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수소융합얼라이언스

Korea's Clean Hydrogen Economy Policy

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Chairman of H2KOREA

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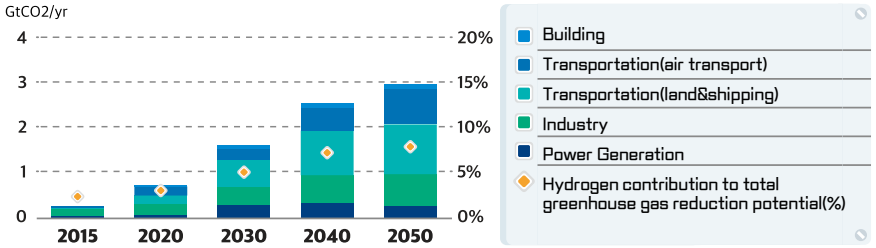
Necessity of Hydrogen Economy

Critical Sector for Carbon Neutrality

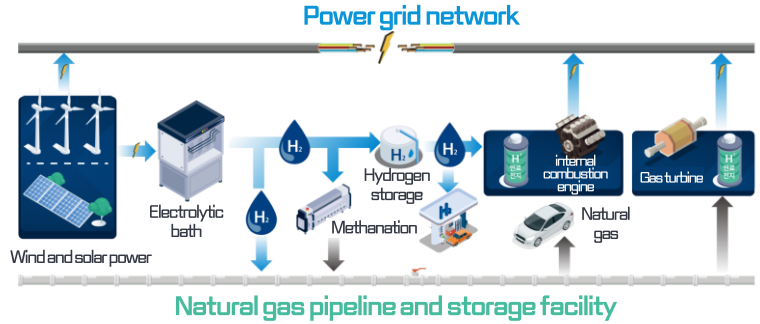
- Eco-friendly energy with zero emissions of greenhouse gases, fine dust, etc.
- Provides new carbon reduction methods for hard-to-abate industries

Hydrogen's Potential for Greenhouse Gas Reduction (IEA, '20)



Stabilizing the Power System

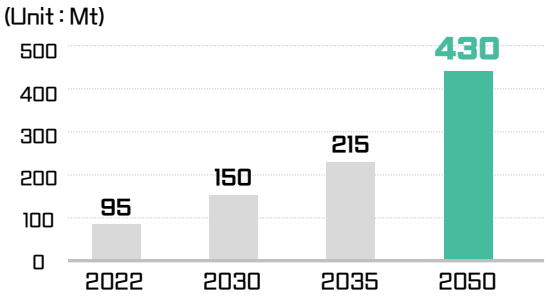
- Resolves power supply imbalance using hydrogen storage technology
- Ensures system reliability through the complementarity of power grids and gas networks



Growing Demand of Hydrogen

- Utilize in power generation(fuel cells, etc.), transportation(hydrogen vehicles, etc.), and industrial processes
- Provides opportunities to create new industries and revitalizing traditional industries

Hydrogen Demand

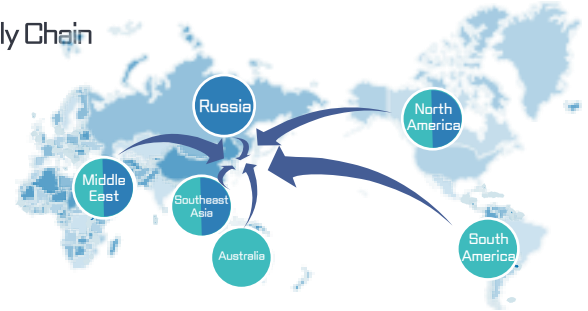


ref: IEA, '23

Strengthening Energy Security

- Reduces dependence on energy imports (currently 93.5%)
- Enhancing energy security from oversea hydrogen production

Hydrogen Supply Chain Development



I Why Hydrogen Economy?

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Global Momentum toward a Hydrogen Economy

Long Journey

"Narrow, but Achievable(2019, IEA)"

Climate Response as a Key Agenda (2023.11, APEC Summit)

- Joining the Carbon-Free Alliance(CFA)

How to achieve the Goal (2023.5 G7 Summit)

Energy Efficiency and Conservation

Commercialization of New Technologies
Offshore wind, Hydrogen, CCUS

Utilization of Nuclear Energy

National and Corporate Efforts to Realize the Hydrogen Economy

RePower EU

Hydrogen Market Size

Hydrogen Market Size
20 million tons of H2 by 2030

Northeast Asia

Preparation of legal and institutional measures

Expansion of hydrogen use,
overseas imports of clean hydrogen

IRA

Clean hydrogen production price

$1 per kilogram within 10 years

Global Energy Companies

Investment + M&A

Decarbonized Economy

II How Hydrogen Economy?

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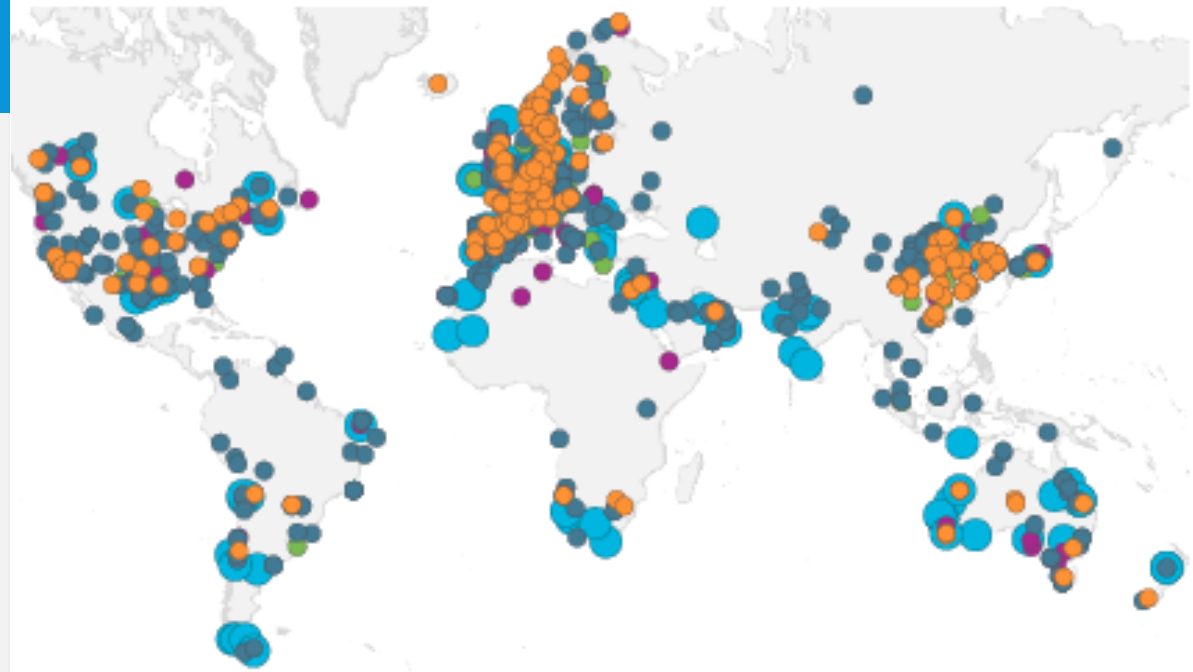
Clean hydrogen deployment steadily continues



1,046 projects[1]

684 in May 2022

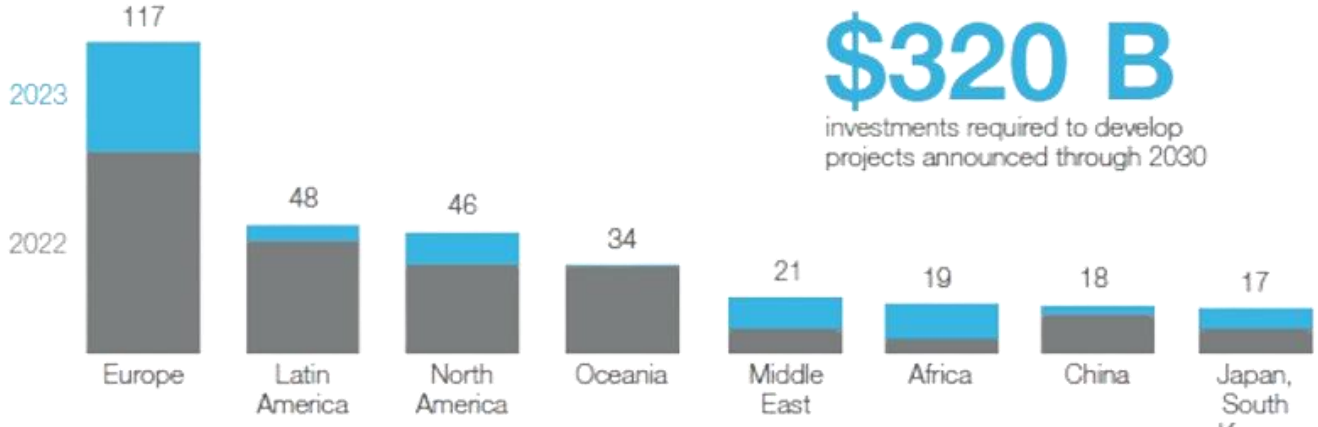
- **112** Giga-scale production
- **553** Large-scale industrial use
- **191** Mobility
- **94** Integrated H_2 economy
- **96** Infrastructure projects

1. Focus on projects of ⟩1 MW, as of Jan 31, 2023

800 kt p.a.
operational clean hydrogen supply capacity today, less than 1% of the grey hydrogen market today

700 MW
electrolysis capacity deployed by the end of 2022, with about 9 GW having passed FID globally

⟩1,070
hydrogen refueling stations deployed globally, with more than 50% growth year-on-year



$320 B
investments required to develop projects announced through 2030

* Reference : Hydrogen Insight 2023, Hydrogen Council

II How Hydrogen Economy?

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Ongoing Hydrogen Applications

Germany, Operate Hydrogen Trains

Photo : FuelCellsWorks

Saudi Arabia, Promote Neom City Project

Photo : Money Today

USA, Promote H2HUB Project

Photo : US Department of Energy

Japan, Demonstrate Hydrogen Frontier Ship

Photo : Money Today

Korea, Utilize Clean Hydrogen In Power Generation And Mobility

Photo : Money Today

Norway, Demonstrate Liquid Hydrogen-powered Ship

Photo : Norled

III Hydrogen Economy in Korea

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Progress of Korea's Hydrogen Economy

Roadmap for Activation of Hydrogen Economy ('19.01)

Launch of the Hydrogen Economy Council ('19.07)

Establishment of the Hydrogen Economy Policy Department in the MOTIE

Amendment of the Hydrogen Law('22.6)

Basic Plan for Hydrogen Economy Implementation ('21.11)

Strengthen NDC Target('21.10)

World-First Hydrogen Law Enactment ('21.02)

5th Hydrogen Economy Council('22.11)

6th Hydrogen Economy Council ('23.12)

Clean Hydrogen Power Generation Bidding Market('24.5)

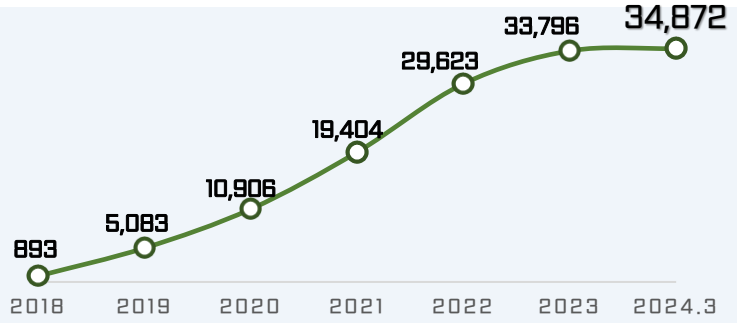
Hydrogen Economy in Korea

Achievements of Korea's Hydrogen Economy

Hydrogen Vehicles

Category	Year (Unit : Vehicle)						
	2018	2019	2020	2021	2022	2023	2024.3
Total (Cumulative)	893	5,083	10,906	19,404	29,623	34,526	34,872

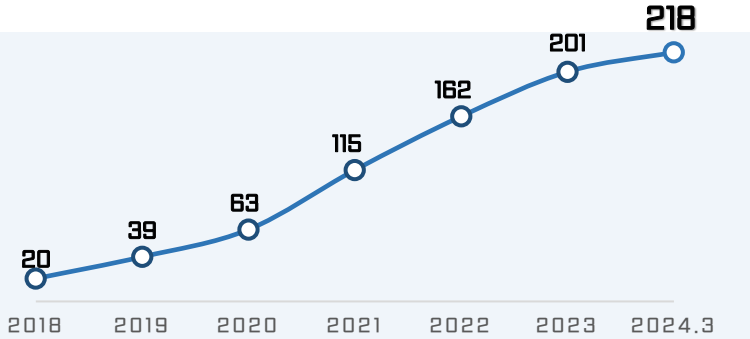
- (April 2024) Passenger cars: 34,383 vehicles, Buses: 757 vehicles, Trucks: 20 vehicles
- Ministry of Land, Infrastructure and Transport



Hydrogen Refueling Station

Category	Year (Unit : station)						
	2018	2019	2020	2021	2022	2023	2024.3
Total (Cumulative)	20	39	63	115	162	201	218

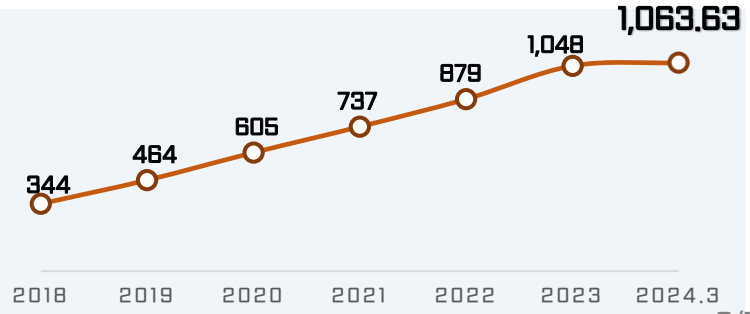
- Ref: h2hub.or.kr/main/index.do



Fuel Cell Power Generaion

Category	Year (Unit : MW)						
	2018	2019	2020	2021	2022	2023	2024.3
Total (Cumulative)	344	464	605	737	879	1,065.75	1,063.63

- Power Statistics Information System



Hydrogen Economy in Korea

Trends of Korea's Hydrogen Economy

SK E&S, Construction of a liquefied hydrogen plant (Incheon)

Photo : SK E&S

Hyundai, Expand its Production Capacity of Hydrogen Bus to 3,000

POSCO, Announcement of plan on clean hydrogen-based steelmaking

Photo : POSCO

HD Korea Shipbuilding & Offshore Engineering, Order of ammonia-powered ship

Photo : HD Korea Shipbuilding & Offshore Engineering

Hanwha, Success in Hydrogen to gas turbine (59.5%)

Photo : Hanwha

Doosan Enerbility, Development of hydrogen combustion turbine

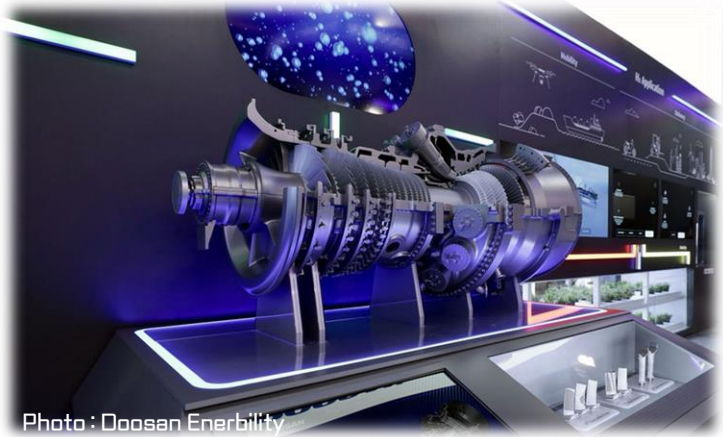


Photo : Doosan Enerbility

Private Investment Plans in Hydrogen Industry (March 2021)

Government policies serve as priming water to activate private investment

- In response to government hydrogen economy policies, private companies **invest a total of USD 3.1 Billion**
- Refinery·gas companies **announced hydrogen economy visions** as part of future new industries
- Small and medium-sized companies in the hydrogen sector **plan to invest USD 880 million** by 2030

2030 Investment Plans

SK	USD 1.3 billion	Construction of large-scale liquefaction plants and expansion of fuel cell power generation
HYUNDAI	USD 8.1 billion	Investment in hydrogen vehicle facilities, R&D, and related infrastructure (charging stations, etc.)
posco	USD 7.3 billion	Production of byproduct hydrogen, introduction of overseas green hydrogen, and development of hydrogen reduction steel
Hanwha	USD 950 million	Green hydrogen (water electrolysis) R&D demonstration, production, hydrogen storage facilities, etc.
HYOSUNG	USD 880 million	Construction of liquefaction plants, distribution of liquefied charging stations, etc.
Small and medium-sized companies	USD 880 million	Residential fuel cells, green hydrogen R&D, hydrogen extractors and storage containers, etc.

IV Hydrogen Policy in Korea

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Importance of Clean Hydrogen Certification System and Industrial Standards

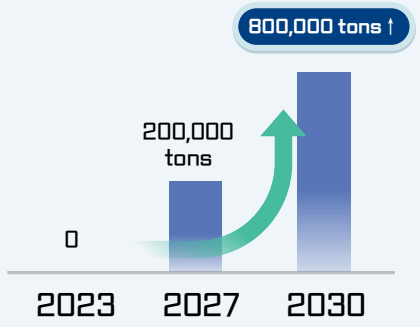
for the Preparation of the Global Hydrogen Economy

WATER	Electrolysis	GREEN
NATURAL GAS	Steam reformation	BLUE
	Steam reformation	GREY
	Pyrolysis	TURQUIOSE
BROWN COAL	Gasification	BROWN
BLACK COAL	Gasification	BLACK
NUCLEAR	Electrolysis	PINK

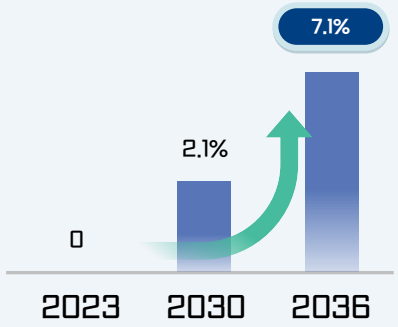
Rainbow color Hydrogen?

Clean Hydrogen Power Utilization Plan

Clean Hydrogen Demand



Clean Hydrogen Power Generation Ratio



Certification Scheme('23.12)

- Classification into 4 grades based on emissions up to hydrogen production and fixed support by grade

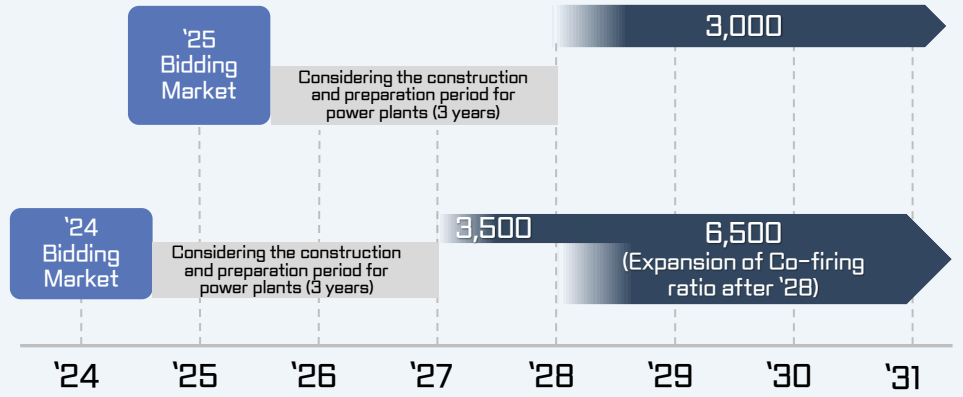
Grade ($kgCO_2eq/kgH_2$)	Subsidy(%)
Grade 1 (~0.1)	A
Grade 2 (0.1~1)	A × 50.0%
Grade 3 (1~2)	A × 37.5%
Grade 4 (2~4)	A × 25.0%

Opening Clean Hydrogen Power Generation Bidding Market('24.5)

- Annual hydrogen power generation targets established in consideration of the 10th Basic Plan for Power Supply and Demand, national greenhouse gas reduction targets, and other factors

Bidding Volume I Clean Hydrogen Bidding Market

(Unit : GWh)



Formal contract with successful bidders expected by December 2024

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Oversea Clean Hydrogen Supply Chain

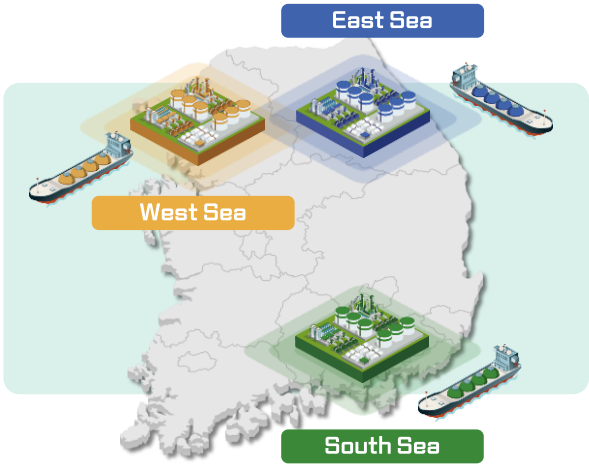
● Securing Oversea Clean Hydrogen Supply Chain

Focus on countries in Southeast Asia, the Middle East, and Australia with favorable hydrogen production environments

Country	Region	Participating Companies	Description
Malaysia	Sarawak	Lotte Chemical, Samsung E&A, KNOC	Signed MoU with SEDC Energy, Sarawak Energy Berhad on Oct. 2022 to import Green Hydrogen
Oman	Duqm	POSCO, Samsung E&A, KOSPO, KEWP	Signed a deal to build a large-scale green hydrogen production plant on June 2023
Saudi Arabia	Ras Al Khair	KEPCO, KNOC, POSCO, Samsung E&A, KOSPO	Signed LOI with Aramco on Sept. 2023 to Import Blue Ammonia
Australia	NSW	KEPCO	Signed MoU with the Port of Newcastle on July 2023. Currently, candidate project that can apply for headstart programme
US	Texas	SK	SK-backed firm is building blue ammonia plant in Texas(announced Jan. 2024)

● Construction of Ammonia Receiving Terminals

Establish large-scale receiving terminals in three regions: West Sea, East Sea, and South Sea with capacity of 1.1 Mt/y by 2027 and 4 Mt/y by 2030



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5th Hydrogen Economy Council ('22.11)

3UP Strategy for the Hydrogen Economy Development

	As-is		To-be
① Scale & Scope	**Creating huge demand for growth of the power generation & transport ecosystem**		
Transportation	Supplying FCEVs focusing on passenger cars (19,270 units by 2021)	»	Accelerating deployment of commercial vehicles (hydrogen bus & truck) (30,000 units by 2030)
Power generation	Small-scale fuel cell (767.1MW by 2021)	»	Large-scale centralized power generation (hydrogen turbine, ammonia co-firing, etc.) (7.1% of Clean Power Generation by 2036)
Production	Domestic gray hydrogen production	»	Establishment of large-scale domestic and overseas clean hydrogen production bases
② Infrastructure & Policy	**Establishment of infrastructure & system for clean hydrogen-based ecosystem transformation**		
Distribution	Gaseous hydrogen transportation & refueling (141 units of Gaseous HRSs by 2021)	»	Liquid hydrogen mass storage & transport (construction of liquefaction plant & refueling station) (70 units of Liquid HRSs by 2030)
Supply	Use of LNG supply chain	»	Construction of ammonia & liquid hydrogen receiving base and hydrogen pipeline network
Policy	Enactment of Hydrogen Act (February, 2020)	»	Opening bidding market for hydrogen-based electricity and promoting enactment of Hydrogen Business Act (2023) Implementation of clean hydrogen certification system (2024)
③ Industry & Technology	**Nurturing new growth engines to become a leading nation in the hydrogen industry**		
Technology	Technology development focusing on hydrogen vehicle & fuel cell (75% level compared to developed countries in 2021)	»	Securing core technologies for the entire hydrogen value chain (fostering 7 major strategic fields) (100% level compared to developed countries by 2030)
Ecosystem	Designation of hydrogen-specialized enterprises (30 enterprises in 2021)	»	Intensive development of hydrogen-specialized companies (600 companies by 2030)
Export	Security of domestic track record (No1 world market share for 2 items in 2021)	»	Full-scale overseas export (No1 world market share for 10 items by 2030)

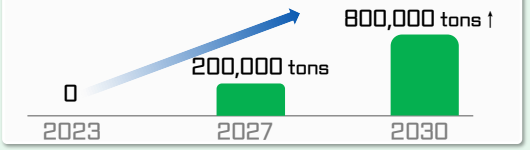
Hydrogen Policy in Korea

6th Hydrogen Economy Council ('23.12)

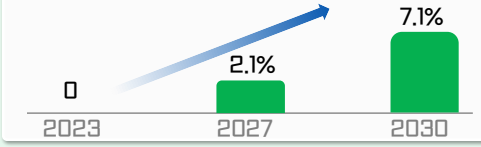
● 1st Agenda: 'Clean Hydrogen Certification System Operations Plan'

○ Goals

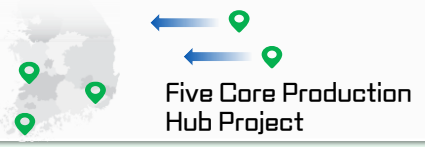
Clean Hydrogen Demand



Clean Hydrogen Utilization Rate



Production Hub Projects



● 2nd Agenda: 'Fostering Strategy for MCE in Hydrogen Industry'

○ Goals

- **Achieve an 80% localization rate of MCE in 10 strategic fields by 2030** (40% in 2022)
- **Foster 20 global hydrogen MCE companies by 2030** (2 in 2022)

● 3rd Agenda: 'Measures Measures to Increase Supply Rate of Hydrogen Electric Vehicles'

○ Goals

Supply of Hydrogen Vehicles

(Nov.23) 34,000 units
→ (2030) 300,000 units

Installation of Refueling Stations

(Nov.23) 274 dispensers
→ (2030) More than 660 dispensers

● 4th Agenda: 'Operation Plan for National Hydrogen Research Lab'

Alkaline Water Electrolysis

Development of a 10MW-class pressurized water electrolysis system by 2030

(Ongoing) Demon. of 1MW-class system in 2023

PEM Water Electrolysis

Commercialization of multi-MW-class high-durability, low-cost water electrolysis system by 2030

(Ongoing) Demon. of 1MW-class system in 2023

Designated as the Hydrogen Industry Promotion Agency in July 2020

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Hydrogen Industry Promotion Agency (Hydrogen Law Article 33)

Supports projects for human resource development and R&D to strengthen the competitiveness of the hydrogen industry

Establishment Purpose **Foster domestic hydrogen-based industries and play a leading role in the global market**

Key Projects

Policy support for Hydrogen Economy

- Support for hydrogen economy policy establishment and implementation projects
- Rationalization of hydrogen industry regulations
- Hydrogen-related R&D planning projects
- Analysis of the hydrogen industry ecosystem

Foster Hydrogen-Specialized Companies

- Support projects for hydrogen-specialized companies
- Hydrogen expert training projects
- Hydrogen and fuel cell standardization projects
- Hydrogen production infrastructure construction projects

International Hydrogen Cooperation

- Bilateral and multilateral international hydrogen cooperation projects
- Operation of the Global Hydrogen Industry Alliance
- Support for the establishment of clean hydrogen certification system
- Support for the construction of overseas clean hydrogen supply chains

Enhancing Public Acceptance

- Operation of the Hydrogen Economy Promotion Council
- Public participation promotion event
- Mass media and media promotion
- Support for the National Assembly Hydrogen Economy Forum

Key Achievements

Support for the establishment of the 1st Basic Plan for Hydrogen Economy Implementation ('21.11) and the new government's hydrogen economy policy direction ('22.11)

Development of support plans and growth strategies for the hydrogen economy through research and analysis of the hydrogen industry ecosystem

Support for the enactment and implementation of the "Hydrogen Economy Promotion and Hydrogen Safety Management Law" and its subordinate regulations ('21.2), and its amendment ('22.6)

Establishment of a systematic basis for supporting hydrogen-specialized companies and activating the hydrogen economy

Establishment of the "World Hydrogen Industry Alliance (GHIAA)" to activate global private hydrogen cooperation ('22.5)

Leading international cooperation by forming a cooperative body with hydrogen associations from 24 countries including the US, EU, and Japan

Member : 156 members (41 special members, 25 regular members, 90 associate members)

Government	Industry	Public Institution	Others
41	79	18	18

Government	H2KOREA 수소융합얼라이언스	Private Sector
Policy Establishment	Public Relations and Data Database	Planning and Business Promotion
Policy Support	Feasibility Analysis·systematization	Proposal of Business model
System Improvement	Presentation of Solution	Problem Finding

Hydrogen Economy Public-Private Communication Channel

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Aiming Higher and Farther