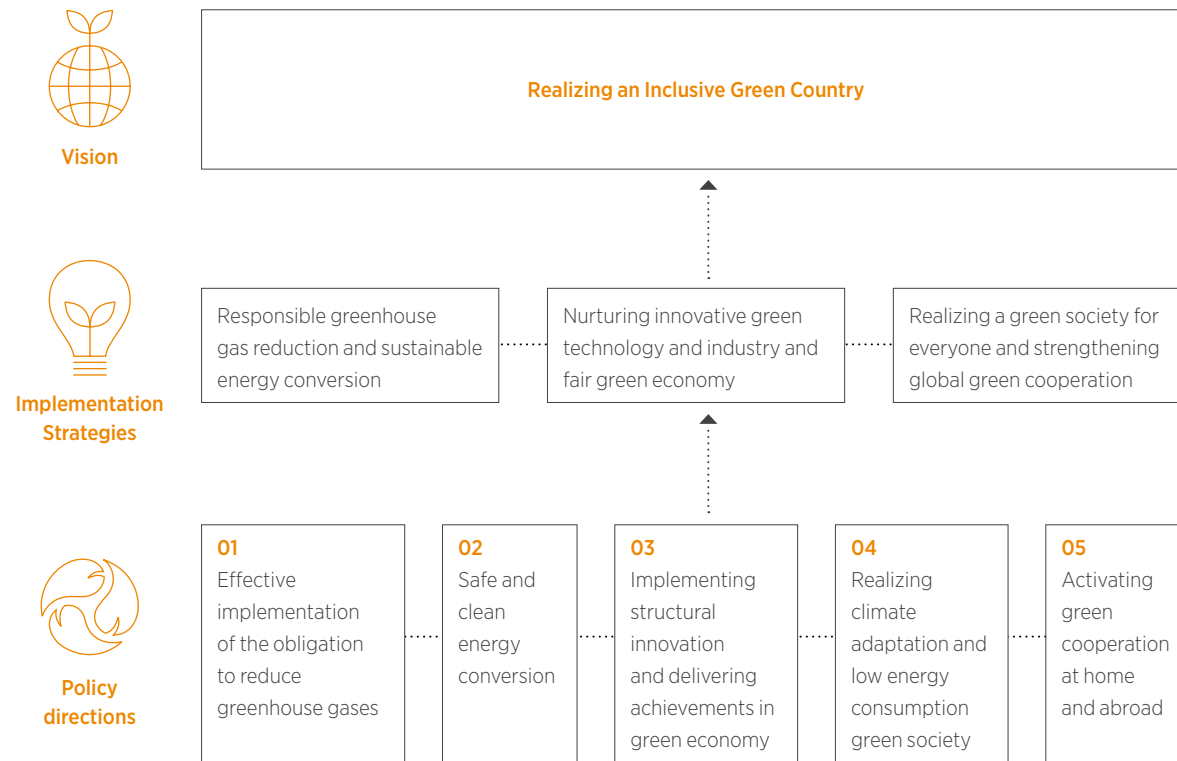
## MAJOR ACHIEVEMENTS 2009-2019<sup>6</sup>

10 years of Green Growth Policy implementation has:

- Facilitated the adoption of Green Growth as an agenda for national development and the institutionalization of Green Growth promotion.
- Aided in preparing the basis for preemptively setting the GHG reduction target and system.
- Established the foundation for future growth engines through the development of green technology.
- Led to an increase in the supply of green products and efforts for actualizing green lifestyle.
- Enhanced national standing by setting green growth as a global agenda by establishing and engaging related internal organizations.

**The 3rd 5-Year  
Green Growth Plan <sup>7</sup>**  
2019-2023

- Responsible greenhouse gas reductions and sustainable energy convergence
- Nurturing innovative green technology, industry and fair green economy
- Realizing a green society for everyone and strengthening global green growth cooperation

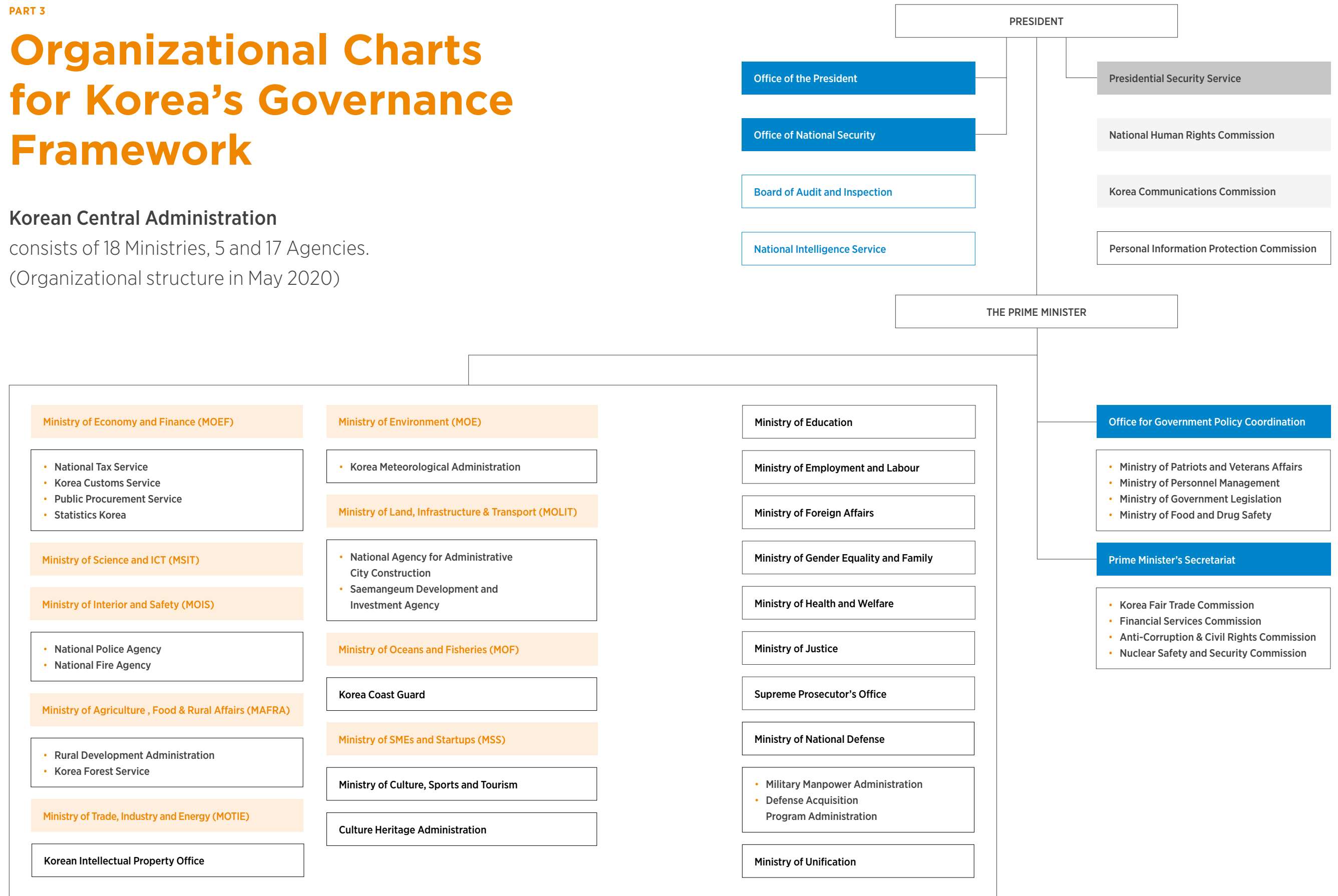


# PART 3

# Organizational Charts for Korea's Governance Framework

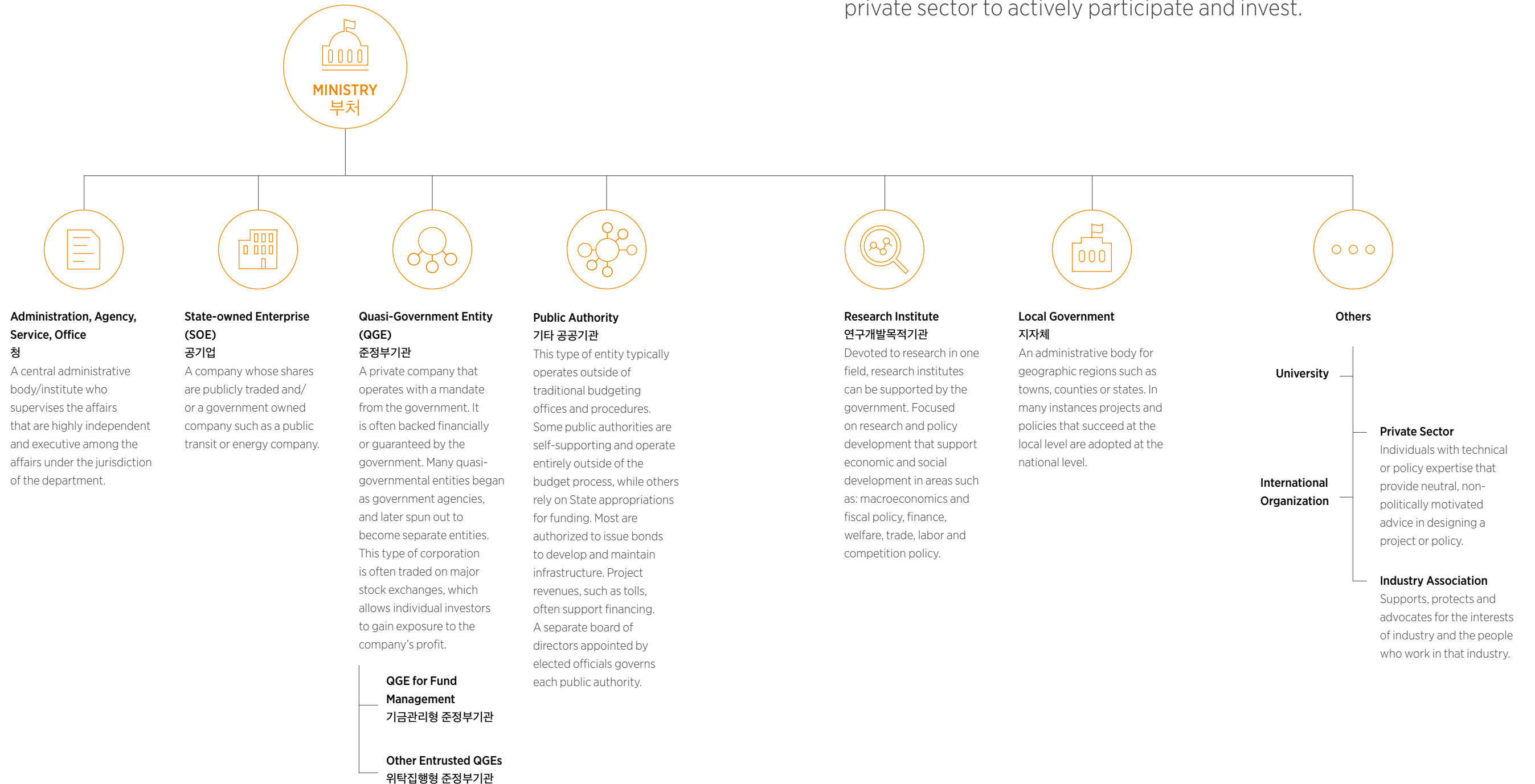
## Korean Central Administration

consists of 18 Ministries, 5 and 17 Agencies.  
(Organizational structure in May 2020)



# Institutional Roles and Functions in Korean Governance

Much of Korea’s successful transformation from war-torn country to global leader is a direct result of institutional frameworks and strategically designed governing structures. Establishing effective institutional frameworks allows for long-term strategic planning and investments. When done correctly, such long-term planning can align citizens’ interests and nation building with clear opportunities for the private sector to actively participate and invest.





# PART 4

# Korea at a Glance



## CLIMATE <sup>8</sup>

The average annual temperature in South Korea ranges from 6°C to 16°C. Excluding mountainous regions, the temperature ranges from 10°C to 16°C.

In 2018, the average monthly temperature ranged from -1.9°C to 27°C. The highest temperature was recorded at 32°C and lowest temperature was -6.2°C.

Depending on which region, soil temperature ranges from 23°C to 33°C in the summer and -2.8°C to 5.3°C in the winter.



## PRECIPITATION <sup>8</sup>

The amount of annual precipitation is 1,500mm in the southern region and 1,300mm in the central region. Seasonally, about 50% to 60% of annual precipitation falls in the summer, and 5% to 10% falls in the winter.



## POPULATION AND HOUSEHOLDS <sup>8</sup> (AS OF 2018)

<b>POPULATION OF KOREA</b>	51,606,633
<b>EMPLOYED POPULATION IN KOREA</b>	16,610,000
<b>POPULATION IN FORESTRY</b> (4.5% of the total population)	2,315,000
<b>POPULATION IN FISHERY AND ANCILLARY INDUSTRY</b> (2% of the total population)	1,044,106
<b>POPULATION IN ENVIRONMENTAL MANAGEMENT (AIR, WATER, WASTE MANAGEMENT)</b> (2.8% of the total population)	443,000



## AREA AND TOPOGRAPHY <sup>8</sup>

<b>THE TOTAL LAND AREA OF SOUTH KOREA</b>	100,401 km <sup>2</sup>
<b>URBAN AREA</b>	16.7%
<b>FORESTS</b>	63.2%
<b>OTHERS</b>	20.1%
<b>THE TOTAL SEA AREA OF SOUTH KOREA</b>	438,000 km <sup>2</sup>
<b>NUMBER OF ISLANDS</b>	3,348
<b>LENGTH OF COASTLINE</b>	14,962 km <sup>2</sup>



## The National Economy and Natural Capital Resource Management



## ENVIRONMENT <sup>9</sup>

<b>THE VALUE OF AGRICULTURAL AND FORESTRY PRODUCTS (2018)</b>	USD 44.1 billion
<b>TOTAL BUDGET OF MINISTRY OF ENVIRONMENT (2020)</b>	USD 5.4 billion (1.2% of national budget)
<b>TOTAL BUDGET OF MINISTRY OF FISHERIES AND OCEANS (2020)</b>	USD 4.7 billion (1% of national budget)



## WATER <sup>10</sup>

<b>WATER PER CAPITA</b>	2,546 m <sup>3</sup> /person
<b>WATER SUPPLY</b>	19.1 billion m <sup>3</sup> /year
<b>WATER SUPPLY AND SANITATION BILLS AS A SHARE OF DISPOSABLE INCOME</b>	0.2%



## FISHERIES <sup>11</sup>

<b>TOTAL BUSINESSES ENGAGED IN THE ENTIRE FISHERIES INDUSTRY</b>	95,980 firms in 2017 <small>(production, processing and distribution industries)</small>
<b>FISHERY PRODUCTS EXPORT (2018)</b>	USD 2,380 million
<b>FISHERY PRODUCTS IMPORT (2018)</b>	USD 6,130 million
<b>NUMBER OF PEOPLE EMPLOYED IN FISHERIES BUSINESS (2017)</b>	638,647

# Korea's Environmental Policy History and Interests



## 1953 - 1969



### Fisheries

- **1953**  
The Fishery Resources Protection Act



### Air

- **1963**  
Enactment of Pollution Control Act, previously air pollution had not been a major concern



### Forest

- **1964**  
Banning illegal timber harvest
- **1967**  
Establishment of the Korea Forest Service. Despite continuous efforts, the national forest stock remained low until the early 1970s.
- **1967**  
Designation of the first national park (Jirisan Mountain National Park)



### Soil

- **1963**  
Mining Prevention Act



### Waste Management

- **1963**  
Enactment of Environmental Pollution Prevention Act & Toxic Substance Control Act



### Water

- **1961**  
Enactment of Water Supply & Waterworks Installation Act & Waste Cleaning Act  
Urbanization and industrialization led to large quantities of waste dumped into open spaces, drainage channels, streams, rivers, and oceans without proper treatment.
- **1966**  
Enactment of Sewage Act
- **1967**  
Establishment of K-water, and construction of first sewage treatment plant

## 1970 - 1989



### Air

- **1980**  
Establishment of Environment Agency
- **1981**  
Introduction of Environmental Impact Assessment



### Fisheries

- **1975**  
Inland Water Fisheries Development Promotion Act
- **1987**  
The Framework Act on Marine Development
- **1983**  
Introduction of Emission Charge System
- **1988**  
Increased use of eco-friendly heating fuel



### Water

- **1967-1988**  
Construction of multi-purpose dams, water supply system, and industrial complex for national economic growth
- **1971**  
Industrial Sewage and Pollutants Discharge Permit System
- **1980-1990**  
Expansion of sewage treatment plants
- **1988**  
Improving the welfare and living standard of citizens now a concern



### Forest

- **1971**  
Introduction of Greenbelt
- **1973-1987**  
1st & 2nd Afforestation, Rehabilitation of slash-and-burn area, erosion control

# 1990 - 2009

## General

- **1994**  
Establishment of Ministry of Environment
- **1996**  
Establishment of Ministry of Oceans and Fisheries
- **1997**  
Establishment of Korea Marine Pollution Response Corporation (KMPRC)
- **2008**  
Launch of Korea Marine Environment Management Corporation (KOEM), formerly KMPRC
- **2008**  
Declaration of the Green Growth Initiative



## Air

- **1997-2002**  
Achieved nationwide management of CleanSYS (air pollutant monitoring system for stationary sources)
- **2000**  
National air quality monitoring now conducted by Korea Environment Corporation
- **2002**  
Converted diesel automobiles to pollution-low or free automobiles and applied emission reduction system on automobiles
- **2003**  
Established national ambient air monitoring information system
- **2006-2015**  
Increased environmentally friendly public transportation
- **2008**  
Enforced total emission cap management system



## Fisheries

- **1990**  
**Fisheries Act**  
Regulates a range of issues, including: fish licensing including aquaculture, fish processing and transport, measures for the conservation and protection of fisheries resources among other issues.
- **2000**  
Aquaculture Ground Management Act
- **2001**  
Fishery Products Quality Control Act
- **2002**  
Culture-based Fishery Promotion Act



## Forest

- **1996**  
Long-term plan on expansion of national forest (1996-2020)  
*Continuous Afforestation to use forest resources*  
*Policies for mountainous villages and forest recreation*  
*Policies for Sustainable Forest Management (SFM)*



## Soil

- **1994**  
Groundwater Quality Regulation
- **1995**  
Soil Environment Conservation Act
- **1997**  
Groundwater Act
- **2002**  
Soil Environment Assessment
- **2005**  
Mining Damage Prevention and Restoration Act



## Water

- **2000**  
Focus transitioned to prevention of urban flooding, and rainfall management



## Ocean

- **1991**  
Marine Pollution Prevention Act
- **1999**  
Coastal Management Act
- **2007**  
Marine Environment Management Act



## Waste Management

- **1995**  
Introduction of Volume-based Waste Fee system

# 2010 - Present



## Air

- **2012**  
New procedure for including public opinions on national plan for air quality management, established automobile fleet average system, and started subsidizes for electric vehicles
- **2018**  
Enacted Special Act on the Reduction and Management of Fine Dust
- **2020-Present**  
Reducing coal station related fine dust, and shift to green energy sources



## Fisheries

- **2014**  
Establishment of Fisheries Monitoring Center and Operation of Vessel Monitoring System to prevent illegal fishing
- **2020**  
Establishment of the Ocean Korea 21, the national 30-year plan



## Forest

- Policies for Promotion of Forest Welfare



## Soil

- **2010-2019**  
Master Plan for Soil Environment Conservation (Phase 1)
- **2020-2029**  
Master Plan for Soil Environment Conservation (Phase 2)



## Water

- **2012-2021**  
Master Plan on Groundwater Quality Management
- **2017-present**  
Focusing on establishment of integrated water management and sustainable water circulation system



## Ocean

- **2011**  
The 4th Comprehensive Marine Environment Plan (2011-2020)
- **2019**  
The 3rd Marine Debris Management Plan (2019-2023)



## Waste Management

- **2018**  
Framework Act on Resource Circulation

# Taking an Integrated Solutions Approach Green Growth for Environmental Impact

Because issues involving the environment are complex, across sectors and stakeholders, the Ministry of Environment adopted a green growth approach. This was done by applying cross sectoral environmental social and governance considerations to shift the economic priorities and environmental health to be synonymous towards a greener economy. Moreover, while the Ministry of Environment led the technical design of the regulatory policy, the Ministry of Economy and Finance also supported this shift. In 2016 a comprehensive roadmap was developed with detailed strategies and policies set out that would help Korea achieve its aim of reducing greenhouse gas emissions by 37% by 2030.

Roughly 2% of Korea’s annual GDP over 5 years was allocated for the implementation of green growth strategies in response to the 2008 financial crisis.

**Environment addressing**

- Climate change
- Particulate matter
- Water conflicts
- Plastics and hazardous chemicals



The Ministry of Environment presents a clear example of how sector collaboration is a force multiplier in solving complex problems.

**HOW GREEN GROWTH LEVERAGES THE ENVIRONMENTAL SECTOR IN KOREA**

**Declaration of the Green Growth Initiative**

Following the 2008 financial crisis, Korea designed a financial recovery, green stimulus towards a green growth future. The comprehensive policy framework for green growth provided short- and long-term stimulus designed to invest in green jobs and support the transition to a cleaner and more sustainable future.

The National Strategy for Green Growth was adopted along with the Five-Year Plan for Green Growth. Under the Five-year plan, the government invested approximately 2% of annual GDP on

green growth programs and projects and passed a 30.7 billion USD annual stimulus package for 2009 (The 1st Five-Year Green Growth Plan 2009-2013 total spend 107.4 Trillion won) aimed to support green ambitions that include renewable energy resources, energy-efficient buildings, expanding of railway systems, improving waste management and many other projects. The targeted financial stimulus was a success as jobs were maintained and the economy emerged faster from the crisis and with less economic damage than other economies around the world.

# Air

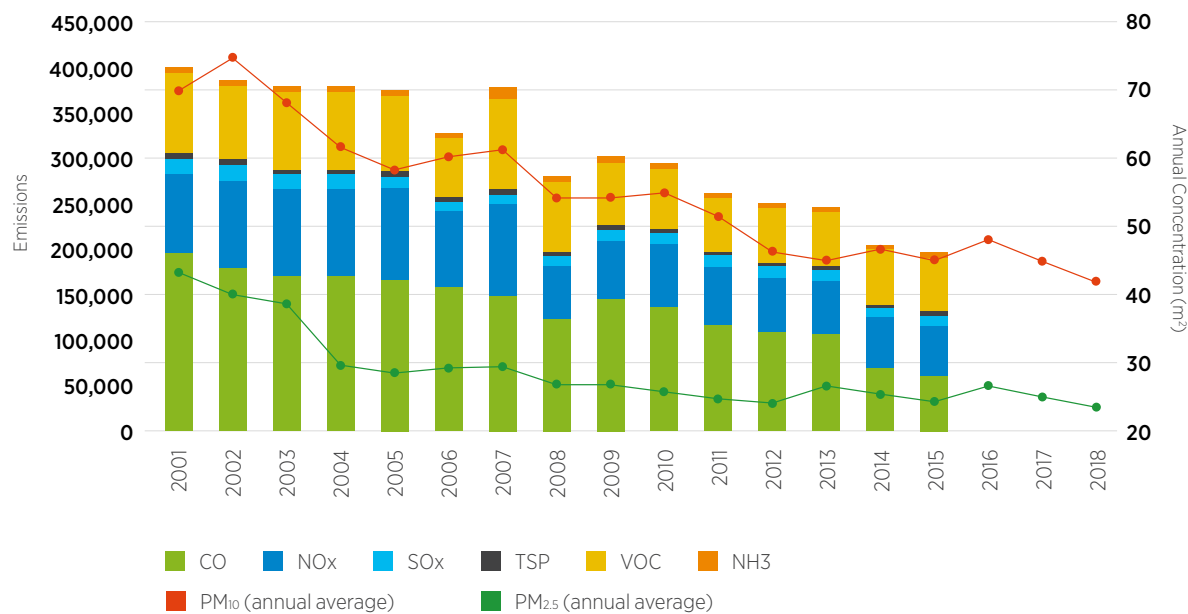
## Green Growth Ideas for Addressing Climate

### AIR QUALITY

Air quality has recently become a national concern in Korea. Over the last few years- particularly in the winter and spring -the country has experienced an increasing number of poor air quality days. Responding to the need for urgent action, the country set higher standards and established a monitoring process. The plan aims to reduce PM2.5 emissions by 35.8% by 2022 from its level in 2014.

Korea aims to reduce fine dust by 35.8% by 2022

Korea's Air Quality Trend (2001-2018) <sup>12</sup>



## Greenhouse Gas Reduction

### NATIONAL GREENHOUSE GAS REDUCTION GOAL

Korea set ambitious emission goals as part of the Paris Climate Agreement. The country's emission reduction goal is 37% by 2030 and in 2016 a detailed strategic roadmap along with policy tools for each sector was created. This roadmap is continuously updated to incorporate the latest technological advances and policy trends.

Detailed strategic plan with policy tools for each sector continuously updated

### EMISSIONS TRADING SCHEME

Implemented nationally in 2015 this tool for emissions reduction now includes over 70% of the national GHG emissions. The share of auctioning continues to rise and the scheme functions as a carbon pricing system. The benchmark method for allocation of permits rewards efficient installations by setting benchmarks based on the best available technology.

### CONTINUAL ADAPTION

Average annual temperatures have been rising at an even faster rate than the warming trends occurring around the rest of the world. In order to adapt, the Ministry of Environment works to enhance climate-resilient infrastructure. Programs to protect the vulnerable -such as the elderly, children and outdoor workers -are being scaled up and expanded.

### SECTORAL STRATEGIES

Achieving environmental goals requires cross sectoral actions and strategies.



Reduce the share of coal in the current energy mix while increasing the proportion of renewables up to 20% by 2030.



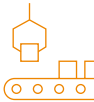
Suspend granting permit for new coal-fired power plant and phase out old ones.



Expand zero-energy requirements for all new buildings and promote green remodeling to dramatically improve building energy efficiency.



Provide more electronic & hydrogen vehicles for the market and offer more low-carbon options for public transportation such as intercity railroad networks.



Support innovation in manufacturing by providing more smart factories. Factory Energy Management System (FEMS) could be one of the options.



Convert into eco-friendly refrigerants for vehicles and air conditioners and replicate the industry's best practices in other sectors by 2030.



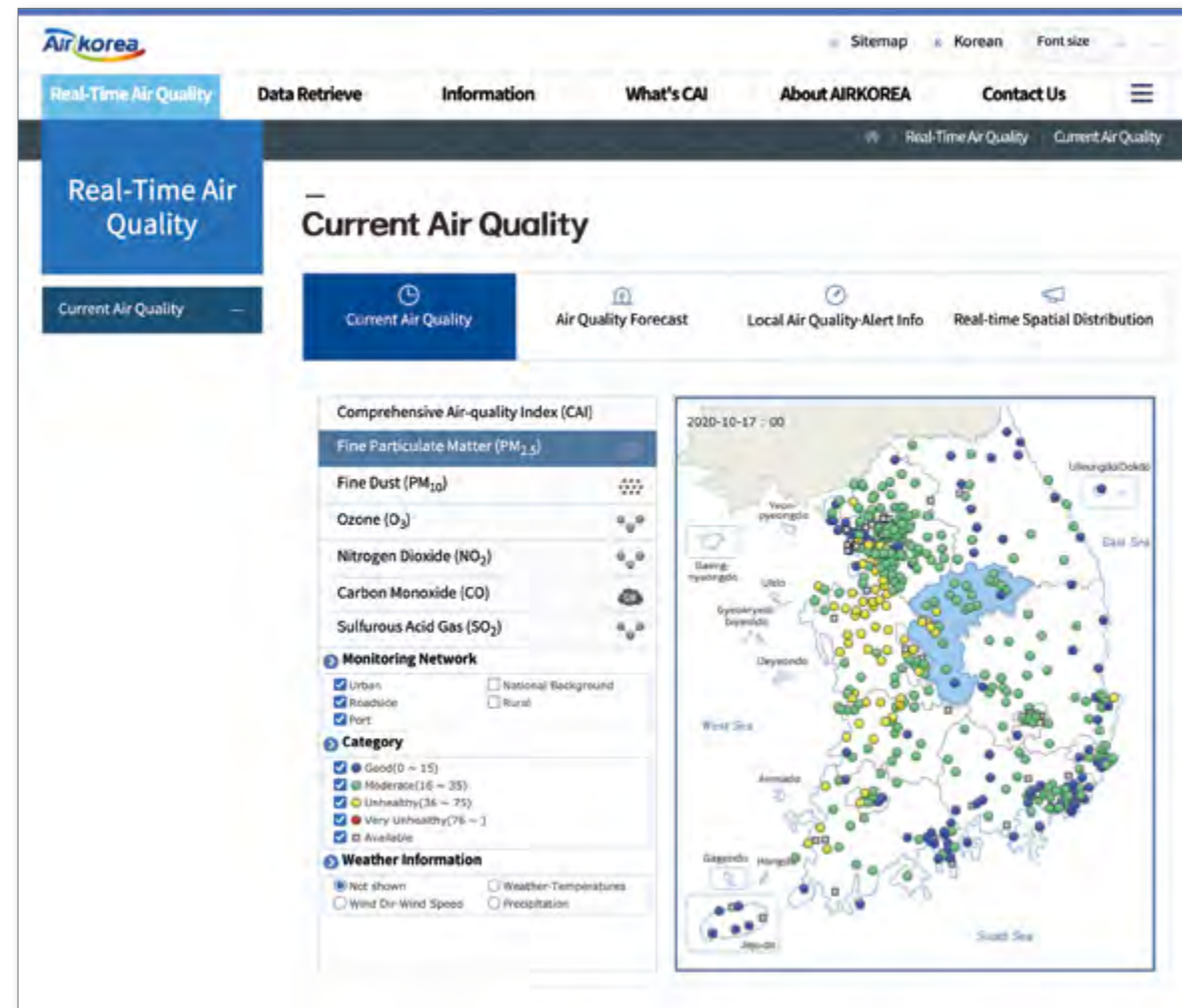
Reduce waste sources and promote recycling. Put circular economy in practice by implementing action plans for each product phase from production to recycling.

# Real Time Air Pollution Information Platform “Air Korea”

In response to public concern, the Ministry of Environment (MOE) installed a monitoring network to measure air pollutants such as fine dust and ozone. The national air pollution monitoring network consists of 514 stations across the country investigating the ambient air pollution to determine if air quality standards are being achieved. Data collected is disseminated in real time through “Air Korea”, an informational

website. The air quality monitoring network checks pollutants such as SO<sub>2</sub>, NO<sub>2</sub>, CO, O<sub>3</sub>, PM<sub>10</sub>, and PM<sub>2.5</sub>, and weather factors such as wind direction, speed, temperature, humidity, solar radiation and UV radiation.

Anyone can access the website to see the status of the nationwide air pollution, and citizens can easily check air pollution in their specific neighborhood.



Section	Good	Moderate	Unhealthy for sensitive groups	Unhealthy	Very unhealthy	Hazardous
(Index value)	(0-50)	(51-100)	(101-150)	(151-250)	(251-350)	(351-500)
Symbol color (RGB cord)	Blue (#000FFF)	Green (#00FF00)	Yellow (#FFFF00)	Orange (#FF9900)	Red (#FF0000)	Brown (#861313)
Character						

Source: Air Korea 2010 brochure

## EMERGENCY REDUCTION MEASURES

The government now takes emergency actions when high concentration of PM<sub>2.5</sub> is predicted in order to reduce emissions and protect citizens from harmful pollutants. Actions include adjusting operation levels of coal-fired power plants, construction sites and emission facilities, and temporarily banning high emission cars from driving.

## STRATEGIES

The plan set up a strong framework for tackling air pollution, with a special focus on four major sources of fine dust, power generation, industries, transportation, and daily surroundings.



### Power generation

Strengthen control over emissions from coal-fired power plants and increase penetration rates of new renewable energy.



### Industries

Introduce the “Dust Cap Regulation” targeting emission facilities in the Seoul Metropolitan Area and apply stricter permissible emissions levels to business facilities.



### Transportation

Apply tighter emission standards to diesel vehicles, expand restrictions of driving diesel vehicles, and encourage the use of eco-friendly cars.



### Daily surroundings

Mitigate fugitive dust from roads, root out illegal incinerations, and reduce emission sources of fine dust in urban and rural areas.

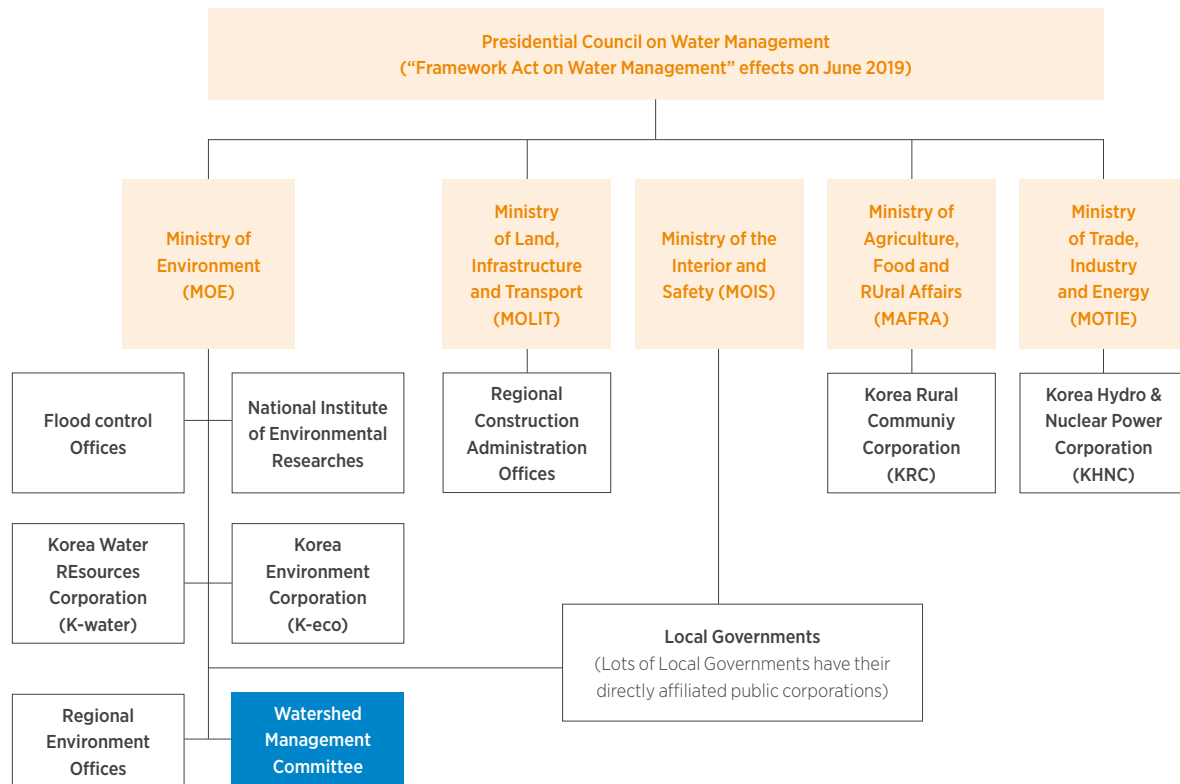
# Water

## Green Growth Approach: Smart Water Systems

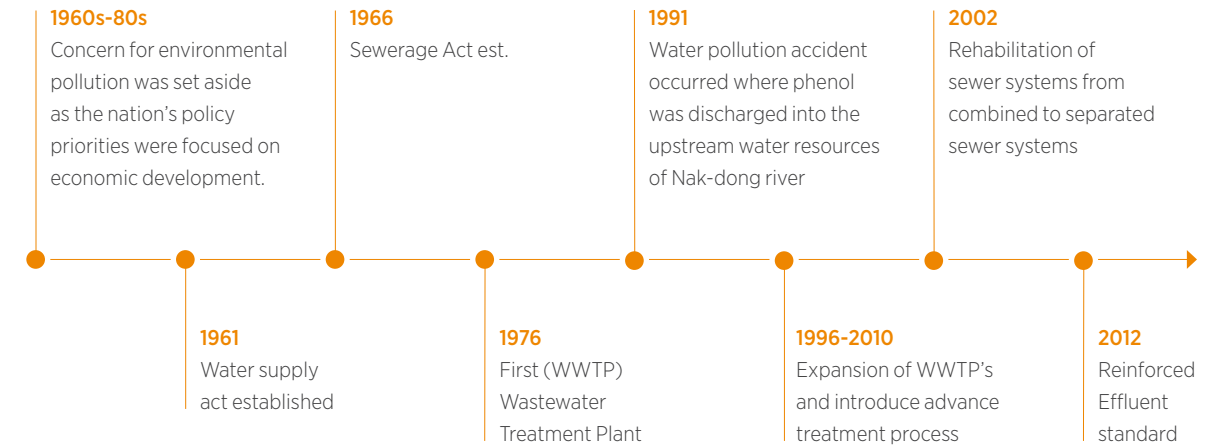
Protecting clean water in rivers and lakes across the country and ensuring a stable supply of safe water is a critical mission for the Government. In 2018 the country overhauled its national water management system and integrated it under the Ministry of Environment. The reforms streamlined the previously fragmented structure to ensure water management is cost-effective, equitable

and sustainable. According to the new Framework Act on Water Management, Korea will build a National Water Management Plan every ten years that establishes policy goals and specific measures on water issues including water quality, water resources, disasters, conflicts and the water industry.

### WATER MANAGEMENT GOVERNANCE AND INSTITUTIONAL ROLES



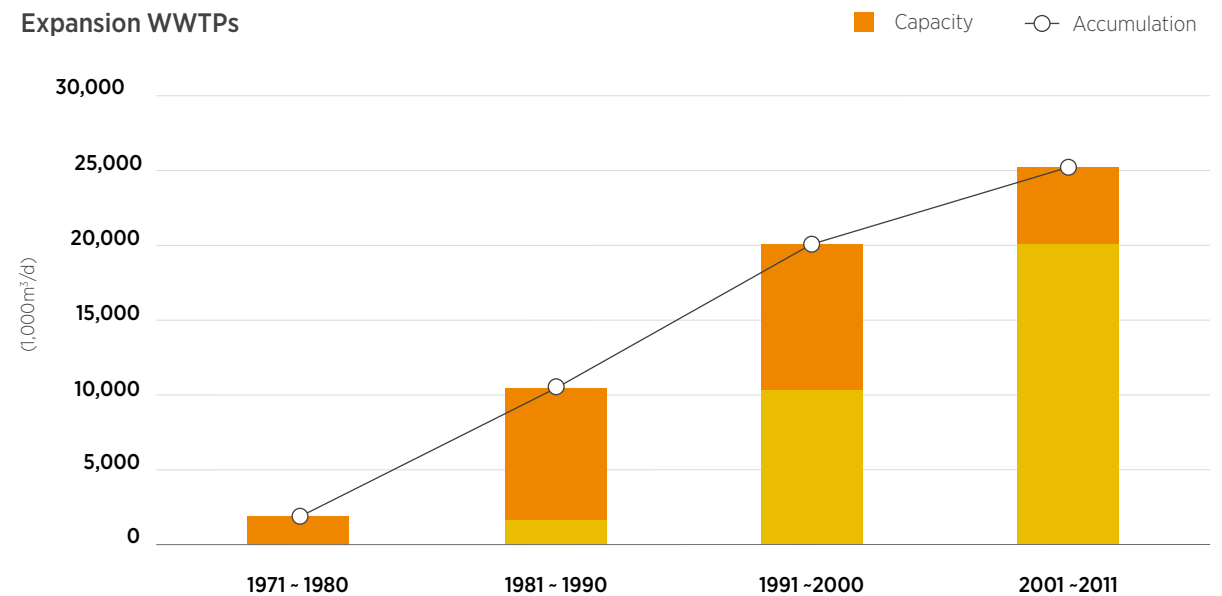
### DEVELOPMENT OF WASTEWATER TREATMENT AND MANAGEMENT



### HISTORY OF WASTEWATER MANAGEMENT

Year	Capacity of WWTP (m <sup>3</sup> /d)	Accumulation (m <sup>3</sup> /d)
1971 ~ 1980	1,710,000	1,710,000
1981 ~ 1990	8,619,000	10,329,000
1991 ~ 2000	9,662,000	19,991,000
2001 ~ 2012	5,075,000	25,066,000

### Expansion WWTPs



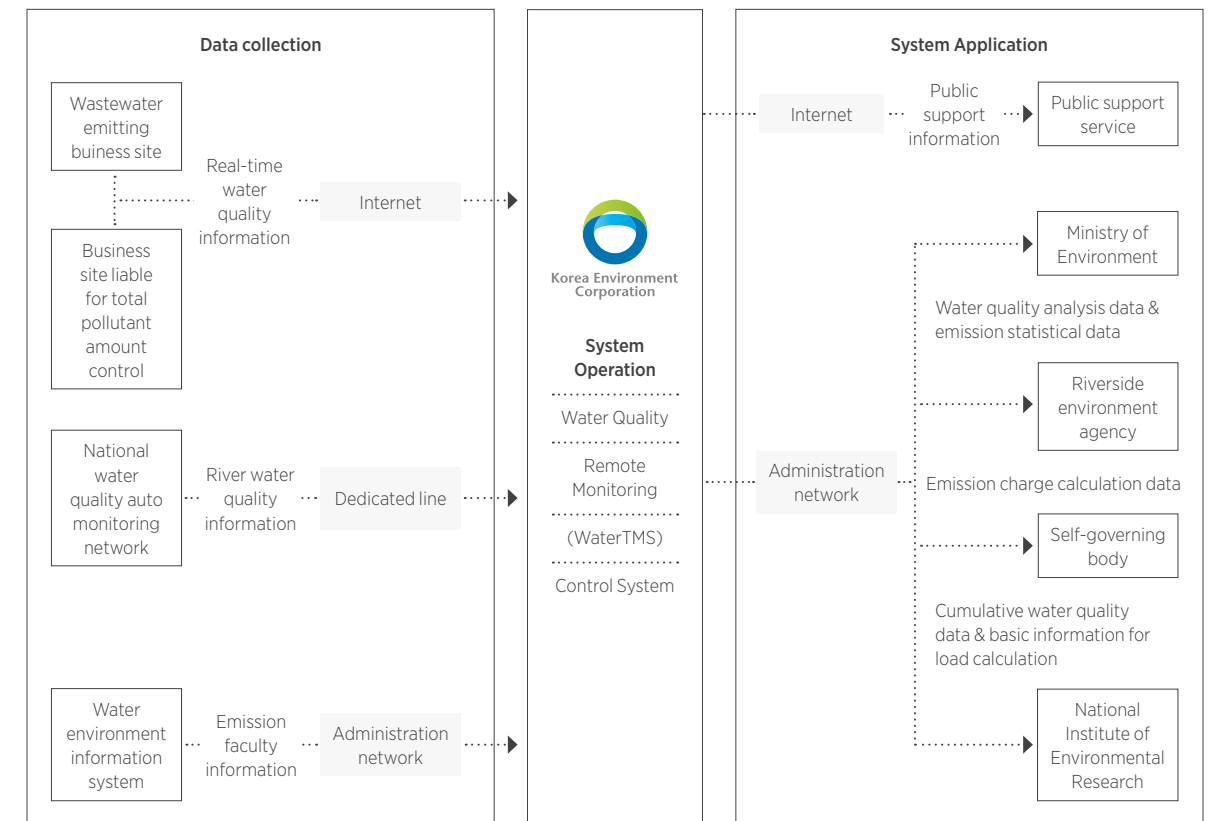
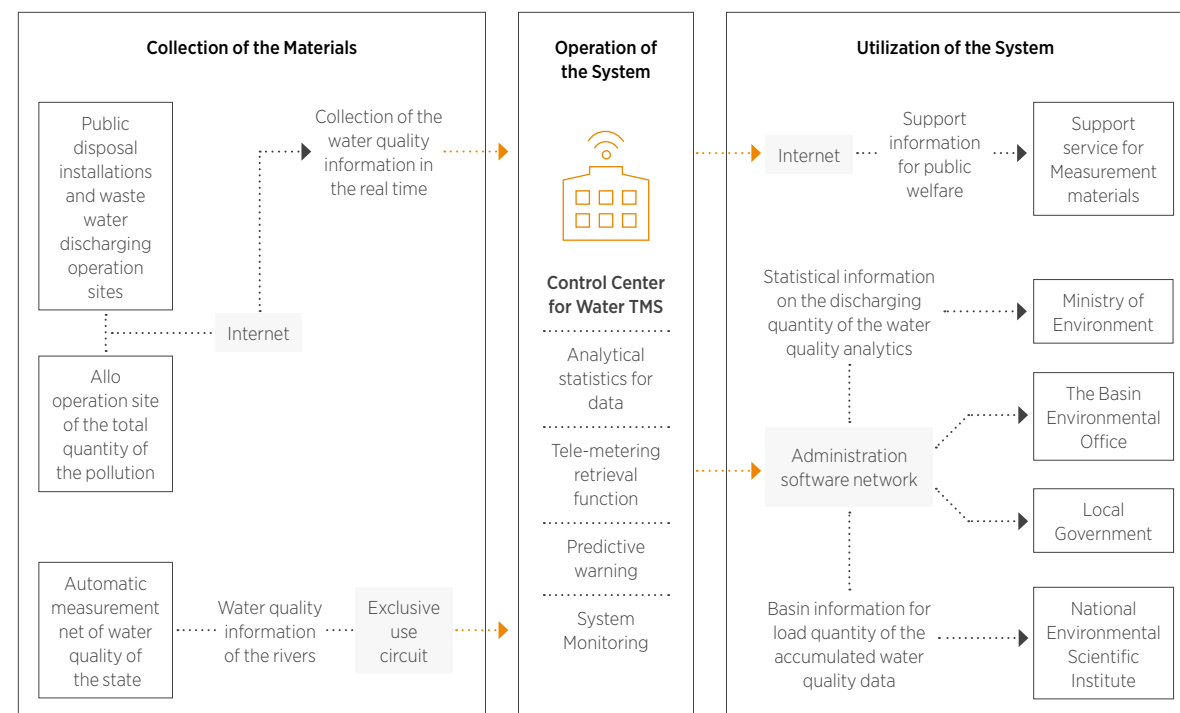
In just a few years the country underwent tremendous changes, expanding capacity at an extraordinary rate.



## NATIONAL WATER QUALITY MONITORING SYSTEM & WATER QUALITY TELE-MONITORING SYSTEM

- (1) Overview: Real-Time water quality monitoring based on advanced IT & ET  
 (2) Application Target

<b>Project name</b>	<b>N WQ MS (Since 1995 ~)</b>	<b>Water-TMS (Since 2008 ~)</b>
<b>Target</b>	4-Major rivers	STP: capacity over 2,000 m <sup>3</sup> /d
<b>Number</b>	60	657
<b>Effect</b>	Early Warning on Pollution Basic Data for Policy Making	Effluent Real-Time Monitoring Basic Data for Violation Check



## POLLUTION CONTROL

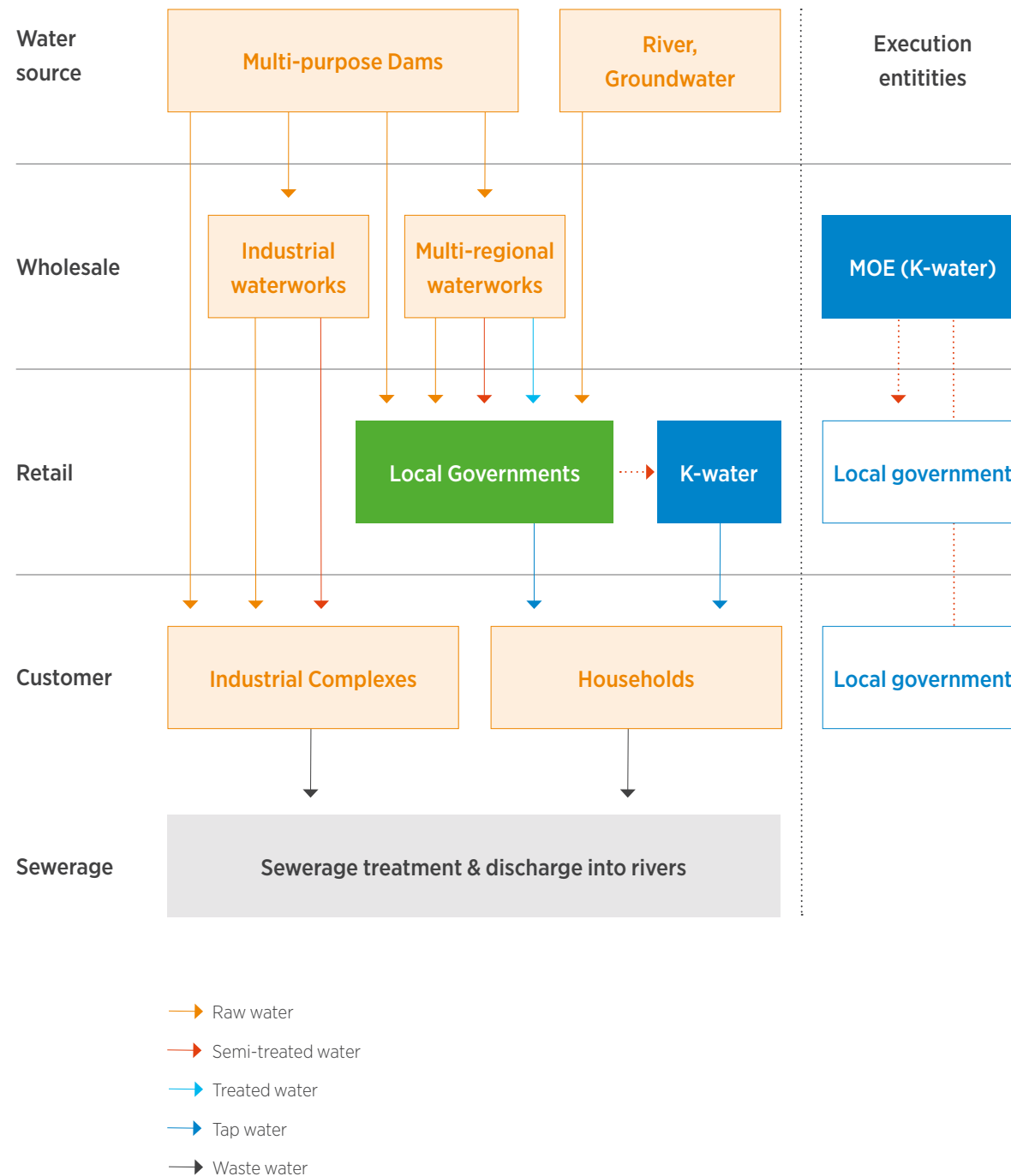
### Total Water Pollution Load Management System

In 2004, the Total Water Pollution Load Management System was introduced at river basin levels to protect and improve the water quality of the rivers across the country. The system sets water quality goals for each river basin, calculates the amount of pollutant discharges to meet the goals, allocates permissible discharges to each local government, and monitors the compliance based on which special measures including development restrictions are taken.

Discharge from industrial and wastewater treatment plants is managed with stringent

standards for 51 parameters. Effluent management is continually strengthened by the adoption of new parameters and expansion of the application of these standards to protect clean river water and healthy ecosystems. Across the four major rivers, 66.4% of pollution comes from diffuse sources other than the industrial and sewage effluent from point sources. Systematic approaches are taken to manage the non- point source (NPS) water pollution such as the designation of NPS Control Areas and the legal obligation to install pollution reduction facilities for large scale development projects.

## Water supply Service (Residential and Industrial use)



## WATER SUPPLY

Decades of work to expand waterwork facilities and service has succeeded in bringing clean water to 99.1% of the population. While access to water for all has nearly been achieved, there is still an urban-rural gap to be fixed. The need for water access to rural villages is now being addressed.

There is a nationwide initiative to upgrade old water pipes and infrastructure. Korea's national water grid is evolving towards higher stability, safety and efficiency by incorporating smart technologies such as automated water treatment and real-time measurement and analysis.

## DISASTER PREVENTION

Due to the impacts of climate change, Korea is experiencing increasingly intensive, concentrated and unpredictable rainfall patterns. Korea is working to optimize the national system to protect people from water-related disasters through making the best use of advanced technologies and information networks. For instance, the Flood Control Offices in the four major rivers collect hydro and meteorological information, analyze flood risks, produce forecast, and issue real-time flood warnings from 60 points nationwide.

## CONFLICT MANAGEMENT

Addressing the conflict between upstream and downstream reaches, and between urban and rural areas has been a key concern in Korea's water policies. Policy instruments to correct the inequity now include water use charges that are collected by downstream tap water users and invested in water quality improvement and welfares in upstream communities.

## EXPERIENCE AND LESSONS

### Harmony

- **Consensus among Shareholders**  
Central & Local Gov & Residents
- Upstream & Downstream Area
- Protection vs Development

### Quality Control & Assurance

#### Importance of QC in Piping Work

- Reducing Leakage in Water Supply and Infiltration/Inflow in Sewerage

#### Introduction QA system in WWTP

- Set Target before Bidding
- 3-6 months for test-run & final Q/A

### Localization

- Water Treatment Process
- Material & Machinery
- For Stable O&M

### Experts and Administration

#### Establishment of Experts Institution

- R&D, National Project Implementation
- Dispersing Relating Technologym QA/QC
- Monitoring Water Quality and Analysis

#### Systematic Water Management

Importance of Master Plan in Water Supply and Sewerage area for efficient budget investment and step wise expanding.

# Korea Water Company

## The Important Role of a Public Corporation

### K-WATER PUBLIC CORPORATION <sup>13</sup>

Korea's water policies and implementation are overseen by K-water, a public corporation established in 1967. K-water has been integral to the economic development of the country and has played a pivotal role in the construction and management of the multi-purpose dam, and the entire water supply system. K-water works with local governments to create economies of scale to modernize facilities and ensure water sustainability into the future. K-water conducts research and development over a range of areas

including integrated water management, water sustainability, eco-friendly water energy projects and developing the water-fusion industry.

K-water owns Integrated Water Resources Management (IWRM) to develop key technologies. They have nine key practical technologies and devices including high-efficiency algal bloom-removal, equipment movable on water, low impact development (LID) technique, distributed watershed runoff-analysis model, and techniques for restoring aquatic ecology of dams.

IWRM indicates a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resulting economic and social impact in an equitable manner without compromising the sustainability of vital ecosystems.

IWRM integrated water governance requires innovative technologies. Its expertise includes:

- Water information survey, management and analysis technologies
- Water management forecasting and decision-making technologies
- Hydraulic infrastructure maintenance & safety management technologies
- Technologies for integrated water quality management.

### GUIDING PRINCIPLES <sup>14</sup>

#### Integrated Water Resources Management (IWRM)

- Fresh water is a finite and vulnerable resource essential to sustain life, development and the environment.
- Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
- Women play a central part in the provision, management and safeguarding of water.
- Water has an economic value in all of its competing uses and should be recognized as an economic good.

### HISTORY AND MAJOR FOCUSES OF SEWAGE TREATMENT

- **Economic development (~1960s)**  
**1st Generation**
  - Sewage and rainwater drainage
- **Economic growth (1970s-1980s)**  
**2nd Generation**
  - Disposal of organic matters
  - Sewage and rainwater drainage
- **Economic Improvement (1990s~)**  
**3rd Generation**
  - Disposal of Nutrients
  - Disposal of organic matters
  - Sewage and rainwater drainage
- **Present (2000s~)**  
**4th Generation**
  - Resource Recovery
  - Disposal of Nutrients
  - Disposal of organic matters
  - Sewage and rainwater drainage
- **Near future**  
**5th Generation**
  - Disposal of Hazardous Substances
  - Resource Recovery
  - Disposal of Nutrients
  - Disposal of organic matters
  - Sewage and rainwater drainage

### WATER AND SEWAGE TREATMENT

- Water supply coverage reached 99.1% in 2017 (compared to 17% in 1961).
- Sewage treatment coverage reached 93.6% in 2017 (it was less than 2% in 1961).
- Korea has 625 public sewage treatment plants (STPs) which can handle 25,398,366t/d.
- The length of Korea's sewer is 137,193km.
- 1,027 million tons of wastewater was reused in 2015.

# Applying Green Growth Managing Waste and the Circular Economy

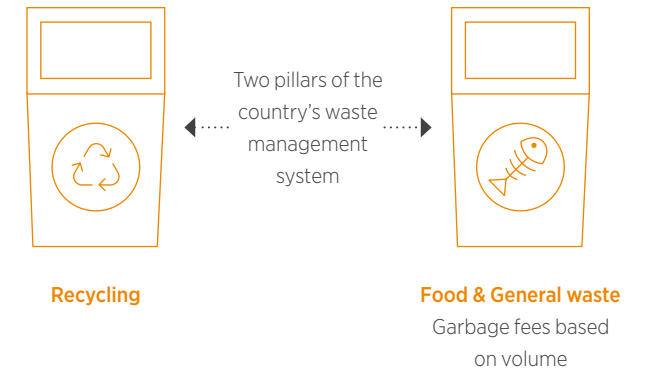


Korea has one of the world's most advanced waste management systems. For decades, the country has been a leader in extraordinarily high levels of recycling and currently 86% of its waste is recycled. The country's adoption and adherence to recycling is the direct result of innovative policies directed at producers and consumers, along with mobilizing new technologies when developed.

Examples:

- Extended Producer Responsibility imposes an obligation on product manufactures to collect and recycle waste derived from their products. Strict restrictions are placed on single-use goods such as coffee cups and plastic bags.
- Because half of waste comes from construction projects, there are requirements to use recycled aggregates in public and private construction projects. This is in order to promote the maximum recycling of construction waste.

Recently, policies to manage resources throughout their entire life-cycles have been introduced with the aim of building a circular economy where resources are reused and recycled instead of thrown away as trash. Businesses are given individual targets to meet, and ease of recycling must be incorporated into product design.



In 2017, each citizen discharged 1.02 kilograms of trash. Only a third of the amount in 1991

## GOALS AND MEASURES

In Korea, as in the rest of the world, plastic waste is a priority concern that is taken seriously. By 2030, Korea aims to reduce plastic waste by 50% and recycle 70% of the waste plastics. The Comprehensive Measures of Waste Recycling announced in 2018 set a series of policy actions to be implemented in each stage of resource cycle from production, consumption, disposal, collection/separation to recycling.



**Production**  
Assess the recyclability of all packaging materials including PET bottles, based on which manufacturers pay the recycling charges at different rates. By 2020, all colored plastic beverage bottles will be replaced with transparent ones which are easier to recycle.



**Consumption**  
Introduce recycling standards for postal and delivery packaging. Increase the number and types of businesses that are required to refrain from using single-use plastics. In 2022, Korea will consume 35% less plastic cups and bags than it is using now.



**Disposal**  
Help people learn and practice the right way to separate recyclables and discharge wastes by providing user-friendly guides and smartphone apps. Empower local governments and communities to handle local wastes.



**Recycling**  
Expand the EPR scheme to include more plastic products. Support the stable operation of recycling market through close price monitoring and proactive responses. Invest in more innovative recycling technologies.

86% of waste is recycled and reborn as resources in Korea

## Solid Waste Management

Being a resource-poor and energy-intensive society, Korea's solid waste management needs and policies have changed drastically over the past 40 years. Transforming the sector from a costly, resource intensive and environmentally damaging sector has been an opportunity to resourcefully recover the vast majority of solid waste and create energy leading to a profound transformation.

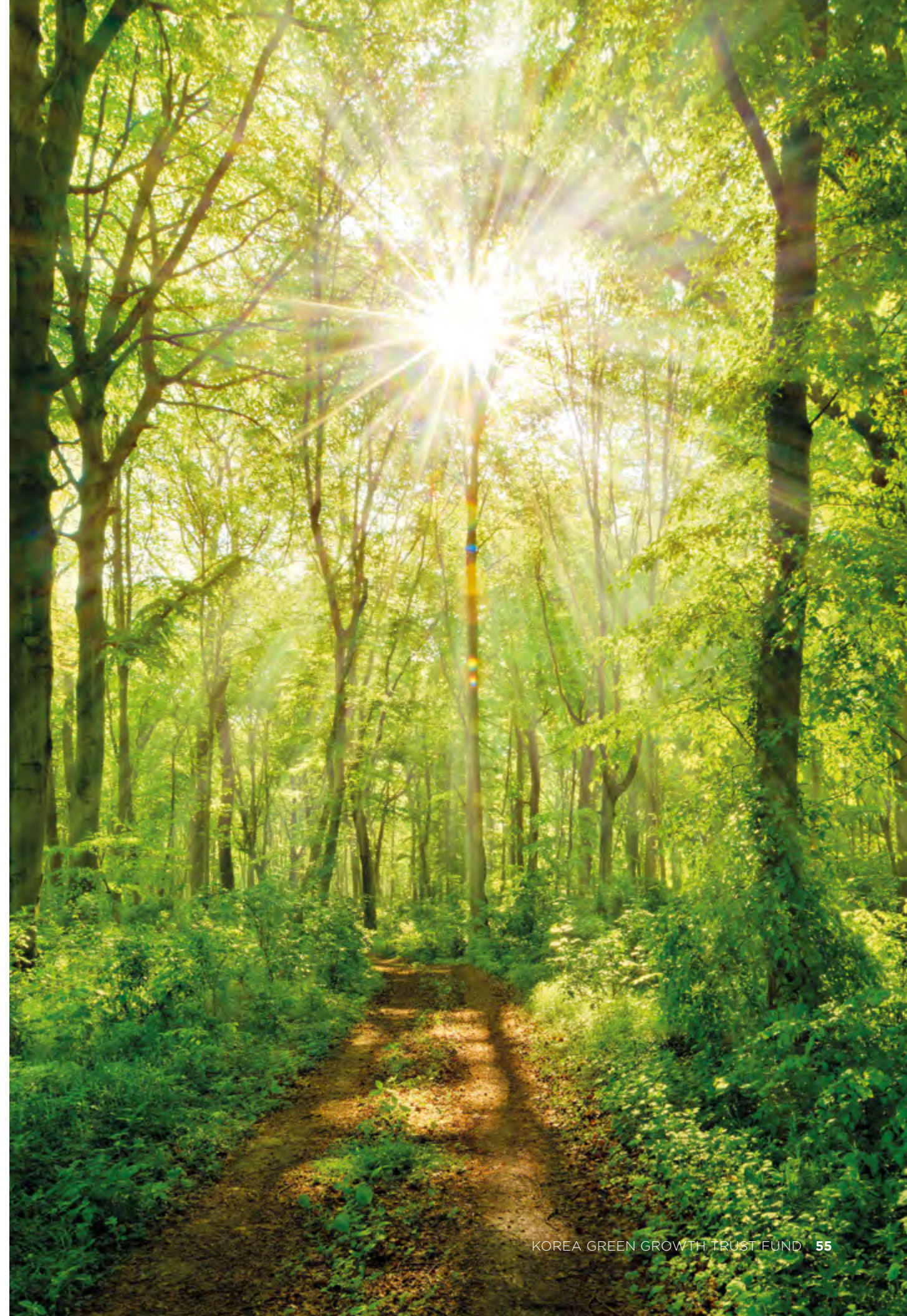
Currently, over 80 percent of the country's solid waste is recycled. In addition to policy interventions, this shift required carefully targeted investments and awareness-raising initiatives to encourage behavioral change among producers and consumers.

### EXTRACTING VALUE FROM MUNICIPAL SOLID WASTE FOR GREENER CITIES: THE CASE FOR GREEN GROWTH



#### Major Policy Instruments <sup>15</sup>

<b>Reduce</b>	<ol style="list-style-type: none"> <li>1. Volume-based waste-fee system</li> <li>2. Waste charge on the producers of hard-to-recycle products</li> <li>3. Restriction on the use of disposables</li> <li>4. Packaging reduction</li> <li>5. Industrial – and construction – waste reduction</li> </ol>
<b>Reuse</b>	<ol style="list-style-type: none"> <li>6. Guarantee money on empty vessels</li> <li>7. Promotion of package reuse</li> </ol>
<b>Recycle</b>	<ol style="list-style-type: none"> <li>8. Extended producer responsibility (EPR) system</li> <li>9. Eco-assurance system</li> <li>10. Food-waste recycling</li> <li>11. Construction-waste recycling</li> <li>12. Local-based eco-industrial towns</li> </ol>
<b>Energy Recovery</b>	<ol style="list-style-type: none"> <li>13. Expanded waste-to-energy facilities</li> <li>14. A clean energy park in the metropolitan area</li> </ol>
<b>Safe Treatment</b>	<ol style="list-style-type: none"> <li>15. Waste manifest (ALLBARO) system</li> <li>16. Waste import and export management</li> <li>17. Hazardous waste management</li> <li>18. Medical waste management</li> <li>19. Neglected waste management</li> </ol>



## The Largest Sanitary Landfill in the World is in Korea

### Sudokwon Landfill Site

A prominent example of Korean SWM policy implementation is the Sudokwon Landfill Corporation (SLC), which was created to manage the Sudokwon Landfill site near Seoul. The success of solid waste policies in Korea has been in large part due to the success of implementation at the local level through the creation of inter-jurisdictional treatment facilities to operationalize policy. SLC demonstrates how solid waste facilities can be developed, efficiently managed and operated for recycling, waste disposal, and energy recovery to enable the sustainable Green Growth of cities in line with national policy.

SLC was established under the Ministry of Environment in July 2000 as a federal venture to promote the appropriate treatment of urban waste material, in addition to resource recovery and protection. SLC was formed under Korea's SWM policy and acts as a cross-jurisdictional implementation and service delivery entity.

South Korea's first sanitary landfill site, Sudokwon Landfill, takes and processes municipal solid waste from 25 million people living in Seoul, Incheon, and Gyeonggi-do. The whole landfill site, occupying 20 million square meters, is South Korea's, and the world's, largest. It accounts for around 57 percent of the landfill area in the country. When Sudokwon Landfill started to receive municipal solid waste in 1993, the volume of solid waste being appropriately processed jumped to more than 60 percent.



The Sudokwon Landfill Site Project demonstrated key points for successfully shifting from unsanitary to sanitary landfills, operationally and environmentally.

#### KEY ELEMENTS OF ITS SUCCESS

- It had strong commitment and support from national and municipal governments.
- It is an interesting example of inter-jurisdictional waste management as it was established by three provinces as a single entity to plan and implement SWM operations.
- Citizen involvement in planning and education were a priority. It established a revenue-generating system.

- It integrated green space into landfill design. Sudokwon Landfill comprises four landfill parts, occupying a total area of 16.85 million square meters. Part of that area is the Ara Canal and Environment Research Complex. The first landfill accumulated 64,000,000 tons of municipal solid waste before it closed in October 2000. Stabilization work was completed in 2004, and it was turned into an eco-friendly golf course, opened to the public in 2013.

#### LESSONS LEARNED

The SLC case illustrates the importance of an integrated approach in managing complex environmental, social, and economic aspects of SWM. One of the key messages South Korea tried to convey to citizens is that “waste is not a waste; and that value can be extracted from waste.”

Without changing public perception of SWM sites, the initiative would never have been successful. Demonstrates Green Growth in Action

- Strong policy commitment from government.
- Supported by the appropriate regulatory and legislative instruments.

This commitment helped move SWM from unsanitary open-dumping sites to a sanitary landfill site and a vision that a new model for SWM could be a win-win for the economy, residents, and the environment.

- The cost of NOT investing in waste management is greater than the amount required to provide a clean, efficient resource.

#### Early planning

Cities need to make solid waste management planning an integrated part of overall city master plans. The planning process must involve a deep understanding of the baseline situation to design plans for sanitary landfills in their own context.

#### Stakeholder engagement

NIMBY attitudes are a common challenge in solid waste management. The Sudokwon Landfill case study demonstrates that such a complex relationship with the neighboring community can be managed better by implementing a thorough consultation and engagement process with the surrounding communities, starting from the onset of the project. This could be in the form of focus groups to discuss the planning, development, and monitoring of a project.

**Cooperation between the central and local governments in all phases of the solid waste management project**

Government involvement should include co-financing of the capital costs, as well as providing overarching policies for improving waste management. Furthermore, the national government should be involved in the planning, construction, and operational stages. Communication channels among all stakeholders and a transparent decision-making process are also key. Deep involvement of the national government does not mean that the national government takes over the management of the sector. In most countries this is a responsibility delegated to local government.

As countries urbanize and develop economically, so does the quantity and composition of the waste generated. The methods of treating the waste requires the exploration of new approaches—often funded by economic growth. Working on behavioral change can increase public participation in better waste management, recycling, and composting, as well as monetizing waste. No matter what measures policymakers deploy to collect, recycle, and process waste, they will never achieve such objectives without a fundamental shift in public behavior toward reducing consumption and littering, as well as recycling.

**System and institutional capacity**

For both an operational entity (i.e. legislation, funding, and technical capacity and staffing for operations) and proper coordination with multiple stakeholders.

**A successful cost-recovery model**

This is one of the major challenges that facilities face in developing countries. The SLC facility has succeeded in creating a cost-recovery model comprising a blend of various revenue sources. With the introduction of the VBFS, tipping fees have become one of the significant sources of revenue. The revenue from the tipping fees is supplemented by revenue from various cost recovery activities, such as the sale of electricity and the sale of recyclable materials.



# Environmental Health

## Green Growth Ideas for Addressing Environmental Health

In 2008, Korea enacted the Environmental Health Act to protect public health from environmental pollution. This was the world’s first integrated approach taken towards environmental damage and its impact on human health by focusing on prevention and management.

Since then, the 10-Year Master Plan for Environmental Health conducts a national preliminary survey on people’s environmental health. It includes areas ranging from birth cohort study on children, and an overall health assessment.

Recently the Government has increased supervision of hazardous chemical substances ranging from asbestos, to disinfectants and other known chemicals used in daily lives now known to be associated with cancer. These dangerous chemicals now have strict supervision and are being tightly monitored and, in many instances, no longer allowed. Resources and medical services are provided for those who have experienced potential pollution damage and harm.

**GOALS: SAFE ENVIRONMENT FREE FROM HARMFUL CHEMICALS**

Following a hydrofluoric acid leak from a chemical plant in 2012, the country has adopted stringent safety management systems for all chemical substances. Public concern and desire for strong chemical supervision has led to the development of a new Chemicals Control Act in which a license can be obtained only if a company submits an off-site influence assessment, test report and harmfulness management plan and is equipped with facilities, equipment and manpower of a certain level.

Handlers of accident preparedness substances (APS) must update their management plans every five years and the duty to report accidents has been tightened.

**Transparency**

Consumer transparency, while challenging at times, has benefited citizens as now 1,125 chemical products indicate all contained ingredients on their labels.

# Marine and Fishery Solutions

## SUSTAINABLE FISHING

Like many countries around the world, marine management is an important part of the country's food supply and economic health. The maritime sector is central to livelihoods and food security and managing the marine environment requires new technologies and policies. The Korean government is working across a wide range of initiatives to preserve and restore the health of polluted areas while improving fishing and processing technologies and working to develop solutions that enhance marine resources.

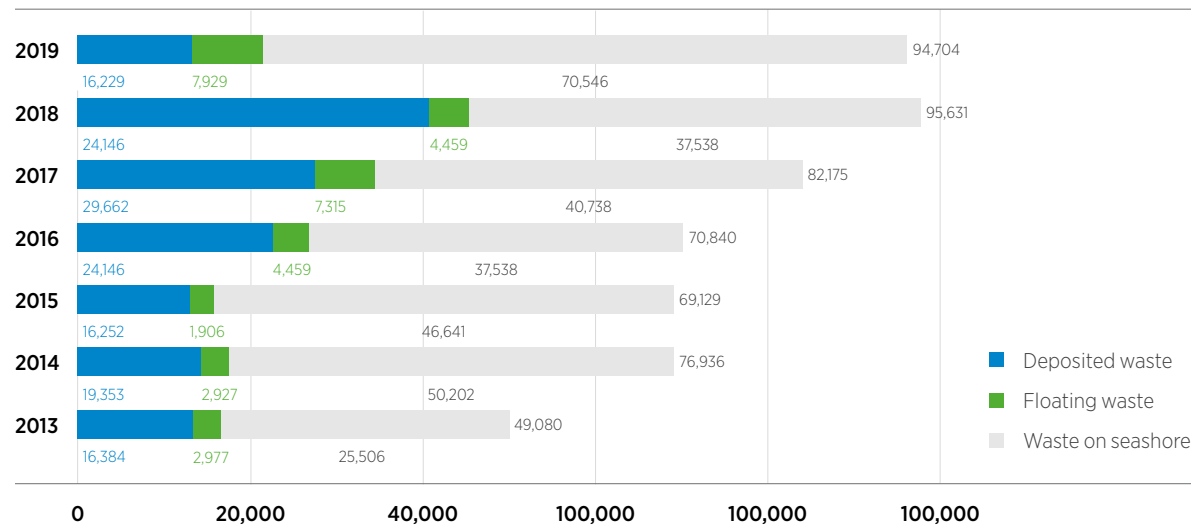
## MARINE ENVIRONMENT MANAGEMENT

### Oil Spills

In 2007 a massive oil spill caused enormous environmental and economic damage still felt today. Because of the accident the country strengthened its national oil spill response system. The response center manages a highly sophisticated system using drones to monitor accidents. The response is highly tailored to the scale, locality and condition of the ocean.

Response facilities include 75 oil spill response vessels, boats, barges, cleaning vessels, tug boats, work boats and others that provide quick response and are equipped with a skimmer, oil delivery pump and temporary reservoir to quickly clean up any environmentally damaging spills.

Annual amount of marine waste collected (unit: ton) <sup>16</sup>



## Shrimp Farming in the Middle of the Sahara Desert



Korea's environmentally-friendly technology called "Biofloc" has made it possible to open a shrimp farm in the middle of the Sahara Desert in 2016. The size of 12 football stadiums, the indoor and outdoor cultivating areas, research building and a feed-manufacturing plant allow farming with less water than traditional cultivation methods.

Biofloc technology uses microorganisms to purify pollutants in the water which then provide nutrients for the shrimp, thus enabling them to recycle the water. The Biofloc technology makes it

possible to reuse 99 percent of the water and farm marine shrimp even in the middle of the desert.

The shrimp farm in Algeria uses an underground salty water oasis beneath the world's largest desert – an astonishing feat considering the heat, salinity and other host of challenging factors. Currently the farm produces roughly 100 tons of marine shrimp a year. It is a fascinating example of how a water-scarce region taking a green growth approach to sustainable aquaculture management can find unexpected benefits.



# Pioneering Technologies for Marine Environment Preservation

## MARINE LITTER

The increase in marine litter over the last few decades is another area that requires an integrated approach to manage and mitigate. The Marine Litter Management Center suggests policies to reduce marine litter, seeks international cooperation, and raises public awareness. The Marine Litter Management Center monitors coastal litter at 40 different locations six times a year, in order to identify the source.

Additionally, Korea operates a marine litter integrated information system to find online marine-litter-related information accumulated over the last 10 years. In this way, the database is systematically managed, operated and continuously updated.

### Q.

#### What is Total Allowable Catch (TAC)?

The total allowable catch (TAC) is a fishery policy that sets regulations on annual catch limits by allowing only a certain amount of catching each fish stock, to ensure sustainability of fisheries in a given period. TAC observers investigate 118 designated fish-landing sites and record catches and biological data including body length of main species including TAC target species.

#### Korea's Cutting-edge aquaculture technologies

##### Smart Fish Farm

Smart Fish Farm is an automation and intelligent technology that combines ICT with the conventional establishment and technology of fishery. The NIFS produces big data on aquaculture and supports designing and establishment of intelligent and automated fish farming.

##### Integrated Multi-Trophic Aquaculture (IMTA)

IMTA is the eco-friendliest method of aquaculture that prevents the pollution of aquafarms. The process utilizes organic substances such as excretion from farm-bred fishes and remaining feeding for shellfishes and uses it as food for seaweeds, and sea cucumbers that consume sediment at the bottom of aquafarms and act as a cleaning mechanism. The NIFS verifies the effects of the IMTA and conducts analysis on its economic feasibility.

##### Recirculation Aquaculture System (RAS)

The Recirculation Aquaculture System (RAS) is a form of aquaculture that involves the purification of contaminated water in fish farms by physical, chemical, and biological means for recycling. It can prevent mass mortality while improving growth speed and efficiency. The NIFS also researches commercialization of aquaculture utilizing the RAS for olive flounders.

## CASE STUDY

# Hybrid Drones for Marine Environment Management

Korea Marine Environment Management Corporation (KOEM), under the Ministry of Ocean & Fisheries has developed a hybrid drone exclusively for marine pollution accidents. This drone has four essential functions for responding to marine pollution.

- Nighttime exploration
- Distribution of oil-preventing drugs
- Information broadcasting
- Measurement of concentrations of air-toxic substances

In the event of leakage of toxic substances, the concentration of air pollution will be quickly and repeatedly measured to ensure the safety of workers. The drone enables quick responses to marine disasters and accidents.



## REAL TIME FISHING MONITORING

Since 2014, Korea began to monitor all of its fishing boats operating in international or foreign waters to prevent illegal fishing and other unwarranted activities. The country's first-ever Fisheries Monitoring Center was established in 2014 and began operating the Vessel Monitoring System (VMS), enabling real-time monitoring of all South Korean vessels engaged in deep-sea fishing. Now, all deep-sea fishing vessels must be equipped with a vessel monitoring system that allows the government to get real-time location of the vessels and issue warnings when they appear to be engaged in illegal, unreported and unregulated (IUU) fishing.

## AQUACULTURE ADVANCEMENTS

For abundant fisheries resources, Korea has strived for sustainable fisheries and aquaculture by enhancing fisheries resource protection and recovery and a developing smart aquaculture system under the "Fisheries Innovation Plan 2030" in February 2019. It includes reforming the industry from a production-focused support structure to a resource-management-oriented structure through the eradication of illegal fishing, and increasing the total allowable catch (TAC) for offshore and coastal fisheries and aquaculture. Korea has also innovated aquaculture into a high-value-added industry by transforming it into an industrialized, eco-friendly and smart industry.

# Forest and Soil

## A NATION TRANSFORMED

During the 35 years of the Japanese occupation and consecutive wars, Korean forests and surface soils were swept away due to heavy human interference, such as forest exploitation and slash-and-burn farming. Forest stock was just 10.5m<sup>3</sup>/ha in the year of 1952, and the operational soil available was shallow and of poor quality.

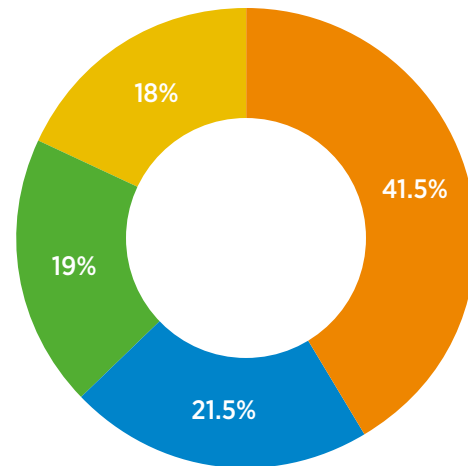
Despite the enactment of the Forest Law (1961), forest protection and management remained a lower priority than economic development and industrialization. Forest greening projects took off in the 1970s. The results are remarkable and as of now, forest take up 63.2% of the national territory at 6,335,000 ha. It ranks fourth for highest forest ratio per land area, after Finland (73.1%), Japan (68.5%), and Sweden (68.4%) among the OECD nations.

## RECOVERING SOIL

Since the enactment of the Soil Environment Conservation Act in 1995, more legislations and policies regarding soil and groundwater have been developed. The Master Plan for Soil Conservation (2010-2019) and the Master Plan for Groundwater Conservation (2005-2014) were created to establish a systematic and integrated soil environment. To control the pollution in the national soil, the masterplan specified 21 substances as soil pollutants. The list includes cadmium, copper, arsenic, mercury, oils, and organic solvents.

21 soil contaminants: Cd, Cu, As, Hg, Pb, Cr+6, Ni, Zn, CN, BTEX(benzene, toluene, ethylbenzene, xylene), TPH, PCB, phenol, F, TCE, PCE, organic phosphorus, benzo[a]pyrene<sup>18</sup>

## Effective soil depth of Korea



- Ordinary (50-100cm)
- Very deep (deeper than 100cm)
- Very shallow (less than 20cm)
- Shallow (20-50cm)

## NATIONAL FOREST<sup>17</sup>

Along with its green growth strategy, Korea is continuing to expand national forests and works to manage forests more effectively, to mitigate climate change impacts, and to improve the self-sufficiency rate of timber. With the long-term plan established in 1996, the government has been purchasing private forests within the conservation area to protect the forest, wildlife, and biodiversity from reckless development. For the last decade the percentage of national forest grew from 24% (1,530,000 ha, 2009) to 25.9% (1,640,000 ha, 2018).

## Post-War Afforestation in Korea Forest Greening Project (1973-1978, 1979-1987)



Suburbs of Seoul in 1960s

## BEHIND THE SCENES - LEARNING FROM PAST MISTAKES<sup>19</sup>

In order to minimize the input of human and physical resources, the military government enacted the Temporary Act on the Promotion of National Greening (1963). In the name of forest greening, the entire nation was forced to work on the projects—meanwhile, the government-controlled the people by linking greening projects with the development of patriotism and political stability. When the outcome of the greening projects, which involved forced mobilization of the nation was worse than expected, the Forest Service was established for efficient forest policy. Yet, even after 5-6 years after the establishment of the Forest Service, there were no visible results and it was eventually transferred to the Ministry of Home Affairs in 1973 as a Greening 10

“Korea is the only developing country in the world that has succeeded in reforestation since the Second World War”

UN FAO REPORT IN 1982

year project. In terms of the content of policies, the administrative reorganization resulted in regression with policies that focused not so much on the ‘promotion’ of forest industry but forest ‘protection.’

Major enabling factors for the successful reforestation in Korea:

- Banning shifting cultivation
- Planting nitrogen-fixing species (such as Black locust)
- Erosion Control Plan
- Slash and Burn Regulation
- National park system
- Greenbelt system around major cities
- Public awareness and education on the importance of nature conservation

“South Korea is in many ways a reforestation model for the rest of the world”

LESTER BROWN, PLAN B 2.0 (2006)

**STAGES OF IMPLEMENTATION & MAJOR OUTCOMES**

**Forest Restoration**

Phase 1 (1973-1979) priority to green the nation. In order to achieve the goal, key initiatives of the plan included:

- Conservation of forest and wildlife
- Enhancing the fertility of soil
- Upgrading fuels in rural areas
- Stabilization of timber demand and supply
- Increasing afforestation by people
- Education and promotion of the national campaign
- Intensive erosion control and regulation over slash-and-burn

**Tree Inspection System**

Once planted, trees were inspected by three authorities in a following order

- Inspection by a mayor (city-level)
- Inspection by a governor (province-level)
- Inspection by the KFS (national level)

Thanks to this system, the survival rate of the nation-wide planted trees was over 90% on average.

The country quickly transformed as a result of the plan. Every village and town carried out monitoring and tree inspections and successful evaluations resulted in additional trees being planted by villages. The campaign was such a success it concluded four years earlier than planned thanks to the enthusiastic support of citizens.

**FOREST REHABILITATION PHASE 2 (1979-1976)**

Forest Rehabilitation, phase two focused more on rendering forests as resources for the nation. Forest government officials adopted best practices from around the world and quickly found areas to improve. Governments, companies, schools, and villages were encouraged to plant trees. The government designated the first Saturday of November as an Arbor day and 80 new forests were cultivated.

The forestry programs throughout the country achieved such remarkable success and citizen support, an institute for forest education and training was established.

**THE TOTAL AREA OF AFFORESTATION**

1,080,000 ha

**THE TOTAL AREA OF EROSION CONTROL**

42,000 ha

**TOTAL NUMBER OF TREES PLANTED**

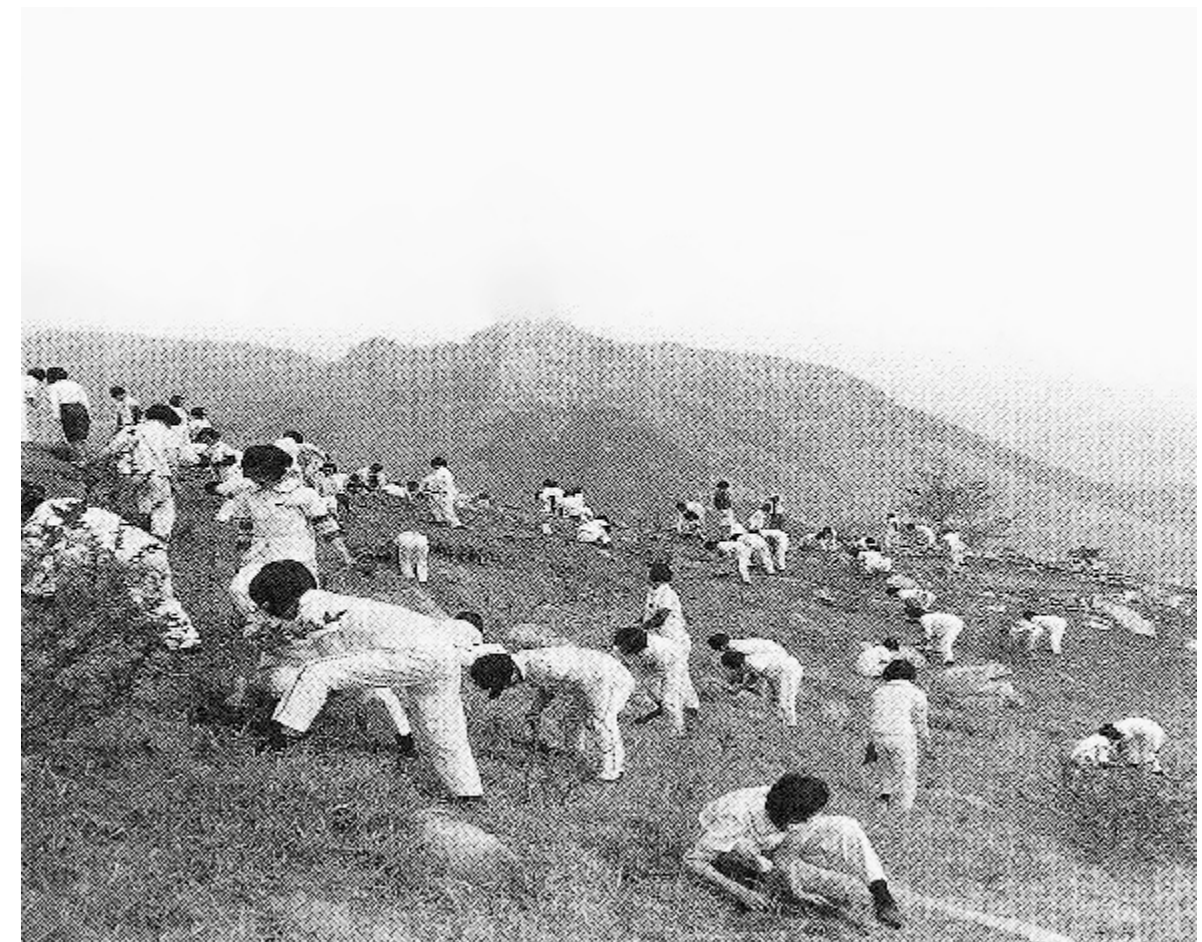
3 billion

**THE TOTAL AREA OF PLANTING**

0.96 million ha

**TOTAL NUMBER OF TREES PLANTED**

1.9 billion





PART 4

# Biodiversity

Korea is fully engaged with issues nationally and globally to protect and conserve biodiversity. As a member of the Convention on Biological Diversity (CBD) the country created a roadmap with detailed pathway on how to achieve their targets and goals.

## ECO-FRIENDLY LAND PLANNING

Since 1981 the country has proactively considered environmental aspects from the very initial stages of planning and designing the use of its land. Environmental Impact Assessment (EIA) processes are conducted depending on the type, scale and timing of the development projects to evaluate the potential adverse impacts on the environment.

## NATIONAL BIODIVERSITY STRATEGY AND ACTION PLANS

The action plan is updated every five years and is instrumental to implementation of the Convention on Biological Diversity (CBD).

## WILDLIFE PROTECTION AND NAGOYA PROTOCOL



### Nature reserves

Biodiversity rich areas, i.e., nature reserves are managed and protected by the Ministry of Environment for their conservation. As of the end of 2018, more than 3,000 areas have been designated as protected areas for their ecological values and the number is expected to grow.



### Wildlife protection

Korea became a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1993. Later in 1997, a legal framework was established for better wildlife protection and stronger law enforcement to stop illegal poaching. The list of endangered wildlife is being regularly updated and the number currently stands at 267 species. More recently in 2018, the ministry has developed the Comprehensive Plan for the Conservation of Endangered Wildlife (2018-2027) with the aim of restoring endangered wildlife habitats as well as their populations.



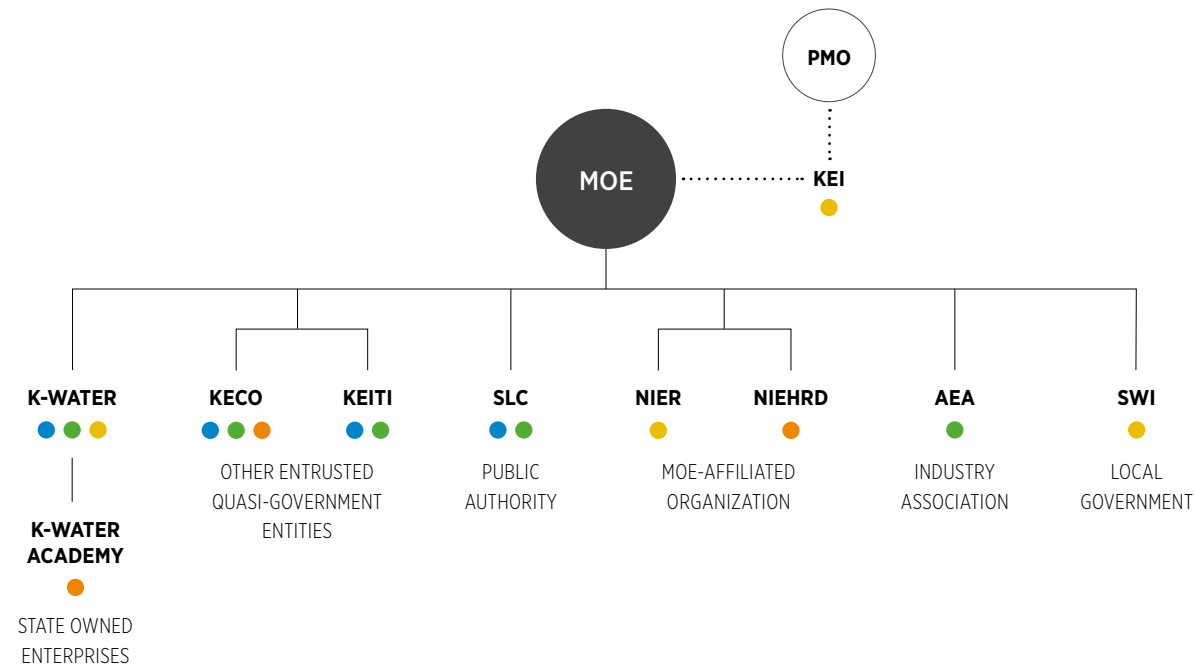
### Nagoya Protocol

After the adoption of the Nagoya Protocol on Access and Benefit Sharing, the Ministry introduced relevant legislation in 2017. Since then, the Ministry has been developing its implementation mechanism for the fair and equitable sharing of benefits arising from genetic resources and its utilization. In March 2018, the Access and Benefit-Sharing Clearing-House (ABSCH) Genetic Resources Information Center was established to assist with technical matter required by law. The center will open up a multilateral cooperation channel with other countries rich in genetic resources that will further enhance Korea's competitiveness in bio industry. The center will also serve as a platform for public-private joint research on valuable biological resources as well as R&D for biomimicry-inspired technologies.

# PART 5

# Key Institutions in Korea's Environment Sector

(Organizational structure/role in May 2020)

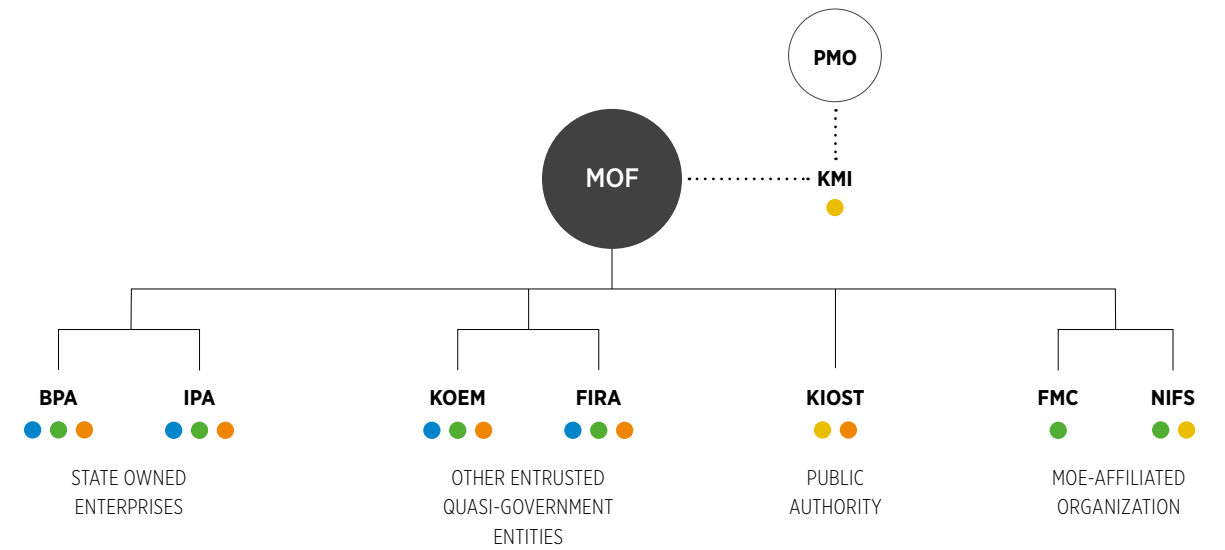


- K-Water**  
Korea Water Resources Corporation
- K-Water Academy**  
Korea Water Academy (K-Water affiliated institution)
- KECO**  
Korea Environment Corporation
- KEITI**  
Korea Environmental Industry & Technology Institute
- SLC**  
Sudokwon Landfill Site Management Corporation
- NIER**  
National Institute of Environmental Research
- NIEHRD**  
National Institute of Environmental Human Resources Development
- PMO**  
Prime Ministers Office
- KEI**  
Korea Environment Institute
- AEA**  
Korean Automobile Environmental Association
- SWI**  
Seoul Water Institute

- DOMESTIC AND OVERSEAS DEVELOPMENT IMPLEMENTOR
- RESEARCH + POLICY INSTITUTE
- IMPLEMENTING AGENCY/INSTITUTE
- CONDUCTING INSTITUTIONAL TRAINING & CAPACITY BUILDING

# Key Institutions in Korea's Ocean and Fisheries Sector

(Organizational structure/role in May 2020)

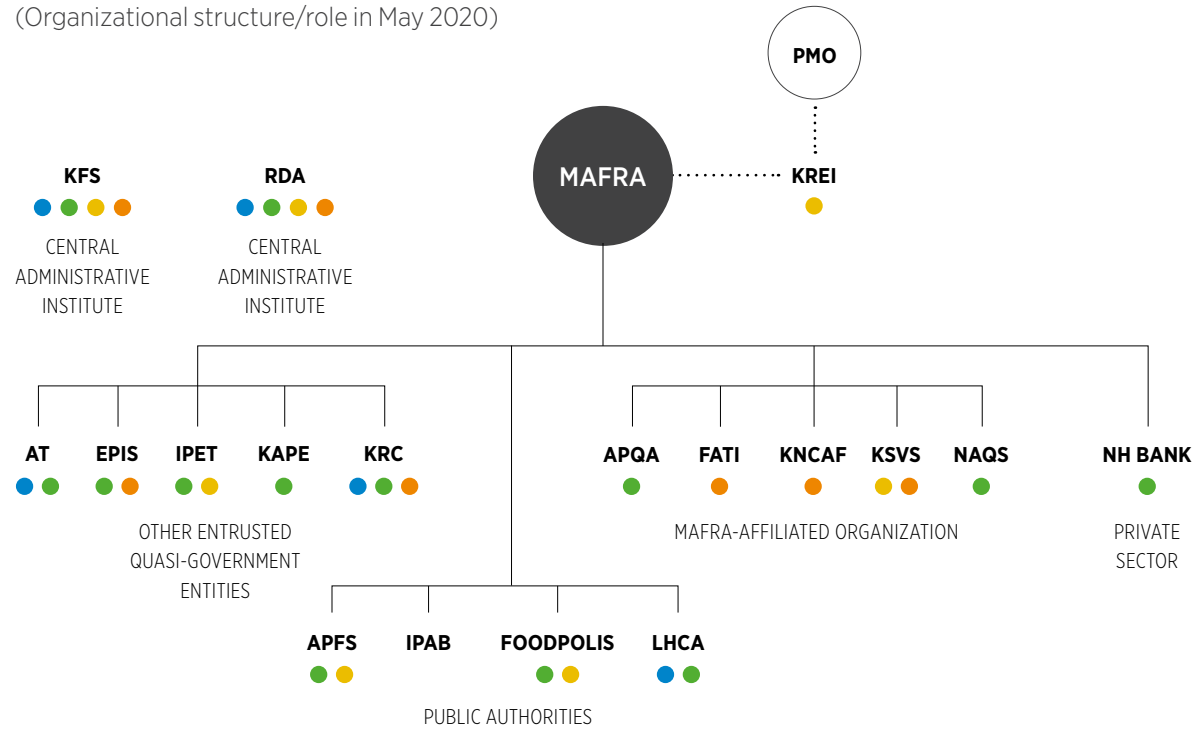


- BPA**  
Busan Port Authority
- IPA**  
Incheon Port Authority
- KOEM**  
Korea Marine Environment Management Corporation
- FIRA**  
Korea Fisheries Resources Agency
- KIOST**  
Korea Institute of Ocean Science & Technology
- FMC**  
Fisheries Monitoring Center
- NIFS**  
National Institute of Fisheries Science
- PMO**  
Prime Ministers Office
- KMI**  
Korea Maritime Institute

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# Key Institutions in Korea's Agriculture Sector

(Organizational structure/role in May 2020)

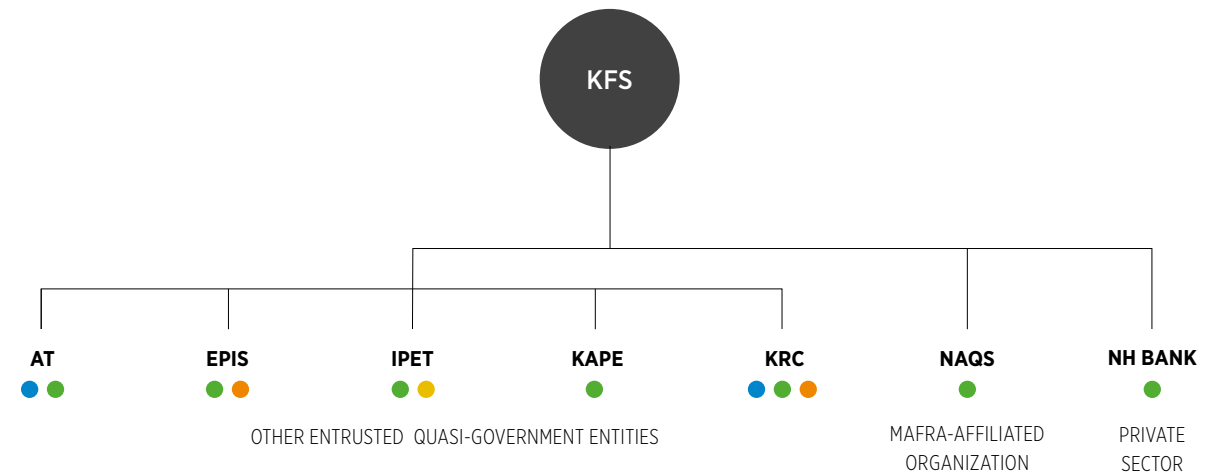


- KFS**  
Korea Forest Service
- RDA**  
Rural Development Administration
- AT**  
Korea Agro-Fisheries & Food Trade Corporation
- EPIS**  
Korea Agency of Education, Promotion and Information Service in Food, Agriculture, Forestry and Fisheries
- IPET**  
Korea Institute of Planning and Evaluation for Technology
- KAPE**  
Korea Institute for Animal Products Quality Evaluation
- KRC**  
Korea Rural Community Corporation
- APFS**  
Agricultural Policy Insurance & Finance Service
- IPAB**  
International Plant-quarantine Accreditation Board
- FOODPOLIS**  
Korean National Food Cluster
- LHCA**  
Livestock Health Control Association
- APQA**  
Animal and Plant Quarantine Agency
- FATI**  
Food and Agriculture Officials Training Institute
- KNCAF**  
Korea National College of Agriculture and Fisheries
- KSVS**  
Korea Seed & Variety Service
- NAQS**  
National Agricultural Products Quality Management Service
- PMO**  
Prime Ministers Office
- KREI**  
Korea Rural Economic Institute
- NH**  
Bank Industry Association/Federation

- DOMESTIC AND OVERSEAS DEVELOPMENT IMPLEMENTOR
- RESEARCH + POLICY INSTITUTE
- IMPLEMENTING AGENCY/INSTITUTE
- CONDUCTING INSTITUTIONAL TRAINING & CAPACITY BUILDING

# Key Institutions in Korea's Forest Sector

(Organizational structure/role in May 2020)



- AT**  
Korea Agro-Fisheries & Food Trade Corporation
- EPIS**  
Korea Agency of Education, Promotion and Information Service in Food, Agriculture, Forestry and Fisheries
- IPET**  
Korea Institute of Planning and Evaluation for Technology
- KAPE**  
Korea Institute for Animal Products Quality Evaluation
- KRC**  
Korea Rural Community Corporation
- NAQS**  
National Agricultural Products Quality Management Service
- NH BANK**  
Bank Industry Association/Federation

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- RESEARCH + POLICY INSTITUTE
- IMPLEMENTING AGENCY/INSTITUTE
- CONDUCTING INSTITUTIONAL TRAINING & CAPACITY BUILDING

# Partner Organizations

## Environment



### Korea Automobile Environmental Association (KAEA)

The Association supports various measures as a part of emission reduction program, particularly the installation of emission reducer on deteriorated old diesel-fueled vehicles, low-pollution engine calibration and early scrapping. In addition, it also promotes a cooperative relationship with the government, as well as academia in order to analyze the environmental problems associated with vehicles in the multilateral perspectives to find better solution. It enhances the automobile emissions level in order to improve the air quality and accelerate the technical development on emissions reduction to ultimately ensure the technological competitiveness as a response to the global environmental regulations, making utmost efforts on the improvement of air environment as well as protection of national health.



### Korea Environment Corporation (KECO)

KECO is a state-owned agency, established in order to handle environment-related projects with maximum efficiency. These projects include; pollution prevention, environmental improvement, and resource recirculation. In

addition, KECO will be involved in installation of a circulatory resource management system, and also the presentation of an environment-friendly blueprint for national development.



### Korea Environment Institute (KEI)

Established in 1992 to prevent and solve environmental problems through environmental policy research and a review of environmental impact assessments. KEI studies and reviews key environmental research around such issues as: climate change, environmental health, resource circulation, water environment, environmental impact assessments, environmental information and international environment cooperation. KEI works towards improving quality of life for people by improving the quality of natural resources.



### Korea Environmental Industry & Technology Institute (KEITI)

KEITI, a quasi-government organization affiliated with the Ministry of Environment and is committed to achieving both environmental protection and economic growth. To fulfill its mission, they support the creation of

environmental technologies, nurturing environmental industries and promoting an eco-friendly lifestyle. KEITI's core task is to support small and mid-sized enterprises which possess outstanding technologies but lack the resources to commercialize them. KEITI provides these companies with the support they need during the start-up and growth stages to help them advance into the global market. Additionally, KEITI nurtures professional manpower in the field of environmental industry and contributes to providing outstanding human resources to companies and creating job opportunities in related fields.

### Korea Environmental Industry & Technology Institute (KEITI)

#### Soil Environment Center (KEITI SEC)

Based on the Soil Environment Conservation Act (2014), Soil Environment Center opened within the KEITI, to provide comprehensive support and services for the sustainable development of soil – and underground water – related policies, technologies, and industries. It supports customized policy research on soil and underground water and hosts industrial development forum on soil and underground water regularly. The center is currently leading a 7-year research project on the management of underground pollution and related risk factors with a budget of KRW 115.8 billion (public and private)



### K-water

K-water has been a national leader in the economic development and living standard improvement through efficient water resources management since its foundation in 1967. Through the operation of 16 multi-purpose dams and integrated regional water supply systems, K-water manages half the national water supply facility capacity. As well, we operate 22 local water supply systems and are participating in the sewerage business. Moreover, along with developing eco-friendly waterfront cities, K-water provides total water service that is unparalleled in the world as Korea's representative state-owned water managing company.



### Ministry of Environment

### Ministry of Environment (MOE)

The Ministry of Environment stems from a ministry established in 1967. Their focus is to establish policies that protect society from environmental pollution and improve the quality of life for the public so citizens can enjoy the ambient natural environment, clean water and clear skies. The tasks of the MOE include enactment and amendment of environmental laws and regulations; introduction of environmental institutions; building up framework structures for environmental



administration; drafting and implementation of mid and long term comprehensive measures for environmental conservation; setting up standards for regulations; providing administrative and financial support for environmental management to local governments; inter-Korean environmental cooperation; and environmental cooperation with other countries around the world.



### National Institute of Environmental Research (NIER) ENV

As a result of rapid industrialization and urbanization in the 1970s, environmental pollution emerged as a serious social and public health concern. In response the government established a research institute dedicated to environmental studies. Research priorities include: protecting people's health from hazardous materials, elimination dangerous environmental factors from local communities, establishing technological base for integrated environmental management systems, improving science-based environmental policies, developing water resources management, taking leadership actions and reinforcing international cooperation against climate change. NIER provides vital research that is integral to the development and implementation of Korea's environmental policies and pollution prevention programs.



### National Institute of Environmental Human Resources Development (NIEHRD)

NIEHRD is an environmental training institute providing a variety of quality education services to develop environmental human resources equipped with professionalism and problem-solving abilities required by central and local governments and businesses for coping with global changes.

NIEHRD is providing government officials from the Asia-Pacific region as well as the Middle East and Africa with valuable opportunities to share advanced experiences, policies and technologies, thereby strengthening international cooperation and reinforcing Korea's role as an advanced country in the area of the environment.



### Seoul Water Institute (SWI)

Since 1989, Seoul Water Institute (SWI) has been working to improve water quality and its safety under the office of waterworks in Seoul Metropolitan Government. SWI not only examines water safety according to WHO's 163 safety categories and open the data regularly but also studies ways to improve water quality and taste.



### Sudokwon Landfill Site Management Corporation (SLC) ENV

SLC was established under the Ministry of Environment in July 2000 as a federal venture to promote appropriate treatment of urban waste matter, resource recovery and protection. SLC applies the amassed waste collection techniques and now utilizes the landfill methane as fuel to drive power generators: minimizing environmental issues, resource recovery, and yielding a three-in-one effect of odor elimination, environmental protection, and alternative energy development. SLC has created the largest ecological park in Korea called the "Dreampark" on its landfill sites in Incheon by leveraging waste treatment technology.

## Ocean & Marine



### Busan Port Authority (BPA)

Busan Port Authority(BPA), the first port authority in the Republic of Korea, was founded in January 2004 by MOF for Busan Port to contribute to the national economy by enhancing efficiency of port operations and securing greater competitiveness. The port is one of the largest in the world and continues to grow. BPA is working to develop Busan Port into the world's second largest transshipment port, balance roles between Busan North Port and New Port, which will provide additional value at New Port distripark, vitalize the cruise industry, and promote port related industries including the ship handling market.



### Korea Fisheries Resources Agency (FIRA)

FIRA is Korea's only national agency in areas of fisheries resources rehabilitation. It achieves its mission by leading efforts to protect and nurture fisheries resources to recover health and foster abundance of the oceans. FIRA is committed to rehabilitation of the depleted fisheries resources and marine ecosystem through activities to form marine forests and sea ranches and management of fishery seed resources with response to climate change, marine pollution and fisheries overexploitation which devastate the ocean ecosystem and cause rapid depletion in fisheries resources.



### Fisheries Monitoring Center (FMC)

FMC was established under the Ministry of Oceans and Fisheries in 2014. Real-time, around the clock monitoring of 260 distant water fishing vessels is being done through Electronic Reporting System (ERS), Korea Fisheries Information Management System (KFIMS), and Video Monitoring (EM). FMC manages a comprehensive database on fishing activities that includes: fishing authorization, license, IUU list, catch limit and transshipment & landing. FMC works as a focal point of MCS activities in Korea.



### Incheon Port Authority (IPA)

Incheon Port Authority was established in 2005 to develop Incheon Port as a competitive logistics base and thereby contribute to the national economy. The goal of IPA is to develop port facilities and hinterland, as well as to improve expertise and efficiency in port management and operation, so that Incheon Port establishes itself as a leading base station for exchange in the Yellow Sea region. Since its development, Incheon Port's competitiveness has been enhanced with reinforced marine transportation, port and logistics functions. Incheon Port is continuously developing, strengthening its position as the core logistics center of Korea and contributing to the national economy. Korea Institute of Ocean.



### Science and Technology (KIOST)

Since its establishment in 1973, KIOST, as the only comprehensive marine research institute in Korea, has conducted broad and in-depth research in the field of oceanography including research of marine environment and climate, marine resources, coastal and ocean engineering, marine domain management research and ocean policy. The institute laid a steppingstone for innovative growth as a national research institute in ocean science and technology while ensuring its international competitiveness through the systematic research, development, management, and use of oceans and marine resources, and the education of extraordinary professionals.



### Korea Maritime Institute (KMI)

KMI is a think tank for developing national policies on marine affairs and fisheries. For more than three decades since its establishment in 1984, the Korea Maritime Institute (KMI) has committed to research for the development of shipping, ports, marine, and fisheries industries, becoming a specialized research institute in shipping, ports, maritime and fisheries sector.



### Korea Marine Environment Management Corporation (KOEM)

KOEM, as the one and only marine environment management organization in Korea, implements various projects such as disposing marine litter, restoring the marine ecosystem, designating and managing Marine Protected Areas (MPAs), responding to oil spills, and operating the Marine Environment Research and Training Institute.

KOEM establishes professional education courses on the marine environment and raises public's awareness on environmental issues by providing field-experience education programs utilizing an artificial marine & wave basin.



### Ministry of Oceans and Fisheries (MOF)

MOF is responsible for the maritime and fisheries sectors. MOF promotes maritime safety and security, and the protection of the marine environment, the development of port and fishing ports, and research and development on polar issues. They additionally oversee the management and sustainable use of fishery resources and the promotion of marine leisure activities.



### National Institute of Fisheries Science (NIFS)

The National Institute of Fisheries Science (NIFS) is a national research institute in charge of Korea's marine and fisheries science. Since its founding in 1921, the NIFS has led the fisheries sector by developing and distributing numerous fisheries science and technologies, thereby increasing the income of fishermen and contributing to the national economy by exporting fishery products. In addition, it identifies a variety of challenges Korea faced and takes suitable measures in the fisheries sector through conducting a wide range of field researches against marine disasters, such as high water temperature, red tide, and high mortality rates of fisheries in aquafarms.

## Agriculture & Forest



### Korea Forest Service (KFS)

KFS was established in 1967 (formerly known as Forest Bureau of the Ministry of Agriculture and Forestry) and is responsible for the establishment and implementation of forest policies and laws. The KFS implements forest policies that support the public with an improved quality of life by offering recreation forests, healing forests, mountaineering services and the expansion of urban green spaces.



### Korea Rural Community Corporation (KRC)

Since 1908, KRC has been a leading institution to found and expand the agricultural infrastructure and to promote the improvement of local amenities, including water resources management. KRC is building a tailored agricultural infrastructure to support diverse usage of farmland and safe agricultural production. Also, it is an authorized soil and groundwater special agency. KRC conducted various types of remediation project for the contaminated sites in Korea including army base, subway or railway station, abandoned mines, chemical factories, and landfills.

## Affiliated Agencies



### Korea Meteorological Administration (KMA)

The Korea Meteorological Administration (KMA) is South Korea's national weather service. Since its establishment in 1990, KMA has provided reliable weather information to Korean people and ensured public safety from extreme weather events and disasters. It also offers scientific data and scenarios on climate change to contribute to developing national policies for climate change response.

## Private Sector



### Dohwa Engineering

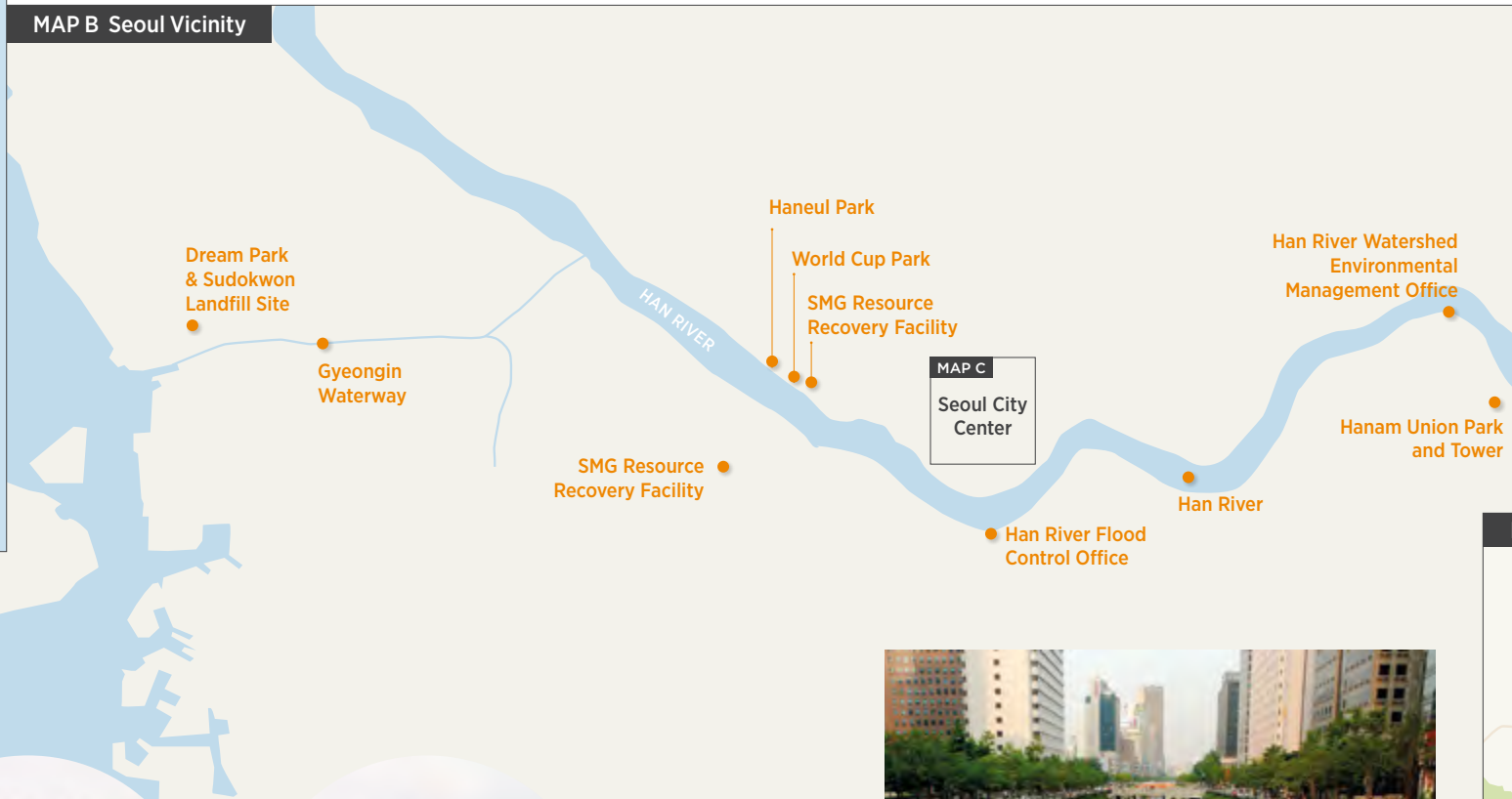
Dohwa Engineering is a consulting company that has a high level of expertise in water infrastructure engineering. The scope of business includes business planning, feasibility study, validity analysis, designing, purchasing construction, analysis, testing, construction supervision, trial running, assessment & validation, consultation, and instruction tasks, the development of water resources, city planning, road traffic, structure, ports, railroads, and environment.

# Site Visits and Locations



## Han River

The dividing line of Seoul, the Han River or 'Hangang' separates North Seoul from the Gangnam district, which means 'South of the River'. The river has witnessed the history of the Korean people for over five thousand years, through good and bad times.

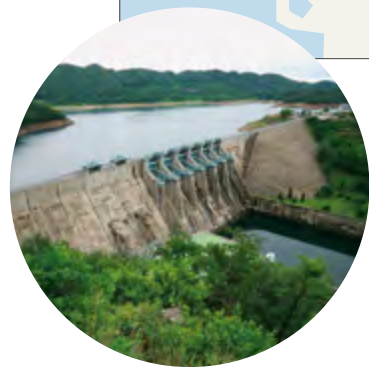


## Hanam Union Park and Tower

Union Tower is the new landmark of Hanam. 105 meters high with an observatory at the top, the tower has infrastructure facilities built in its basement under the ground. These include a domestic waste incineration plant, food recycling facility and sewage treatment plant. On the ground, there are a variety of cultural spaces and sports facilities including an outdoor stage, ecology pond and lawn.



**Dacheongho Dam**  
[Daecheong Dam](#) by Yoo Chung is licensed under [CC BY-SA 2.5](#)



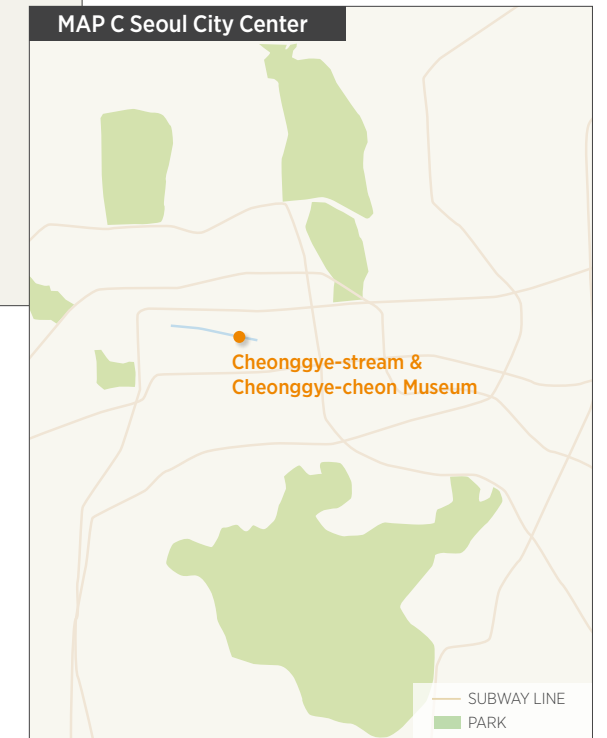
**Yeongju Dam**  
[Yeongju Dam](#) by Gcd822 is licensed under [CC BY-SA 4.0](#)



**Gyeongin Waterway**  
[Gyeongin Waterway](#) by Gcd822 is licensed under [CC BY-SA 4.0](#)



**Cheonggye-stream**  
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# Environment

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**MAP B****DREAM PARK**

Dream Park is built atop the Sudokwon Landfill site, previously the world's largest landfill site covering 20 square kilometers. Established in 1990 on land reclaimed from the sea, the site uses advanced, high-tech waste management technologies to daily treat 20,000 tons of waste from households, construction sites and businesses from the Seoul Metropolitan Area, where 40% of the national population lives. In 2000, Sudokwon Landfill Site Management Corporation (SLC) built Dream Park atop this used landfill sites and created an ecological leisure park and education park. The complex includes a sports park with soccer fields, basketball, tennis, a running track, golf course, horse-back riding center and more. In addition to every manner of sports, the complex includes extensive flower and botanical gardens and greenhouses where visitors enjoy flowers farmed using the gas from the landfill waste. In 2006, the OECD deemed Dream Park one of the best managed landfills in the world and the site is designated one of the best eco-tourism sites in the world.

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**MAP B****HANAM UNION PARK AND TOWER UNION TOWER**

Hanam Union Park and Tower Union Tower is the new landmark of Hanam. 105 meters high with an observatory at the top. The tower has infrastructure facilities built in its basement under the ground. These include a domestic waste incineration plant, food recycling facility, and sewage treatment plant. On the ground, there are a variety of cultural spaces and sports facilities, including an outdoor stage, ecology pond, and lawn. Hanam Union Square is located in the center of Hanam City, just east of Seoul. The site is approximate 117,115 square

meters (28.94 acres) and is a popular shopping, recreational, and entertainment area. Recent redevelopment in 2013 now makes it the largest retail center in South Korea. The city of Seoul took an innovative approach to redesign the area and introduced new forms of governing and investment structures. The project was designed to maintain equality of living service facilities and educational conditions across the regions with a particular emphasis on alleviating the financial gap between previously autonomous regions. The result is now several neighborhood districts previously discrete are combined into the same living zone and share desirable amenities, cultural sites, and efficient transportation.

---

**MAP B****HANEUL PARK**

Haneul Park is now an ecological park and one of five World Cup Parks that opened in 2002. Originally a landfill for metropolitan Seoul, it has been converted into a beautiful camping site for visitors. In order to prevent waste runoff and contamination of the surrounding environment, the city undertook a process to stabilize the landfill with precautionary measures, while simultaneously converting the garbage under the park into a source of energy for local residents. Electric vehicles are available to reach the top of the hill where the park is located. Wooden walkways, flowering plants and remarkable views of the Han River can be seen as you walk around the park.

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**SMG RECYCLING CENTER**

Seoul Metropolitan City is comprised of 25 Districts. Each District called 'gu' has its own recycling center that gathers re-usable items at no charge or for a small fee.



Haneul Park

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**MAP B****SMG RESOURCE RECOVERY FACILITY**

SMG runs four Resource Recovery centers in Mapo, Nowon, Yangcheon, and Gangnam. As part of an effort to ensure hygiene in household waste disposal while addressing the problem of insufficient landfills, Seoul opened resource recovery facilities in 1996. Today, the facilities can handle as much as 2,850 tons of waste every day. The new state-of-the-art incinerators are called 'Resource Recovery Facilities.' They burn solid urban waste at 850-950°C to recover the heat (above 400°C) in the process of trash burning. Also, the high-pressure steam is used as an alternative source of energy that provides heating for the near communities. This is why resource recovery facilities are conceptually different from traditional incinerators. Seoul Metropolitan Government first gave consideration to building resource recovery facilities in the early 1990s and subsequently the construction of four major resource recovery plants was carried out over two decades

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**MAP B****WORLD CUP PARK**

In the late 1970s, the island of Nanjido, located in the northwest of Seoul was designated the waste disposal site for the city of Seoul. After years of heavy use, the landfill came to hold over 92 million tons of garbage. A proposal was put forth to reclaim the land and turn the previous waste site into a series of eco-friendly parks for citizens to enjoy. After six years of cleanup and stabilization, followed by a year of building the previous landfill welcomed the public to a series of parks that include everything from walkways with river vistas, fields of flowers, a golf-course to all manner of outdoor sports and recreational facilities. The World Cup Park hosted the World Cup Games between Korea and Japan in 2002. The previous landfill turned park is a fascinating example of innovative policy makers, engineers and city leaders working together to transform an area and increase the quality of life for citizens.

# Water

## BAEKJE WEIR, GEUM RIVER INTEGRATED OPERATIONS CENTER (IWRM)

Located on the Geum River is Baekje weir. Baekje weir's design was inspired by the phrase 'establishing local identity and revitalizing Baengmagang (Geumgang)' with the supporting theme 'where Baekje's history still flows.' Baekje weir controls and maintains the water level and has a small hydro-power capacity of 2,500kW. Built as part of Korea's Four Major River Restoration Projects, the goals are to; secure water, prevent floods, generate hydropower, improve the quality of life and restore ecosystems. The Geum River, also known, as Kum River is the third longest river in South Korea. It is 401 kilometers and originates in the North Jeolla Province. It flows through North Jeolla, the North and Southwest Chungcheon Provinces and empties into the Yellow Sea near Gunsan city.

### MAP C

#### CHEONGGYE-STREAM (CHEONGGYE-CHEON)

Cheonggye-stream is a 10.9-kilometre long modern public recreation space in downtown Seoul. Its transition to a pedestrian haven and green space in the middle of an urban area is a remarkable story. Prior to modern day Seoul, the Chosun Dynasty (1392-1910) maintained the river with regular dredging for flood risk management, as the river swelled during the heavy summer rainfall. After the Korean War (1950-1953), as more people migrated into the city the river became the site of makeshift housing. Deteriorating conditions resulted to the development of an elevated highway constructed atop the river. In July 2003, then Seoul mayor, Lee Myung-bak had a vision to remove the elevated highway and its heavy traffic and restore the stream and surrounding area to a public green space. The \$900 million project initially attracted much public criticism but, after

opening in 2005, the stream has proved popular among residents and tourists alike and is an example of green growth in action. See Case Study in Chapter 3.

### MAP C

#### CHEONGGYE-CHEON MUSEUM

Cheonggye-cheon Museum has been established to commemorate the historic Cheonggye-cheon restoration project. Visitors can learn about the history of Cheonggye-cheon, the Restoration Project which proceeded for two years and three months from July 2003 until October 2005, the changing face of the city since then, and the city's long-term vision.

### MAP A

#### DAECHEONG DAM

Dacheongho is the third largest artificial lake in Korea. Construction on the dam began in 1975 and concluded in 1980. The main purposes of the dam were flood control, water supply and electric power generation. Daecheong Dam is a multi-purpose dam consisting of a 72m tall and 485 m long concrete gravity dam and rock fill dam. The dam's reservoir capacity is 1.49 billion cubic meters and with two generators (max capacity 45,000kW) it generates 240 million kW per year. The dam supplies roughly 1.5 billion tons of water to residents of the Daejeon and Cheongji areas and functions as the main water supply for the region. Additional stops include the: Water Culture Museum where information related to the water, ecology, and local culture is explained, the Dam Inspection Gallery and the Emergency Spillway.

### MAP B

#### GYEONGIN WATERWAY

Gyeongin Waterway also known as the Ara Canal flows downstream of the Han River to the West



Han River

Sea. In the 13th century, King Gojong, the twenty-sixth king of the Korean Joseon dynasty began construction for the first time. The project was put on hold due to technical obstacles and the difficult state of the country. Finally completed in 2011, the Waterway was completed and is a destination for waterway cruises, kayaking, biking, walking and all manner of recreational activities. Along the main waterway are ports and water bridges where pedestrians can enjoy the river views.

### MAP B

#### HAN RIVER

The Han River(Han-gang) is a major river in South Korea and the fourth longest river on the Korean peninsula. The river begins as two smaller rivers in the eastern mountains of the Korean peninsula, which then converge near Seoul, the capital of the country. The Han River and its surrounding area have played an important role in Korean history. The river serves as a water source for over 12 million Koreans. Currently, the lower stretches of the Han River running through Seoul are lined with pedestrian walkways, bicycle paths, public parks and restaurants. The river has witnessed the history of the Korean people for over five thousand

years, through good and bad times. The riverside parks offer a pleasant retreat for the citizens of Seoul.

### MAP B

#### HAN RIVER FLOOD CONTROL OFFICE

Han River Flood Control Office, is part of Ministry of Land, Infrastructure and Transport, and is in charge of the flood forecast, hydrological observation, and hydrological data management for Han river, Imjin river and Ansong stream basin located in the central area of Korea. A rainfall radar monitors the Imjin river basin where flooding occurs yearly. The Han river flood control office works to provide accurate flood forecasts for the city. Established in 1974 information gathered is sent to the flood control office, where data is monitored, analyzed, and water level and discharge are calculated.

### MAP B

#### HAN RIVER WATERSHED ENVIRONMENTAL MANAGEMENT OFFICE

Established to manage the water quality of the Han River Watershed. In 2005 its operations were integrated with the operations of Gyeongin



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Regional Environmental Office and it now controls environment-related issues for the Metropolitan areas. It promotes a variety of measures to improve water quality in the Han River watershed such as: reduction of pollutants, imposition and collection of water use charge, land purchase in Riparian Buffer zones. In addition, the office pursues economic development in the region and works to protect the environment through impact assessments on a range of areas that include: waste management, management of hazardous chemicals and protection of wildlife animals and plants.

**MAP A**  
**INTEGRATED WATER SUPPLY OPERATION CENTER (K-WATER)**

Multi-purpose dams have multiple purposes including flood control, water supply, and hydropower generation. For these functions, it is essential to secure optimal operation of water gates through continuous measurements and analysis of information on rainfall, inflow and

outflow, weather conditions, and water quality. K-water is trying to exert all of its efforts to maintain scientific operations and management of water resources through implementation of an Integrated Water Resources Management system for each river system.

**K-WATER HAN RIVER AREA HEAD OFFICE**

K-water Han river area head office located at Gwacheon-city provides 8,535,000m<sup>3</sup> per day through 957.1km pipelines. It provides water to 26 cities including Seoul city. It monitors and remotely controls the system for 24 hours, and it has water demand prediction system. Han river area head office has engaged in the work for increasing efficiency of local water supply system and researches for water quality.

**MAP A**  
**K-WATER WATER QUALITY RESEARCH CENTER**

Its main purpose is the provision of a total solution to improve the healthiness of tap water. It has three major research areas: Securement of trust in tap

water adjusted to customers' need, reinforcement of global competitiveness by developing analytical methods and strengthening the role of official institutions, and prompt solutions to problems with active support of environmental issues.

**MAP A**  
**KOREA HYDRO & NUCLEAR POWER CORPORATION (KHNP)**

Hangang Hydro Power Site is the headquarters of hydraulic power generation division supervising 10 hydraulic power plants scattered in 5 Dos (Gangwon, Gyeonggi, Chungbuk, Jeonnam and Jeonbuk) in a systematic manner. The total capacity of the hydraulic power plants is 603MW. During the flood season, Hangang Water System Remote Supervisory Control Station focuses on prevention of flood damage to the residents in the downstream regions and in the capital region. Prevention is controlled through interconnected operations with seven dams in the Hangang water system and through close cooperation with Han River Flood Control Office. In the dry season, the control station distributes water to the dams in the Hangang water system, and the Paldang dam finally supplies water to 2,200 million people in the capital region.

**MAP A**  
**SOYANG RIVER DAM AND K-WATER SOYANG DAM WATER CULTURAL CENTER**

Built in October 1973, Soyang Dam is Asia's largest and the world's fourth largest rock-fill dam. It stands 123m high and 530m long, and can generate 200,000kW/h of electricity. It serves multiple purposes including flood control, hydroelectric power generation, irrigation, and fishing. It holds 29 million tons of water, which has become Soyangho Lake, Korea's largest man-made lake. Spanning a large area that borders the Gangwon-do cities and districts of Chuncheon, Hongcheon, Yanggu and Inje, the lake is often referred to as an "inland sea". Passenger ferries bound for Yanggu and Inje run along the 60km long water route that leads to Seoraksan Mountain.

K-water Soyang dam water cultural center has several exhibition rooms such as first floor for introducing 'Dam Story' of Soyand dam and experience space.

**MAP A**  
**TECHROSS WATER & ENERGY INC. (FORMER LG-HITACHI WATER SOLUTIONS)**

Techcross Water & Energy Inc. was founded in 2012 with main objective to provide a green environment and contribute to a healthy water ecosystem. It is engaged in water treatment businesses such as industrial water treatment, waterworks and sewage systems, wastewater reuse, seawater desalination as well as environmental businesses such as air pollution prevention and waste-to-energy (WTE). It consistently expanded business to many industries including not only water-related business but waste-to-energy, ESS, and renewable energy business. It aims to be a total solution provider that offers services across the entire environmental value chain including business proposal, investment, design, construction and operation.

**MAP A**  
**YOUNGJOO DAM**

Yeongju Dam in one of the multi-purpose dams run by K-water. Multi-purpose dams are operated for a variety of purposes including flood control, water supply, and hydropower generation. For these functions, it is essential to secure optimal operation of water gates through continuous measurements and analysis of information such as: rainfall, inflow and outflow, weather conditions, and water quality. The capacity and height of Yeongju dam are 106.4 million m<sup>3</sup> and 55.5m respectively.

## Oceans and fisheries

### MAP A

#### BUSAN FACILITY MANAGEMENT OFFICE FOR THE DISTRIBUTION OF INTERNATIONAL FISHERIES PRODUCTS

Busan is a world-class marine and fisheries city that is well-equipped with a variety of marine and fisheries infrastructure, including the Busan International Fish Market and Advanced Seafood Processing Complex. It is located between the North and South Pacific fishing grounds, as well as in the center of Japan, China, Russia and Taiwan, who are the largest consumers of fisheries products in the world. To take advantage of its location, the city has created a cluster of fisheries distribution and processing companies, as well as refrigerated warehouses. Busan is not only a gateway for the export and import of fisheries products, but also a center for distribution. With the aim of creating the largest international logistical fisheries trading platform, the Busan International Fish Market and the Advanced Seafood Processing Complex are equipped with state-of-the-art refrigeration and cold storage and processing facilities, along with a specialized port for deep-sea fishing.

### MAP A

#### DADAE FISHING VILLAGE IN GEOJE

Located just two hours from Gimhae Airport and Busan Port, it is the only sea experience village in Geoje island with natural mud flats where vacationers can find clams, catch swimming crabs and other marine life, and engage in water sports. The village has been subsidized by the government through fishing village promotion projects and it is a good example of co-management modality of the coastal area as each household in the village take co-responsibility for managing tourism programs to attract tourists and promote the village.

### MAP A

#### FISHERIES SCIENCE MUSEUM

It was the first complex marine sciences and fisheries museum in Korea. It opened on May 26th, 1997 according to a provision of the National Science Museum Act to introduce the fisheries and ocean as a thesaurus of natural resources and develop the interest and spirit of exploration in people. The exhibitions were designed to chronicle the progress and enhance the image of the future of scientific technology in the fields of marine sciences and fisheries. These exhibitions were produced by the joint efforts of professional researchers and staff at the NFRDI from 1991 to 1996. The unique collections were developed by 15 divisions and about 7,400 exhibitions, some of which include: Marine Resources, Fisheries and Aquaculture Technology, Marine Ranching, Fish Specimens, Aquarium, Marine Food Production, Whale Skeleton and Laboratory of Ship Control Navigation etc.

### MAP A

#### JAGALCHI FISH MARKET

Jagalchi Market, located on the shoreside road in Busan's Jung-gu, is Korea's largest seafood market, selling both live and dried fish. After the Korean War, the market solidified itself as a fish market. This market represents Busan and is famous throughout the country. Visitors to the market can eat fresh raw fish and experience a fish auction in the early morning.



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