



# Korea's Energy Transition: Challenge and Opportunity

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▶  Energy Status of Korea



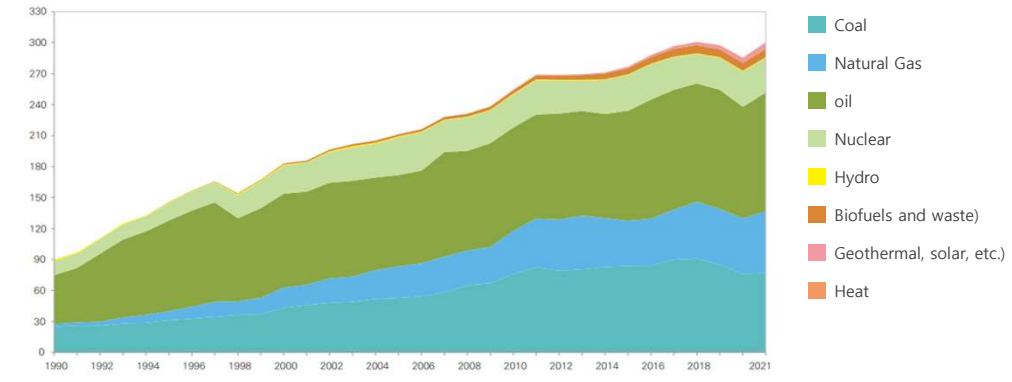
# 1. Domestic Energy Supply and Demand: Overview

Primary Energy Supply: 300.5Mtoe

- Fossil fuel consumption steadily increasing  
Oil (38.3%) , Coal (25.6%), Gas(19.8%) Nuclear (11.2%) ,  
Hydro, NRE and others (5%)

Share of Fossil fuel:  
83.7%

Trend of Primary Energy Supply

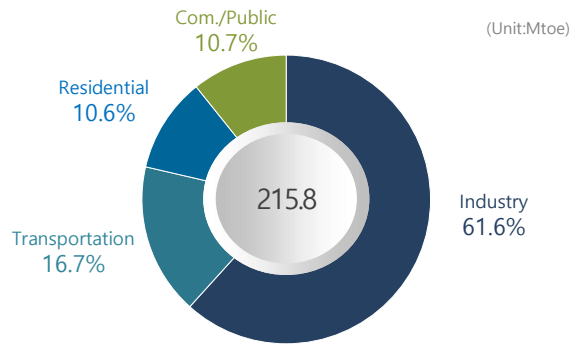


Source: KEEI(2023)

Final energy consumption in 2021:215.8Mtoe

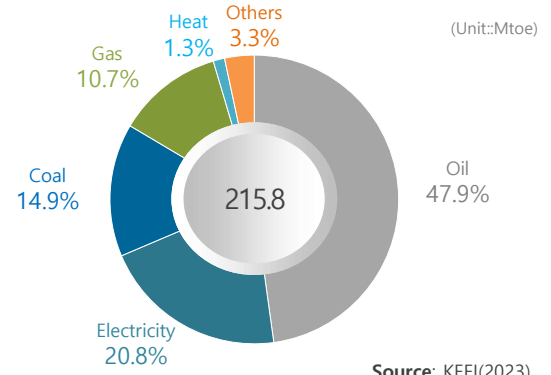
- Consumption of industry sector accounts 61.6% of final energy consumption

Final energy Consumption by sector in 2021



Source: KEEI (2023)

Final energy consumption by source in 2021



Source: KEEI(2023)

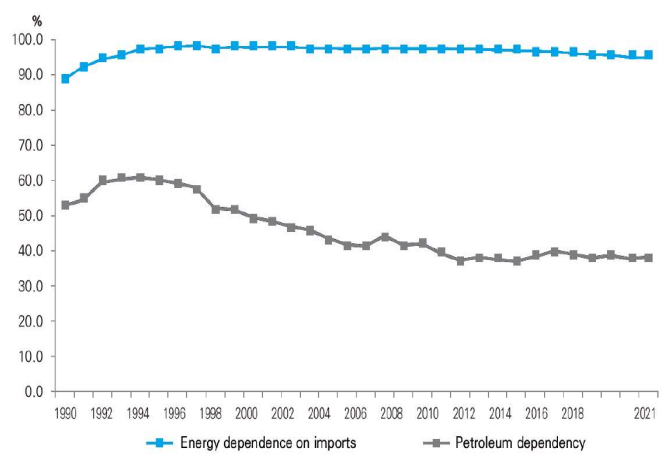
## 2. Energy Import

- ❖ Dependency on imported energy has been so high in Korea
  - Korea's dependence on oil for its primary energy supply has decreased as Korea has sought to diversify its energy mix through the use of LNG and other sources.

- ❖ In 2021, Korea imported 94.8% of primary energy from overseas
  - 84% of primary energy supply relies on foreign imported energy sources

**Highly vulnerable energy supply system**

Korea trend on energy and oil dependence from overseas



Source: KEEI (2023)

Energy supply sources and production details



Source KEEI (2023)

### 3. Domestic Electric supply

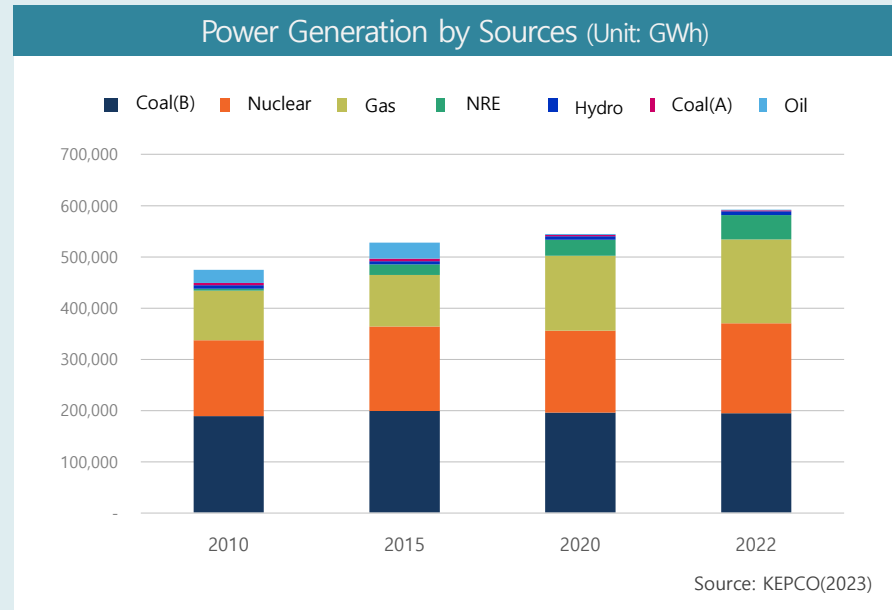
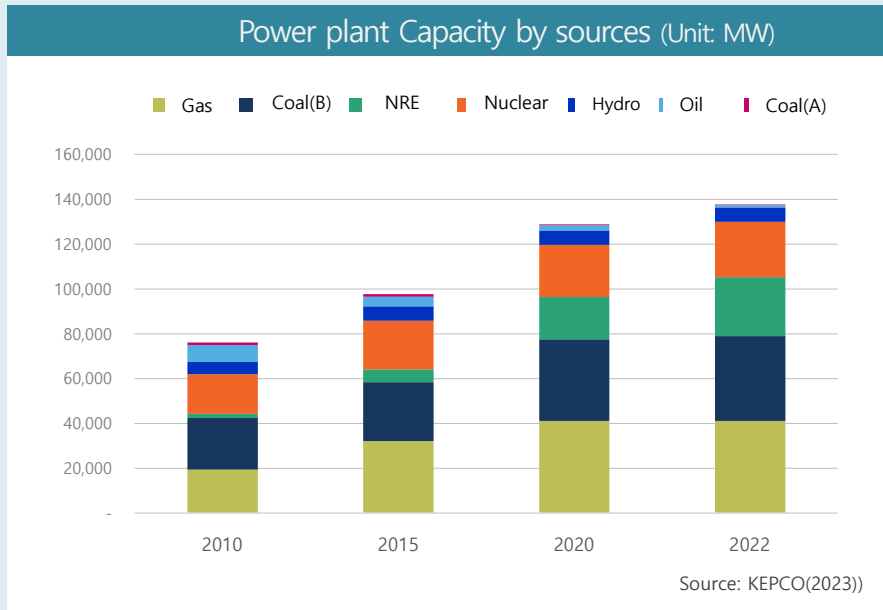
#### Power plant capacity in 2022: 138.2 GW

- Gas(41.2GW), Bituminous(37.7GW), NRE(26.3GW), Nuclear(24.7GW), Hydro(6.5GW), Petroleum(0.9GW), Anthracite(0.4GW)
- ▶ Gas(29.8%), Bituminous(27.3%), NRE(19.0%), Nuclear(17.8%), Hydro(4.7%), Petroleum(0.7%), Anthracite(0.6%)

#### Power Generation in 2022: 594.4 TWh

- Bituminous(194.8 TWh), Nuclear(176.1 TWh), Gas(163.6 TWh), NRE(47.3 TWh), Hydro(7.3 TWh), Anthracite (1.9 TWh), petroleum(1.6 TWh)
- ▶ Bituminous(32.8%), Nuclear(29.6%), gas(27.5%), NRE(8.0%), Hydro(1.2%), Anthracite(0.3%), Petroleum(0.3%)

Clean energy (38.8%) vs. Fossil fuel (60.9%)

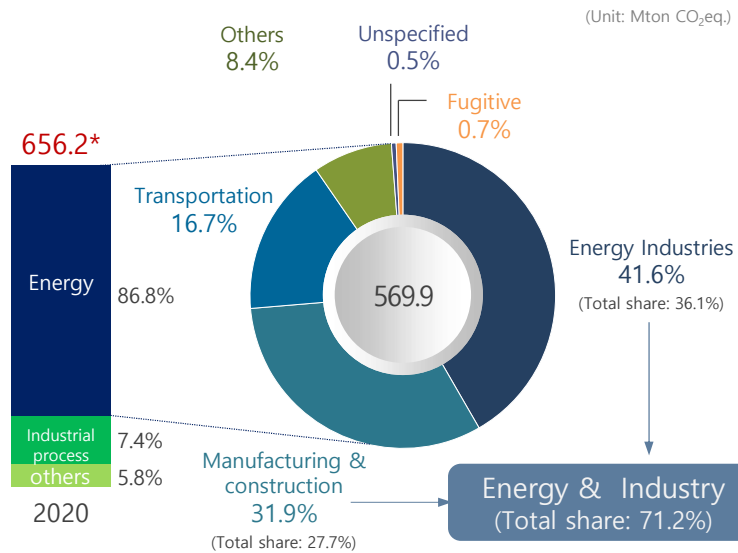




# 4. GHG Emission Status of Korea

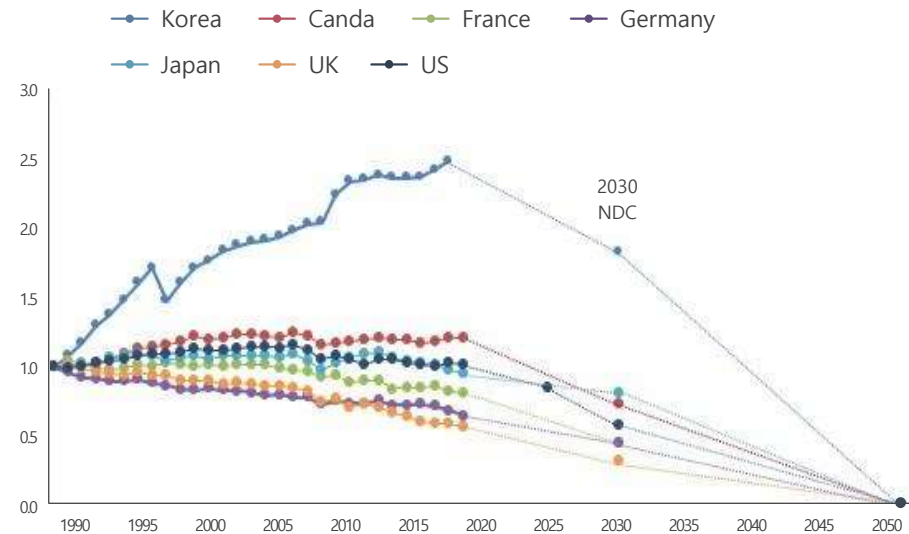
- Domestic Total GHG emissions in 2020: **656 Mton**
  - Energy and industrial process emissions account for about **94.2%**
    - > **Mostly from energy use as fuels (86.2%)**
- Transition to substantial, sustained, and rapid reductions in national GHG emissions is needed
  - Overcome structural weaknesses such as a **manufacturing-oriented industrial structure** and a **fossil fuel-based electricity supply system** and explore new growth paths

Green House Gas Emission of Korea (2020)



Source: KEEI(2023)

The speed at which Korea needs to reduce its GHG emissions compared to other countries



Source: KEEI(2023)



# Energy Transition Goal & Strategy





# 1. Policy target for carbon Neutrality

## Current Policy

To fulfill its international responsibility of carbon neutrality, the Korean government has announced carbon reduction plans

### Basic Plan for Carbon Neutrality(2023.4)

Reduce the absolute level of energy demand by **improving energy efficiency**, and transforming the fossil energy structure to **low-carbon and carbon-free energy sources**(NRE, nuclear, clean hydrogen and ammonia, bio, etc)

### 2030 National GHG Emission Reduction Target (Unit:1 million tons of CO<sub>2</sub>e )

Power & Heat	Industry	Building	Transportation	Agri, Fisheries
145.9 (45.9%) * Power:149.4(44.4%)	230.7 (11.4%)	35 (32.8%)	61 (37.8%)	18 (27.1%)
Waste	Hydrogen	Carbon Sinks	CCUS	Overseas Offset
9.1(46.8%)	7.6(8.4%)	-26.7	-11.2	-37.5

Note: parentheses show a decrease compared 2018

Source: Joint Government Agencies, Carbon Neutral Green Growth National Strategy and First National Basic Plan (2023.4.)

### The 10<sup>th</sup> Basic plan of Long-term Electricity supply and Demand (2023.2)

Active **use of nuclear power plants**, but promotion of new and renewable energy supplies based on **cost-effectiveness and high public acceptance**

### Outlook for the power generation and the share of energy sources (unit : TWh)

Year		Nuclear	Coal	LNG	NRE	Hydrogen Ammonia	Others	Total
2030	Output	201.7	122.5	142.4	134.1	13.0	8.1	621.8
	Share	32.4%	19.7%	22.9%	21.6%	2.1%	1.3%	100%
2036	Output	230.7	95.9	62.3	204.4	47.4	26.6	667.3
	Share	34.6%	14.4%	9.3%	30.6%	7.1%	4.0%	100%

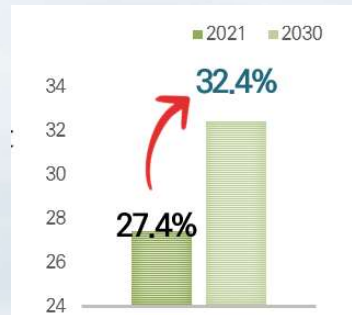
Source: MOTIE, The 10th Basic Plan of Long-Term Electricity Supply and Demand (2023.02.13.)

## 2. Achieving Carbon Neutrality in Energy Supply

01

### Nuclear Power

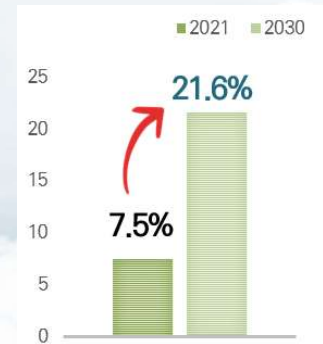
- Complete new nuclear power plant construction projects
- Sustain continued safe operation
- Secure future technologies like SMR



02

### Renewable Energy

- Expand feasible deployment with deployment conditions, the power system and social acceptance



03

### Coal power

- Phase down gradually old coal power plant
- Implement a ceiling for coal power generation

04

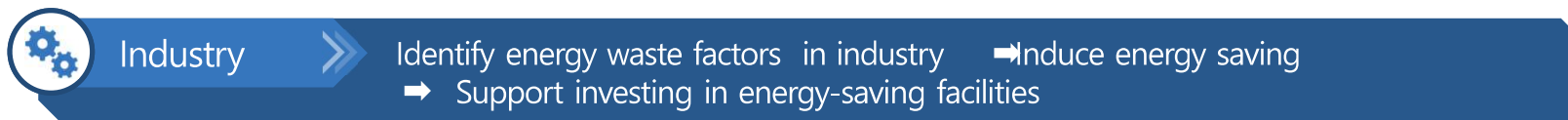
### Low carbon Energy

- Utilize LNG + Hydrogen or Coal + Ammonia Dual fuel
- (Hydrogen) Establish a clean hydrogen value chain and infrastructure
- (CCUS) promote CCUS projects

III Energy Efficiency Enhancement Measures



# 1. Major Measures for Energy Efficiency by Sector



Overview of Policy Measures in Each Stage in the Industrial Sector		
	Policy	Description
01 Identify Energy wasting factors	Energy Use Report by Energy Intensive Business	Collect information such as energy use status, investment in energy-saving facilities, energy-saving performance, equipment and Analyze trends
	Energy Audit	Require energy intensive business (consume more than 2,000toe annually) to receive an energy audit at least every 5 years
02 Induce energy saving	Energy Efficiency Target Management Scheme	Certify companies that have voluntarily achieved efficiency improvement goals as excellent business establishments and provide incentives
	Energy Saving through Partnership(ESP)	Form a joint council for energy conservation within the same industry and share energy management information
	Consulting and Subsidy for better energy efficiency of SMEs	Provide free consulting and subsidize a part of the energy-saving facility costs to improve the energy efficiency of SMEs
03 Support investing in energy-saving facilities	Soft Loan & Tax Incentives	Provide soft loans for energy efficiency investment and financial support to energy-saving specialized companies (energy service companies, ESCO)
	EnMS deployment	Help SMEs to build an energy managements system and FEMS

## 2. EE in Industry



### Energy Efficiency innovation in the industrial sector



#### ① KEEP (Korea Energy Efficiency Partnership) 30

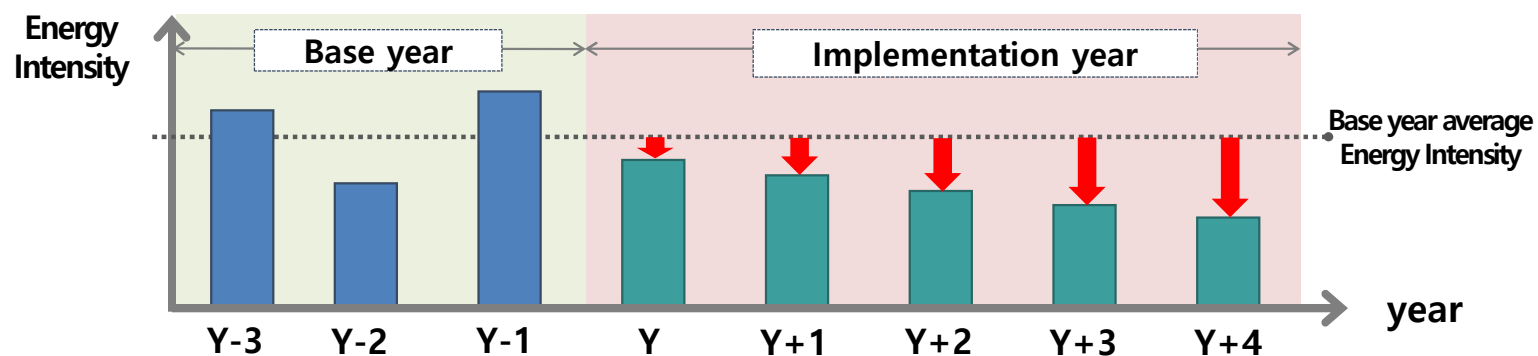
» Government-to-business voluntary agreements improve annual energy intensity by more than 1%/year and support incentives when achieved.

**Target** The 30 firms that consume over 200,000 TOE a year.

**Agreement** ① Mid-to-long term vision for carbon neutrality and efficiency innovation, ② Efficiency innovation goal, ③ Annual detailed implementation plan, ④ Incentive

**Evaluation** The 3-Step evaluation system (Document review → On-site verification → Certification)

**Support** K-ESG Certification, prizes, subsidy for facility efficiency improvement etc.



## 2. EE in Industry

### 2 KEEP+

- » Small and medium-sized companies leading energy efficiency innovation and support the entire diagnosis-investment-management process package.

**Target** A total of 1,000 small and medium-sized companies.

**Goal** 10% improvement in energy efficiency through intensive support management.

**Benefit** Additional points awarded for government efficiency improvement support projects.

### 3 EERS(Energy Efficiency Resource Standards)

- » Introduce mandatory standards for government-owned energy suppliers to support efficiency innovation of energy customers.

\* Operating as a pilot project before legalization

**Target** KEPCO(Korea Electric Power Corporation), KOGAS(Korea Gas Corporation), KDHC(Korea District Heating Corporation)

**Goal** Annual energy sales in the previous year(n-2) x target ratio(%)

**Tool** Compensation for implementation costs, Imposing penalty if goal is not met.



▶ IV Challenges to Korea's Energy Transition

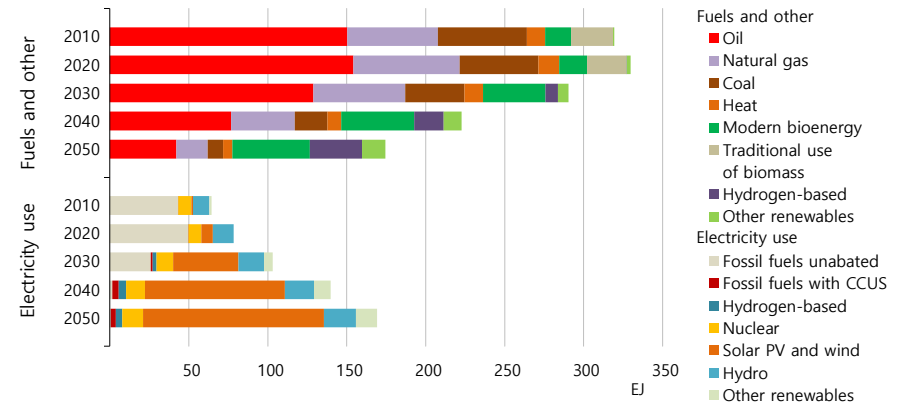
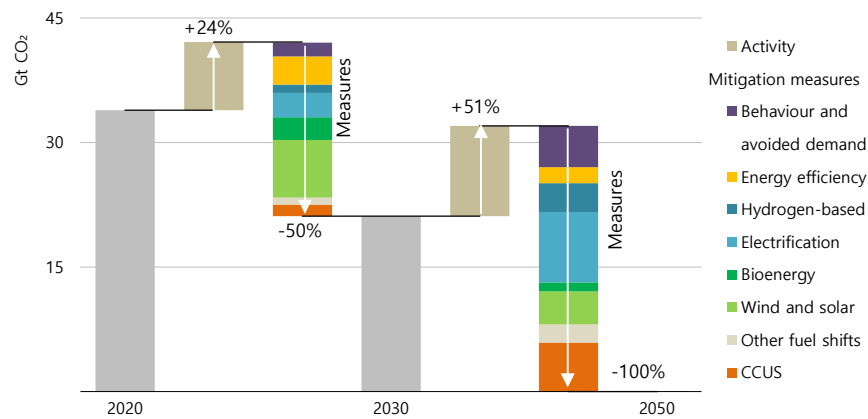


# 1. Increasing electricity demand due to electrification

Electrification of end-use energy is expected to accelerate in the middle of energy transition

- ✓ IEA: "Electrification of final energy consumption is one of the key pillars for mitigation measures (20% contribution to total reduction by 2050)
  - Electricity's share of final energy consumption in 2050 is expected to increase from **20% in 2020 to 50%** (2050 Net Zero scenario)
- ✓ In Korea's carbon neutral scenario (released in 2021), electricity demand in 2050 is expected to more than double(1,209~1,258 TWh) compared to 2018 due to electrification
- ✓ With the increasing electrification of final energy consumption, we face the challenge of providing clean power to meet the growing electricity demand while ensuring the stability and affordability of grid operations.

Emission Reduction by mitigation measures under 2050 Net zero scenario



Source: IEA (2021), 2050 Net Zero Report

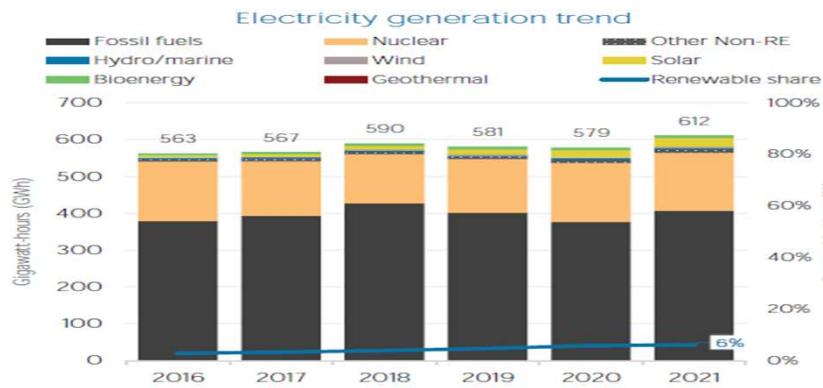
## 2. Lack of role for Renewables in energy transition

The supply of renewable energy in Korea is limited due to economic, geographical and technological reasons.

- Despite efforts to promote renewable energy, especially solar, the share of renewable energy generation in Korea is only 6% as of 2021
  - Renewable capacity share (2022): Solar 77%, Bio 10%, Hydro 7%, Wind 6% / Renewable Generation share(2021): Solar 4%, other 2%
- Generation costs for solar and offshore wind, biggest potential for future development, remain high compared to the rest of the world
- Rigid electricity markets, isolated & unilateral grid, and various barriers in the licensing & permitting process (social acceptance, regulated areas, etc.) are the main hurdles to renewable energy deployment.

Trend of Electricity Generation of Korea by sources

Current LCOE Range(US\$/MWh) in some countries



Source: IRENA(2023)

Solar PV

Offshore wind



Source: Bloomberg NEF

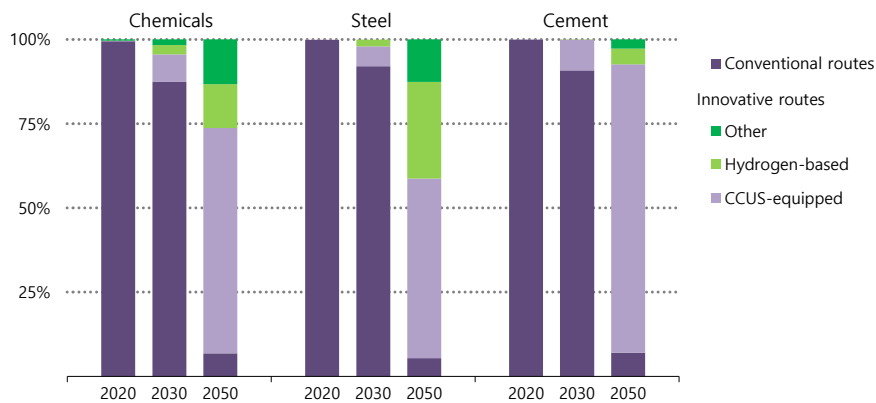
### 3. Insufficient of capacity to supply affordable Clean hydrogen

While the role of clean hydrogen as future energy source is high, domestic supply capacity is limited

- ✔ A stable supply of cost-competitive clean hydrogen is essential for the decarbonization of high-emitting industries( steel, petrochemicals, etc.)
- ✔ Given the huge demand for clean hydrogen in the power and transportation sectors, the potential for domestic hydrogen supply would be **insufficient**
- ✔ Accordingly, clean hydrogen should be secured from overseas to meet the domestic demand

-> (1st Basic Plan for Hydrogen Economy) Aiming to secure **50% of domestic hydrogen demand from overseas by 2030 and 82% by 2050**

Role of Clean Hydrogen under the 2050 Net –zero Scenario



Source: IEA (2021), 2050 Net Zero Report

Future Clean hydrogen demand by sector (unit: ten thousand ton)

Sector	2023	2025	2030	2036	2050
Transportation	0.85	2.35	39.1	46.5	220
Power	-	-	29	126	1,350
Ammonia	-	-	51.0 (289)	154.6 (876)	
Industry					1,060
<b>Total</b>	<b>0.85</b>	<b>2.35</b>	<b>119.3</b>	<b>327.1</b>	<b>2,790</b>

• Needed hydrogen volume in parentheses

Source: KEEI(2023) , " Analysis of Hydrogen supply and demand Plan of Korea"

▶ **V** Opportunities in the midst  
of challenges



# 1. Build-up Carbon Free Power system

Establishing a balanced carbon-free power system with various sources to ensure stability and cost-effectiveness

## Inside Korea

### Policy direction

- Build an innovative electricity market by reforming the pricing mechanism and designing & implementing advanced institutional systems and frameworks.
- Expand support to ensure adequate and affordable supply of carbon free energy.

### Opportunity

- Establish more reliable network operations.
- Increase revenue certainty and future investment opportunities by reducing investment uncertainty.

## Outside Korea

### Policy direction

- Leading Carbon Free Energy(CFE) Initiative to expand It globally

#### CFE Initiative

An initiative that sets targets and certifies the use of carbon-free energy sources (renewables, nuclear, clean hydrogen, CCUS, etc.) in the total energy used by energy consumers.

### Opportunity

- Reduce the burden of RE100 implementation for companies/countries under unfavorable RE conditions.
- Create diverse business opportunities not only in renewable but also in other carbon-free energy sources in a practical and effective way.
- promote cross-border cooperation and institutionalization by CFE initiatives with like-minded countries



## 2. Economical Clean Hydrogen Supply System

Building infrastructure for cost-competitive supply and consumption of clean hydrogen

### Clean Hydrogen Supply Chain

Needs to establish a stable clean hydrogen Supply system to meet domestic supply targets

#### ① Securing an overseas supply chain

Need for stable and affordable overseas Clean hydrogen supply bases

#### ② Establishing receiving facilities for overseas hydrogen

- (Short-term) For Clean Ammonia
- (Mid-term) For Liquefied hydrogen

#### ③ Establishing Domestic Distribution system

- Connecting systems between hydrogen production, receiving facilities with demand destinations



- New business and investment opportunities will be created in the development of clean hydrogen supply chains and related technologies, as well as opportunities for increased international cooperation.



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