Internation Conference on Green Hydrogen 2025 , India

Korea's Hydrogen Economy Status & Prospect

Nov. 12th, 2025

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Secretary General

Korea Hydrogen Alliance (H2KOREA)

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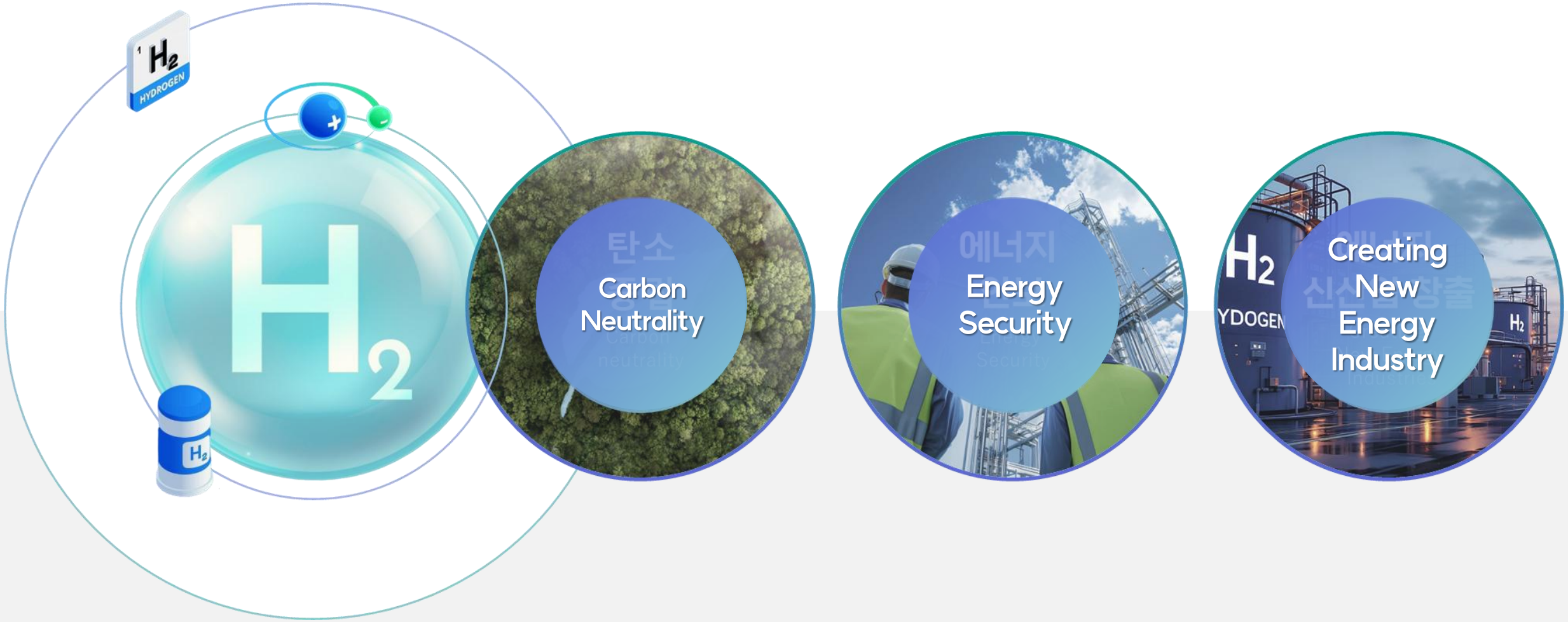
I.

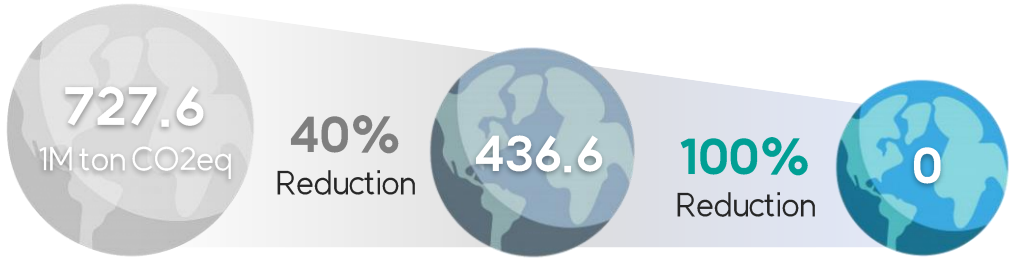
Necessity of The Hydrogen Economy

Ⅰ. Necessity of the Hydrogen Economy



Ⅰ. Necessity of the Hydrogen Economy

Carbon Neutrality
Our defining Challenge : Climate Action



* Source : 2030 Enhanced NDC (2021)

Hydrogen: Carbon-Free like Nuclear & Renewables

- Balances Nuclear **Rigidity** & Renewable **Intermittency**
- Cuts Emissions in **Power, Transport & Industry**

Power Generation

LNG, Coal

H_2 Co-firing &Power Plants

Transportation

Gasoline, Diesel

H_2 Fuel Conversion

Industry (e.g. Steel)

Coking Coal

H_2 Substitution

Importing over 90% of its energy needs

Lowest rate of energy self-sufficiency in the OECD

Primary Energy Import Dependence (Korea)

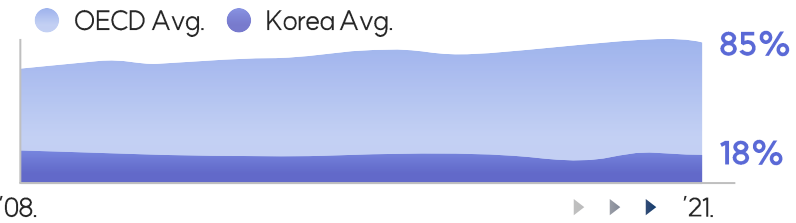
96.4%

Since 2008

*Source : National Assembly Budget Office

OECD Energy Self-Sufficiency (2021)

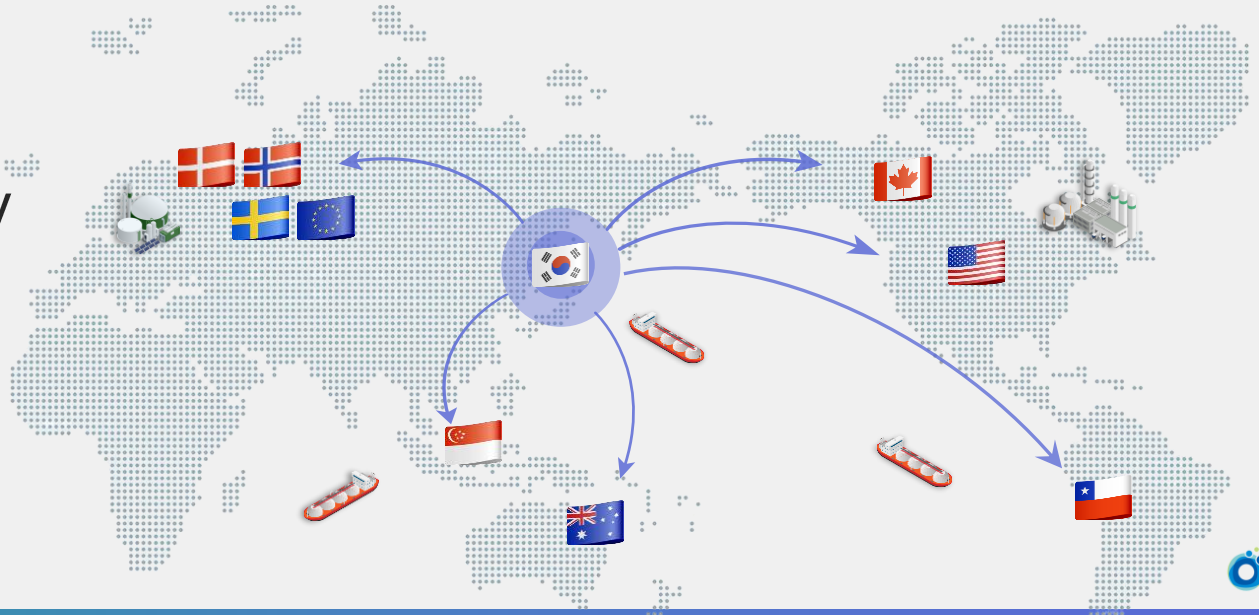
85%



*Source : IEA Report('21)

Hydrogen : Key to Energy Security

- **Low Regional Dependence, Diversified Supply**
- **Domestic Production* + Overseas Imports**
  *Renewables·Nuclear + Water Electrolysis, Reforming + CCS
- Better storability than Renewables,
  Reliable in Supply Crises



Ⅰ. Necessity of the Hydrogen Economy

03. Creating New Energy Industries

Production – Distribution–Utilization

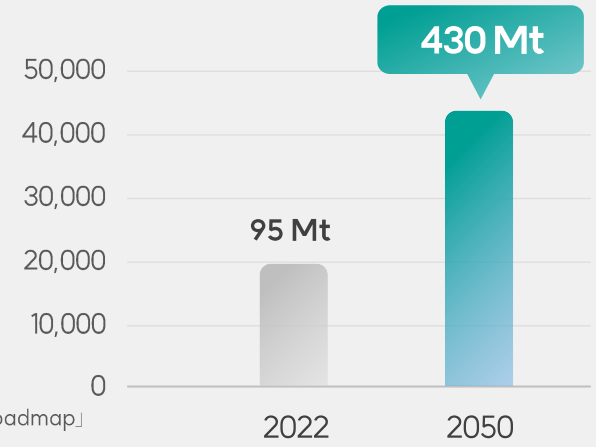
Creating New Industries Across the Hydrogen Value Chain

	Investment (KRW)	Investment (KRW)	Investment (KRW)
2024	681.5 billion	177.1 billion	736.1 billion
25~29 (cumulative)	9.207 trillion	615.2 billion	2. 544 trillion

* Source : '25~29 Estimated Investment(Survey on H2 Industry, H2KOREA('24))

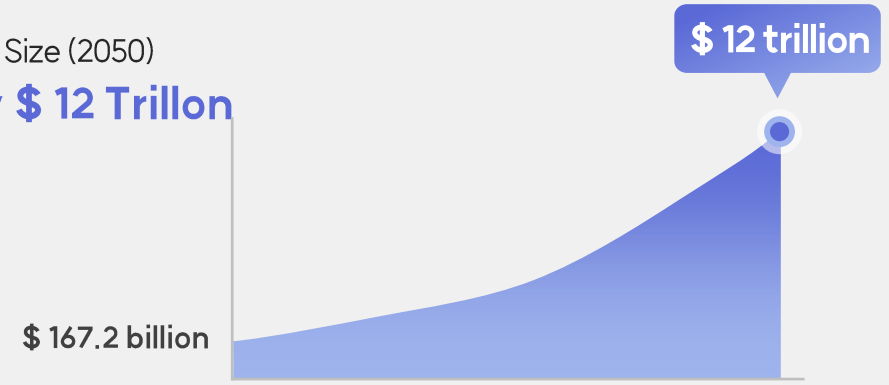
Unlimited Growth Potention » $12 trillion by 2050

Global H^2 Demand
430 Mt



*Source : IEA「Net Zero Roadmap」

H^2 Market Size (2050)
Nearly $ 12 Trillon



*Source : Goldman Sachs, 2020

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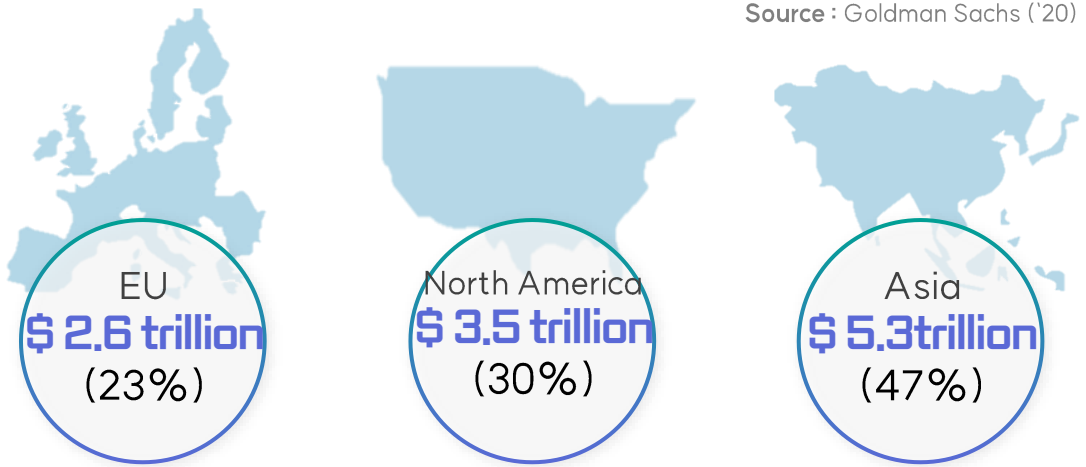
II.

Global Hydrogen Economy Trends

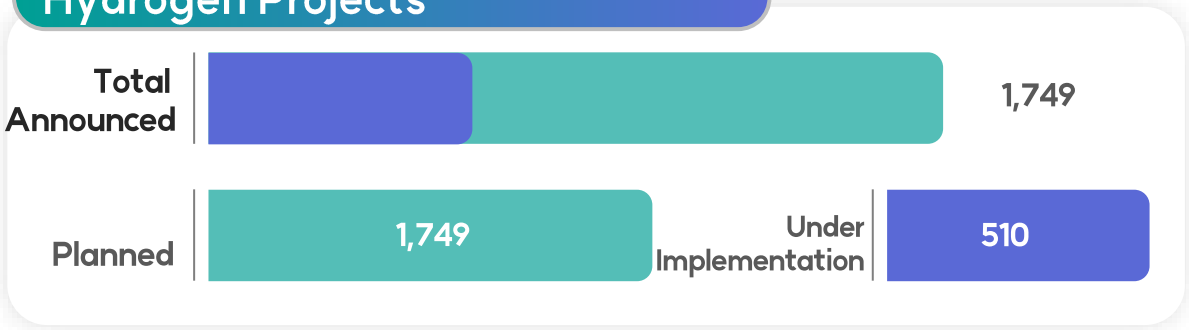
Global low-carbon hydrogen market to reach ~USD 12 trillion by 2050

Global Market Outlook for 2050

Source : Goldman Sachs ('20)



Hydrogen Projects



* 2050

USD 104 billion already invested, projected to exceed USD 695 billion (~2030)

Regional Investment (as of 2025)

$ 33B China	$ 23B North America	$ 19B EU
$ 14B India	$ 11B Middle East	$ 4B Korea–Japan

Over 40 countries developing low-carbon hydrogen strategies and roadmaps (as of 2024)

Source: Stefan Gevaert & Lioba Pause('22.11), "Green Hydrogen in the Global South"

Strategies Adopted

Korea, Japan, Germany, France, Netherlands, UK, USA, Canada, China, Norway, Denmark, Switzerland, Australia, Saudi Arabia, India, etc

Roadmap

Singapore, Brazil, Chile, Colombia, Finland, Portugal, Spain, Oman, UAE, Malaysia, Indonesia, Russia, Philippines, etc

In Preparation

Kazakhstan, Algeria, Egypt, Burkina Faso, Nigeria, Tunisia, Bangladesh, Hong Kong, Greece, Iceland, Serbia, Latvia, Albania, Georgia, Bulgaria, Trinidad & Tobago, etc.

* Based on World Energy Council(2021.9), "National Hydrogen Strategies" , Columbia SIPA('24.5), "National Hydrogen Strategies & Roadmaps Tracker"

2050 Global Hydrogen Trade Scenario

Source: Global Hydrogen Flows: Hydrogen trade as a key enabler for efficient decarbonization Hydrogen Council, McKinsey & Company('23)

Northeast Asia Import Hubs
(Korea · Japan · China)

1. Australia > Korea · Japan
2. Southeast Asia > Korea · Japan
3. Middle East(GCC) > Northeast Asia
4. North America(West Coast) > Northeast Asia
5. Russia/North Asia > Northern China

Europe Import Hubs
(UK · Germany · Netherlands)

1. North America (East Coast) > Northern Europe
2. North Africa · Middle east > Europe
3. Arctic routes: North Sea/UK linkages

Major Export Regions

Emerging Supply Hubs: Australia, North America, Southeast Asia, GCC, North Africa, South Africa

II. Global Hydrogen Economy Trends

04. Major Countries' Hydrogen Policies

	U.S	EU	Germany	China	Japan	한국
Supply Target	**Clean Hydrogen** ('30) 10Mt ('40) 20Mt **('50) 50Mt**	**Clean Hydrogen** ('30) 20 Mt regional supply	**Clean Hydrogen** ('30) 2.85Mt ~3.9Mt	**Clean Hydrogen** ('30) 10 Mt (incl. 100 GW electrolysis)	**Hydrogen** ('30) 3 Mt ('40) 12Mt **('50) 20Mt**	**Hydrogen** ('30) 3.9 Mt (Clean 50%) **('50) 27.9 Mt** (Clean 100%)
	Clean Hydrogen Strategy & Roadmap('23.6)	**RePowerEU**('22.5)	**Revised National Hydrogen Strategy**('23.7)	**Mid-to-Long-Term Hydrogen Energy Development Plan** ('22.3)	**Revised Basic HydrogenStrategy** ('23.6)	**HydrogenEconomy Implementation Plan('21.11)**
Application (Price)	Industry · Transport ('30)$1/kg	Industry · Transport ('30)$3~5/kg		Industry · Transport ('30)$1.44/kg	Power · Transport ('30)$2/kg	Power · Transport ('30)$2~2.5/kg
Demand Creation	**Incentives**	**Incentives** **(Industry & Transport Mandates, RED III)**		**Incentives**	**Incentives**	**Power Sector Incentives** **(Mandatory for Industry and Transport Sectors, ~2027)**
Support Schemes						
Legal Basis	IRA('22), BIL('22)	Carbon Neutral Industry Act ('24)	Emergency Climate Protection Program('22)	Notice on Pilot Operation of Hydrogen FCV('20)	GX Promotion Act('23)	Hydrogen Act('22.6)
Support Mechanism	**Grant**	**Grant+Bid**	**CfD + Bid**	**Performance Based**	**CfD**	**CfD+Bid**
Support Details	Tax credits, Financial support for 7 hydrogen hubs	Subsidy Grants	'Lowest supply price – highest demand price' CfD support	Performance-based subsidies by pilot region for fuel cell vehicles	Compensation for reasonable profit of hydrogen producers	CfD support for bidders' power generation cost
Funding Sources	Government Budget	EU Innovation Fund	Federal Government Budget	Government Budget	Green Transition Bonds	Electricity tariff settlement

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III.

Status & Policies of Korea's Hydrogen Economy

Ⅲ. Status & Policies of Korea's Hydrogen Economy

01. Policy Changes

'19.01 Hydrogen Economy Roadmap

- Market creation and growth in hydrogen applications (vehicles, power fuel cells)
- Gray hydrogen ecosystem based on fossil fuels

'20.07 Launch of Hydrogen Economy Committee

- Strengthening competitiveness of the H_2 industry ecosystem
- Implementation status & future plan of the H_2 tech roadmap
- Progress & future plan of H_2 vehicles and HRS
- Status & expansion strategy of H_2 cities
- Designation of a dedicated H_2 agency
- Establishment of operating rules for the H_2 Economy Committee

'21.02 World's First Hydrogen Act Enforced

- H_2 governance: committee, dedicated agency
- H_2 promotion: firms, workforce, statistics
- H_2 infrastructure: stations, clusters, pilots
- H_2 distribution: price reporting & disclosure

'21.11 Hydrogen Economy Implementation Master Plan

- Lead in clean H_2 production (green, blue, imports)
- Expand H_2 infrastructure (pipelines, stations)
- Scale up H_2 power & mobility, industrial use
- Advance tech, workforce, standards & safety
- Promote global cooperation, firms, finance, clusters & cities

'22.11 3 Key Strategies for the Clean H_2 Ecosystem

- Scale Up! (Scale·Scope)
  Large-scale demand creation for the growth of the power and transport ecosystem
- Build Up! (Infra·System)
  Establishing infrastructure and institutions for a clean H_2-based ecosystem
- Level Up! (Industry·Tech)
  Fostering new growth drivers for global leadership in the H_2 industry

'24.03 Implementation of the Clean H_2 Certification Scheme

Grades (kgCO2eq/kgH2)	Main Tech
Grade1 (0.00~0.10)	Domestic & Overseas Green H_2 (100% renewable-based production)
Grade 2 (0.11~1.00)	Nuclear H_2 (Domestic & Overseas), Green H_2 (Overseas)
Grade 3 (1.01~2.00)	Blue H_2 with 90%+ CCS and extra reductions
Grade 4 (2.01~4.00)	Blue H_2 with 90%+ CCS

'24.05 Introduction of CHPS

- Reducing GHG emissions through clean H_2 use in power sector
- World's first auction-based clean H_2 power bidding market

Participant: Clean H_2 dedicated & co-firing facilities
Volume: [2024] 6,500GWh

'24.11 7th Hydrogen Economy Committee

- Announcement of Hydrogen City 2.0 vision
- – Selection of 12 leading H_2 cities
- **Goal: Achieve global No.1 in the liquefied hydrogen carrier market by 2040**
- – Securing core techs for key materials and components
  – Demonstration and large-scale development of liquefied H_2 carriers
  – Fostering a world – leading H_2 industry through the specialized H_2 clusters

Ref. Three Growth Strategies for Building a Clean Hydrogen Ecosystem('22.11)

National Agenda — Build a Clean H_2 Supply Chain & Lead the Global Industry

Policy Direction — 3 key strategies for H_2 economy growth

3UP

	As-is		To-be	
① **Scale UP!** (Scpoe·Scale) — Create large demand for H_2 growth	Transport	H_2 vehicles centered on passenger cars	2021년 **19,270 units**	Expand hydrogen buses and trucks	2030: **30,000 units**
	Power Generation	Small scale fuel cells	2021년 **767.1MW**	Large-Scale centralized PG (H_2 turbines, ammonia co-firing, etc)	2030년 **Clean PG 7.1%**
	Production	Domestic grey H_2 production		Build large-scale clean H_2 production bases (local & global)	
② **Build UP!** (Infra·Structure) — Build clean H_2 infrastructure & rules	Distribution	Delivery and charging mainly by compressed gas	141 compressed gas stations, 2021	Mass storage & transport with liquid H_2 (Liquefaction plants, LH_2 stations)	2030, LH_2 stations
	Supply	Use of LNG supply network		Ammonia and liquid H_2 import terminals, hydrogen pipelines	
	System	Hydrogen Act enacted	2020, Feb	2023,Clean H_2 power bidding market & enactment of H_2 Act 2024, Clean H_2 certification Implementation & full-scale bidding market	
③ **Level UP!** (Industry·Tech) — Grow new engines to lead the industry	Tech	Fuel cell and H_2 vehicle R&D	2021: 75% of global leader level)	Secure core H_2 technologies (7 strategic areas)	2030, **100%** (on par with global leaders)
	Ecosystem	H_2 -specialized companies	2021: **30 Firms**	Foster H_2 -specialized companies	2030, **600 companies**
	Export	Domestic track record secured	2021: 2 items ranked 1st Globally	Strengthen H_2 export	2030: **10items** (ranked no.1 global market)

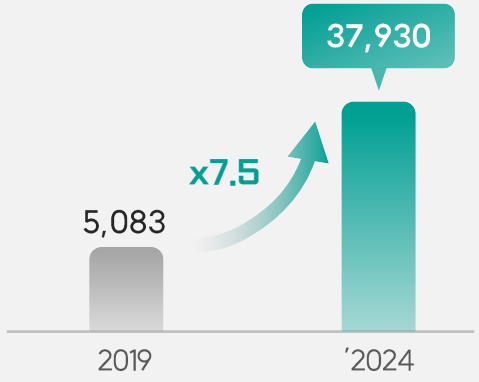
Global H_2 deployment (2024)


Country	H_2 Vehicles (Commercial)	Forklifts	Trains	Fuel Cells (MW)	H_2 Refueling Stations (small)	Electrolyzers (MW)
North America	18,150 (150)	**70,000**	2	735	89	**3,700**
Japan	8,282 (149)	417	–	513	162	–
Europe	4,439 (418)	526	**41**	21	214	190
China	Approx. 25,000		2	Approx 1,700 (Exact statistics unavailable)	**Approx. 540 (203)** * 134 in progress(2024)	722
South Korea	**37,930 (2,441)**	5	–	**1,185**	408(257)	3

SOURCE : IPHE, DOE (2024. Dec), KOR. (2024.Dec.), China (2024, Jun.)

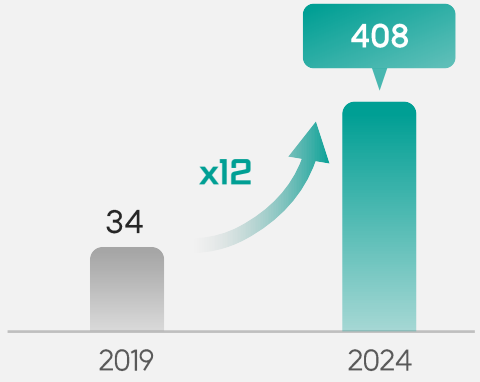
H_2 Utilization – Growth Trends

H_2 Vehicles



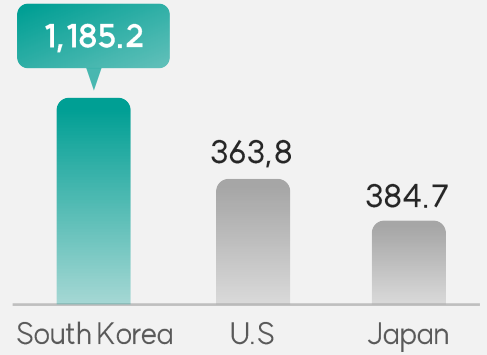
※ 2030 Target: 300,000 H_2 vehicles
(6th H_2 Economy Committe)

HRS



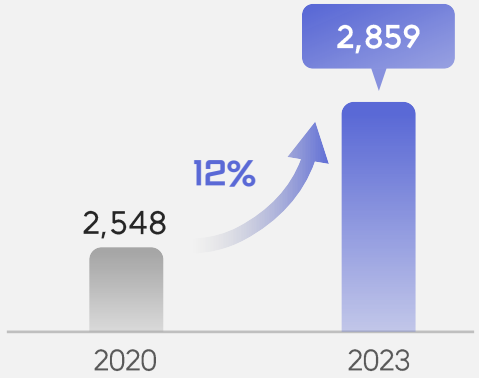
※ 2030 Target: 660+ H_2 stations
(6th H_2 Economy Committe)

Fuel Cell Capacity (MW)

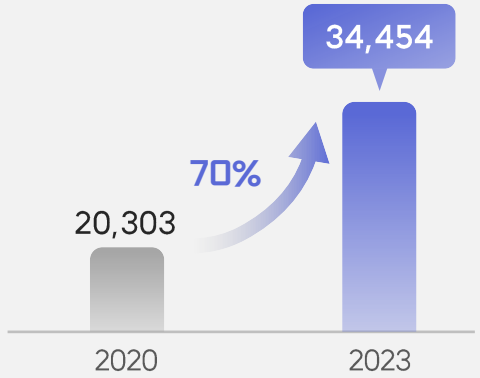


H_2 Ecosystem – Growth Trends

Companies

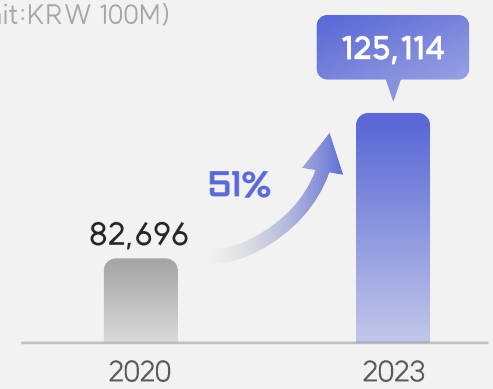


Employees



Sales

(Unit:KRW 100M)



CHPS (Clean H_2 Power Bidding Market), 2024~

World's First Clean H_2 Power Bidding Market

- **Annual Auction**(additional rounds if needed)
  - **Volume** 6,500 GWh(2024), 3,000 GWh(2025)
  - **Terms** 3-yr prep (+1) + 15-yr trading
  - **Eligibility** Clean H_2 facilities (dedicated & co-firing)

2024 CHPS Auction Results

- **Bid Volume :** 6,172 GWh (95% of 6,500 GWh offered)
  Participants : 6 power plants from 5 companies
- 750 GWh (11% of 6,500 GWh) awarded to preferred bidders
  Only 1 bidder, price below cap (fuel price key)
- ☑ Price cap est.: 460-490 KRW/kWh

2024 CHPS – Key Insights

1. Reference price identified
   – Ammonia ~**₩6,000/kg,**
   Blue H_2 ~₩8,000/kg
2. Green H_2 less competitive
   – High cap price favors Blue H_2
   (Fuel cost >70%, ~85% reliant on imports)
3. Need FX support
   -15-y contracts;
   most supply imported
4. Prep Period
   -2024: 3+1 yrs / 2025: 3 yrs

Ref. Global H_2 Certification Standards

Korea's Clean H_2 Certification — Aligned with Global Standards

* IEA, IPHE recommend adoption of national certification aligned with global norms

Category	South Korea	U.S	EU	U.K	Japan
Threshold ($kgCO_2e/kgH_2$)	4	4	3.4	2.4	3.4
Tier	4	4	-	-	-
Scope	Well-to-Gate	Well-to-Gate	Well-to-Wheel	Well-to-Gate	Well-to-Gate

Pre-certification Consulting for H_2 Certification

Pilot Audits & Digital Platform for H_2 Certification

15 Production Sites + 3 Shipping Centers

Total of 18 sites supplying 25.4K tons of transport-use H_2 annually

Category		Location	생산능력	비고
Small-scale (reforming)	2019	Changwon	1ton/day	Completed
		Samcheok	1.3ton/day	Completed
		Pyeongtaek	7.1ton/day	Completed
	2020	Daejeon	1.3ton/day	Completed
		Busan	1.3ton/day	Completed
		Incheon	1.3ton/day	Completed
		Jeonbuk	1.3ton/day	Completed
Mid-Large (reforming)	2020	Changwon	10.8ton/day	Completed
		Gwangju	4.3ton/day	In progress
	2021	Pyeongtaek	16.2ton/day	In progress
Distribution Center (byproduct)	2021	Yeosu	7.8ton/day	Completed
	2022	Ulsan	15ton/day	Completed
		Seosan	15ton/day	Completed
Electrolysis	2022	Pyeongchang	1ton/day	In progress
		Boryeong	1ton/day	In progress
	2023	Donghae	1ton/day	In progress
		Cheongju	1ton/day	In progress
CCS	2023	Jeongju	3ton/day	In progress

* 25.4 kt/yr = 90.7 t/day × 0.85 × 330 days

Large-Scale H_2 Production Complexes & Demand Creation

Build large-scale complexes (Green, Pink, etc.)

Green

Prod.–Storage–Import Demo

Loc.	Renewable-rich areas
Period	2028 ~ 2034
Key	Build & operate domestic/overseas GH2 complexes, demo import

Pink

Large Complex & Supply Cluster

Loc.	Near nuclear plants
Period	2027 ~ 2039
Key	Staged construction of pink H2 production complex & electrolysis supply chain

Develop Korean H_2 reduction steel tech

Korean H_2 Reduction Steel Demo

Period	'26~'30(5y)
Expected outcomes	Secure core technology for H_2 reduction steel Enable technology exports & create new markets

Germany
ThyssenKrupp €2.8B support

The. U.S
Up to $1B support for HBI

Japan
¥449.9B support incl. R&D

Expansion of Clean H_2 Production & Liquefied H_2 Ecosystem

Pilot & Demonstration Project

Stepwise demonstration from electrolysis to nuclear H_2 production (since 2017)

Securing Technological Leadership

Hydrogen economy roadmap ('19–'24)

17 R&D projects in electrolysis

₩15.2B investment

category	Electrolyzer capacity	Type of electrolyzer	'22	'23	'24	'25
Jeju Sangmyung	250kW	Alkaline	Commissior	Commercialization		
Jeju Haengwon	3.3MW	Alkaline PEM	Completion	Commissioning	Commercialization	
Jeju Bukchon	10.9MWD	Alkaline, PEM, SOEC, AEM	Site preparation& System design			
Ulsan, Ulju	10MW	Alkaline	Site preparation	Permitting		

EXPAND

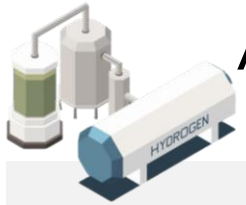
High-tech industry-level incentives

Up to 50% tax credits for core clean H_2 tech (electrolysis, CCS, etc.) from 2023

Facility Investment	Max 25%
R&D	Max 50%

Promoting Clean H_2 Investment & Tech Development

Activating the Liquefied H_2 Ecosystem



Able to fuel about 5,000 H_2 buses

World's Largest Incheon LH_2 Plant to be completed (May 2024)

Localization of core LH_2 components, support for R&D and commercialization

Technology development and demonstration for LH_2 carriers

Expansion of LH_2 plants and establishment of safety standards (by 2026)

Securing Advanced-Level H_2 Technology by 2030

Focused R&D in 10 Strategic Areas

Commercialize 10MW H_2 electrolysis systems, achieve 100% localization of HRS parts, and 65% efficiency in fuel cells (HDVs)

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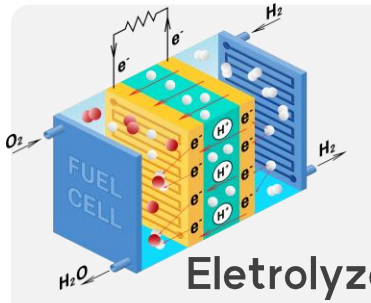


Eletrolyzer

2


HRS

3


H_2 Transport Vehicles

4

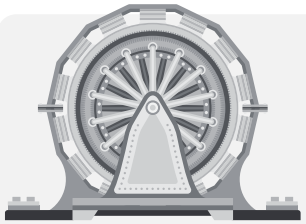
LH_2 Carriers

5


Mobility Fuel Cells

6

Power Generation Fuel Cells

7

H_2 Turbine

8

NH_3 synthesis & cracking

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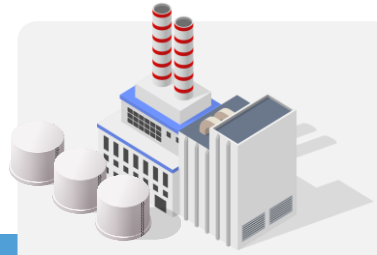
H_2 Storage & Pipelines

10


H_2 Engines

40 key H_2 items designated as strategic technologies

Strengthened support for SME R&D & partnerships

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Thank you