Hydrogen Readiness:

How Close Are We and What's Our Path Forward?

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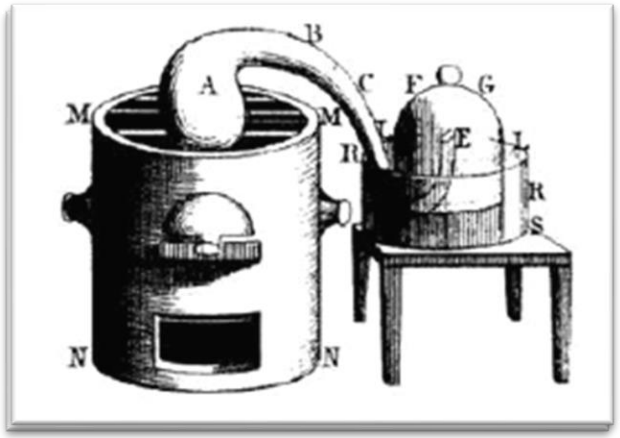
Why **hasn't the hydrogen society arrived yet?**

What **is needed for the hydrogen readiness?**

How **can we make it happen?**

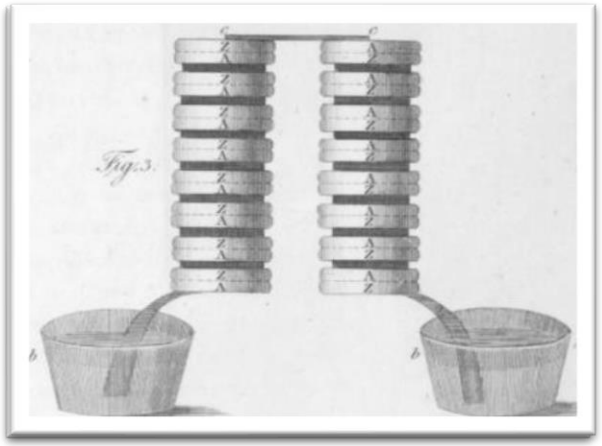
Nothing new

Most key technological principles on H_2 were already developed over 200 years ago



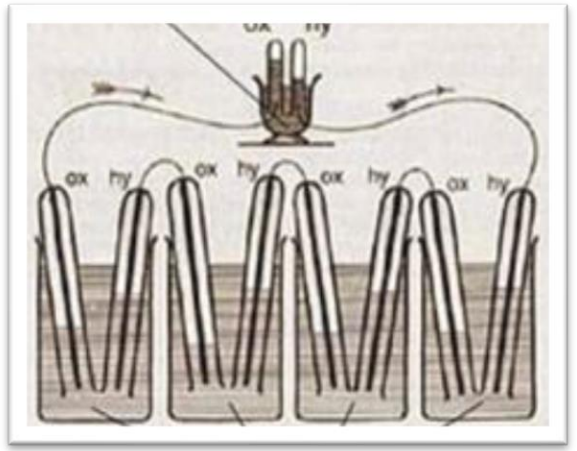
1783

First to name **"Hydrogen"** meaning "Water Creator" in Greek



1800

First discovery of the concept of **electrolysis**



1839

First construction of **fuel cell**

Until 2019 there was no single major report on energy industry which included H_2 in a long term energy mix

Still not yet

Once thought to be imminent, the hydrogen society has been increasingly delayed.

5 years ago…

Hydrogen is today enjoying *unprecedented momentum.*

Fatih Birol (IEA 2019)

And now…

Creating Demand Market Mechanisms: ***Make or break*** for the hydrogen industry.

CERA Week (Mar 2024)

Carbon intensity regulation to ***make or break*** global low-carbon hydrogen market.

Wood Mackenzie (Feb 2024)

Hydrogen: New Ambitions and Challenges. Is low-carbon hydrogen ***ready for lift-off***?

S&P Global (Feb 2024)

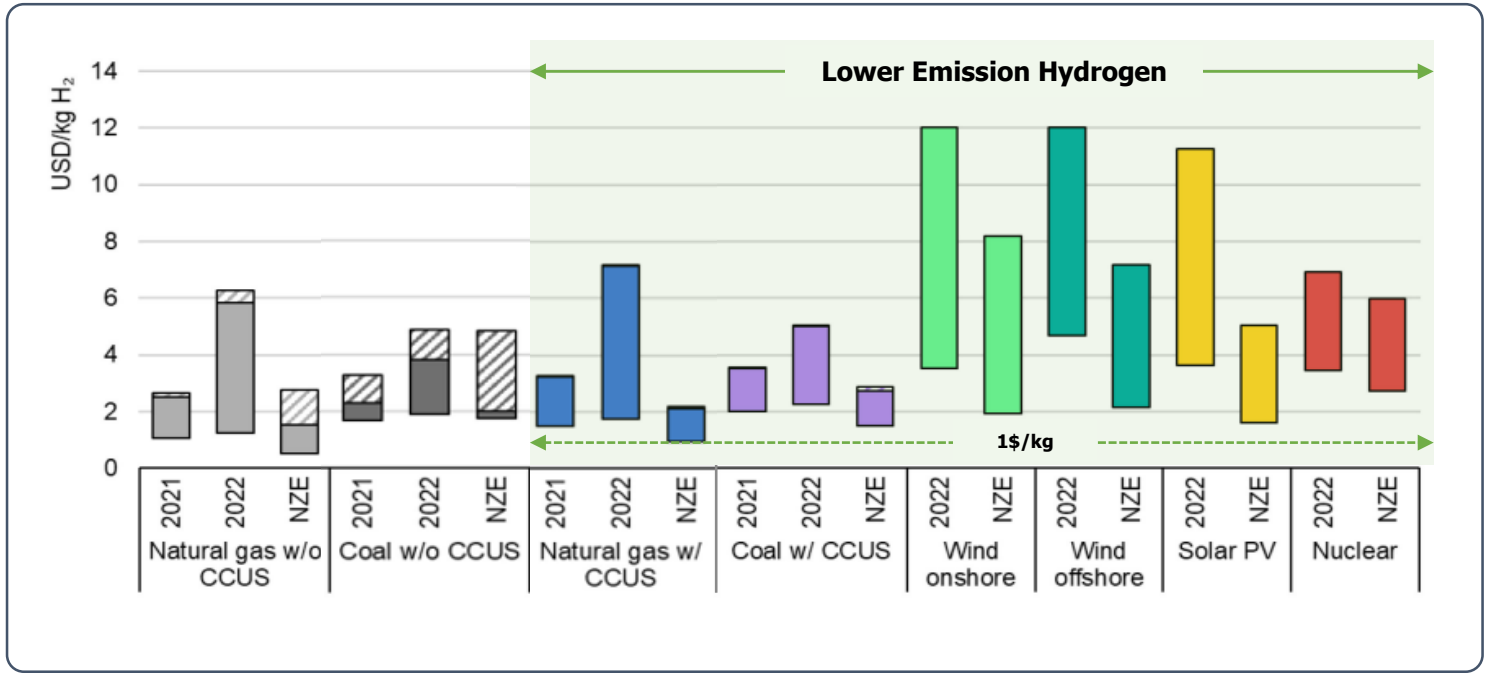
Reality or Price check

Even with best efforts, achieving a clean hydrogen price of $1/kg by 2030 appears challenging.

US DOE Hydrogen Roadmap launched in 2021

VS

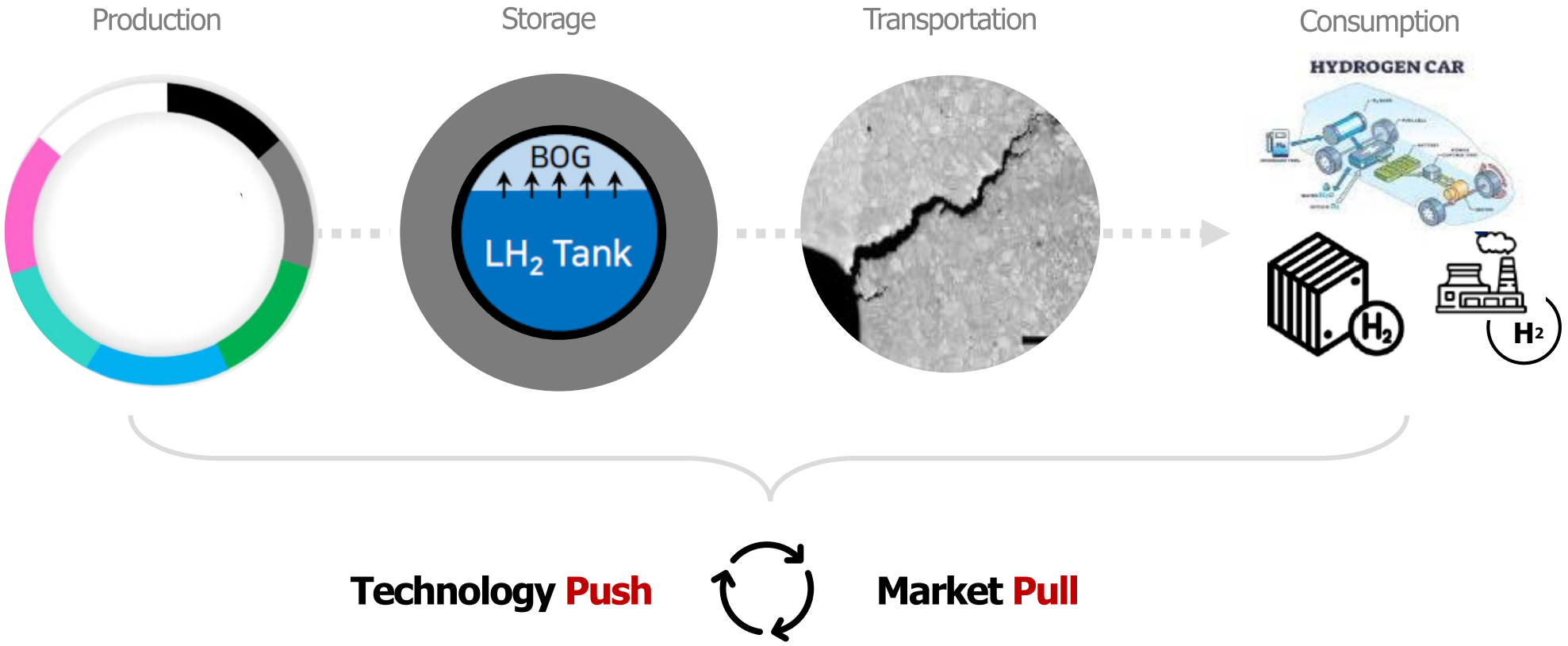
LCOH production by technology in 2021, 2022 and in the "Net Zero Emissions by 2050 Scenario" in 2030



IEA (2023) Global Hydrogen Review 2023

Significant technological progress

What remains is ultimately the establishment of a market at scale.



Supportive policies are not a cost but rather an investment that gives birth to technological innovation and larger markets.

China's EV Support Policies

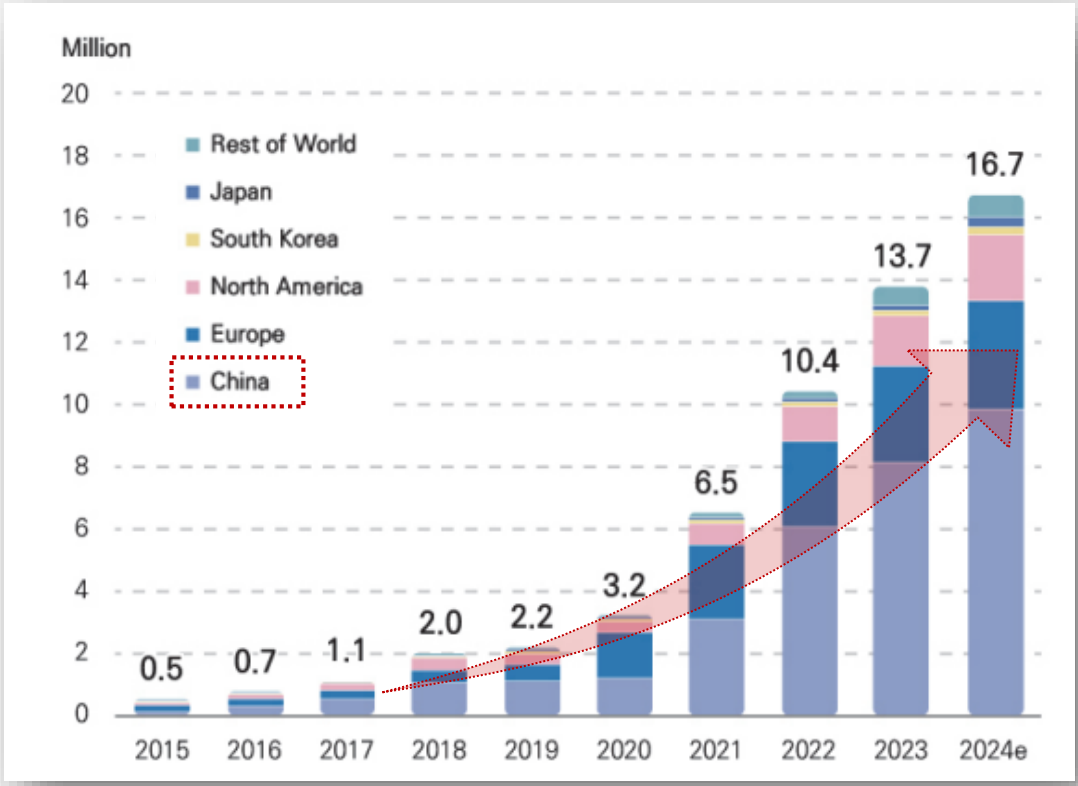
1991~2000
Included EV business in core national industries

2001 ~ 2010
Confirmation of EV technological development roadmap

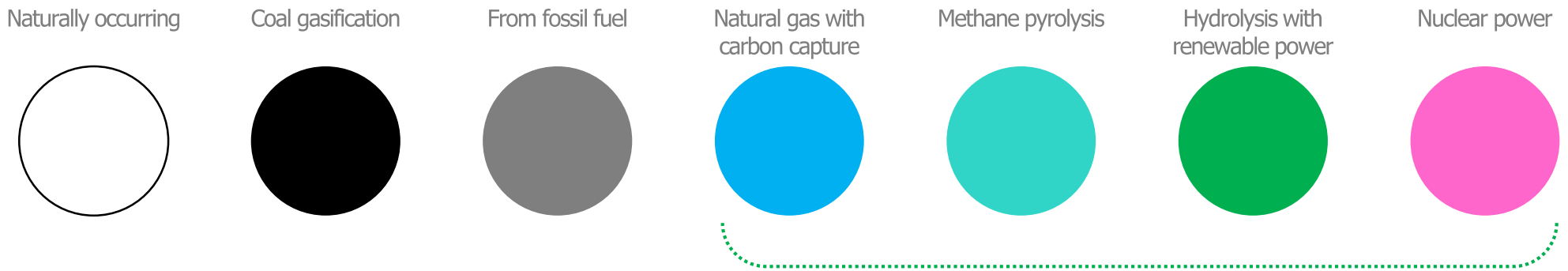
2010~2015
Included in the 7 strategic emerging industries & in the 10 key sectors in "Made in China 2025"

2017~Present
Beyond policy support to market self-reliance

Chinese EV Market Penetration



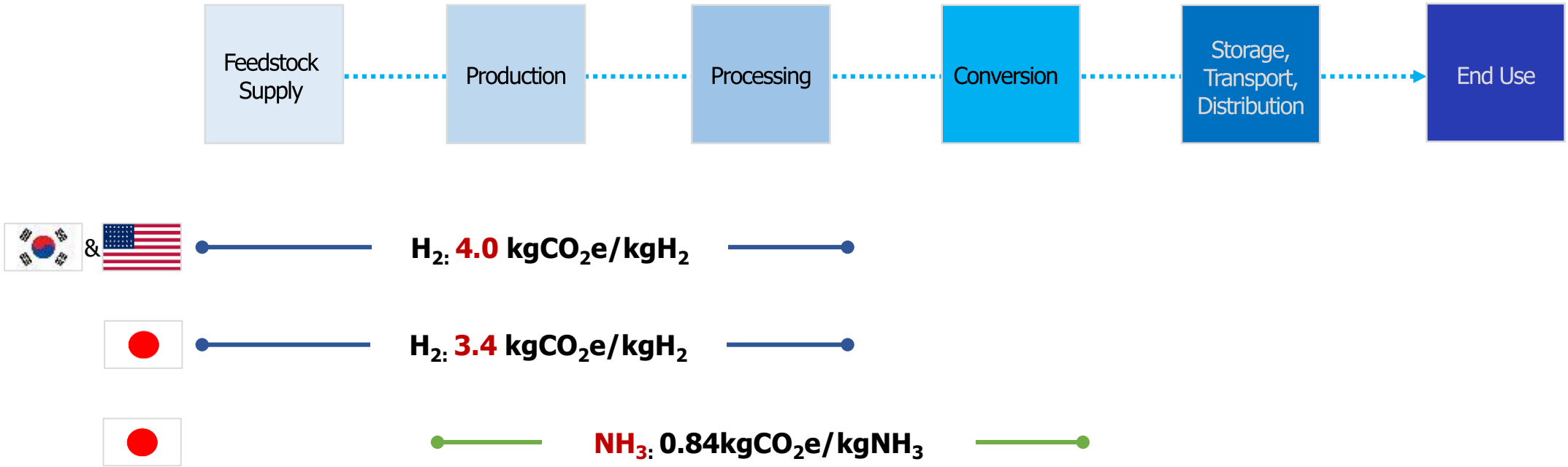
"*The beginning of wisdom is the definition of terms*." - Socrates



What will be placed
*in the **'clean'** hydrogen basket?*

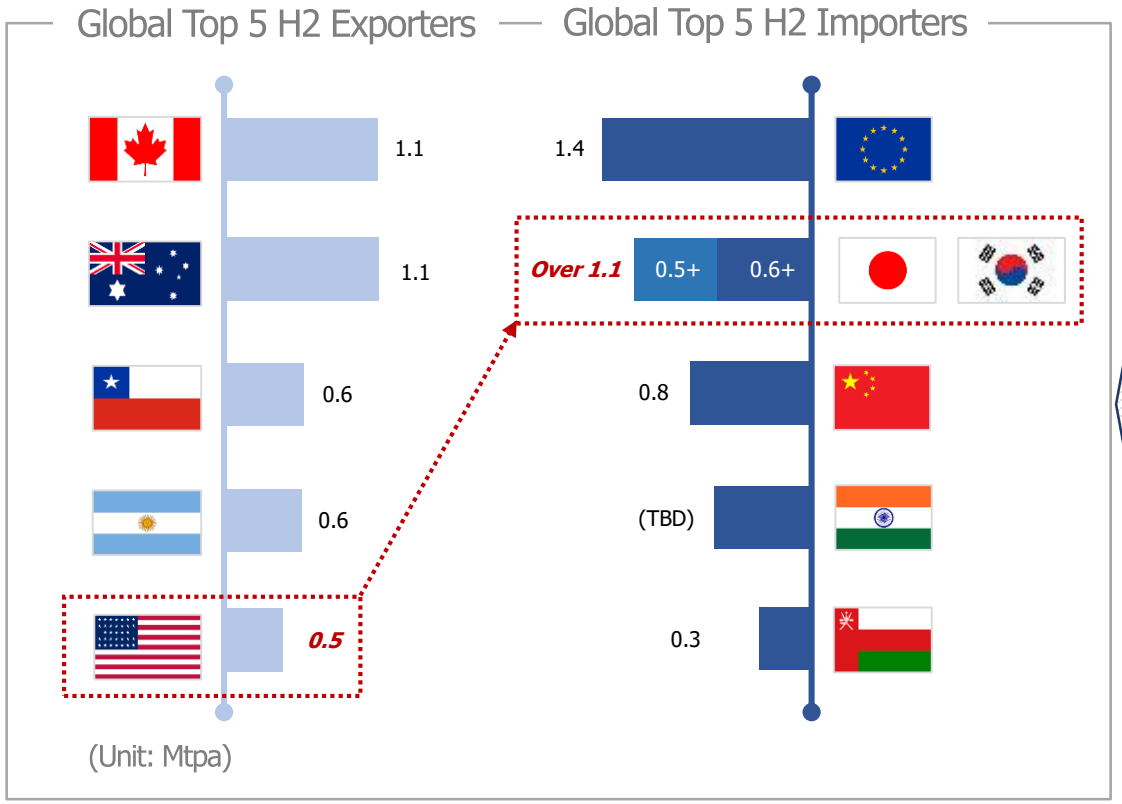
Market growth through standards harmonization

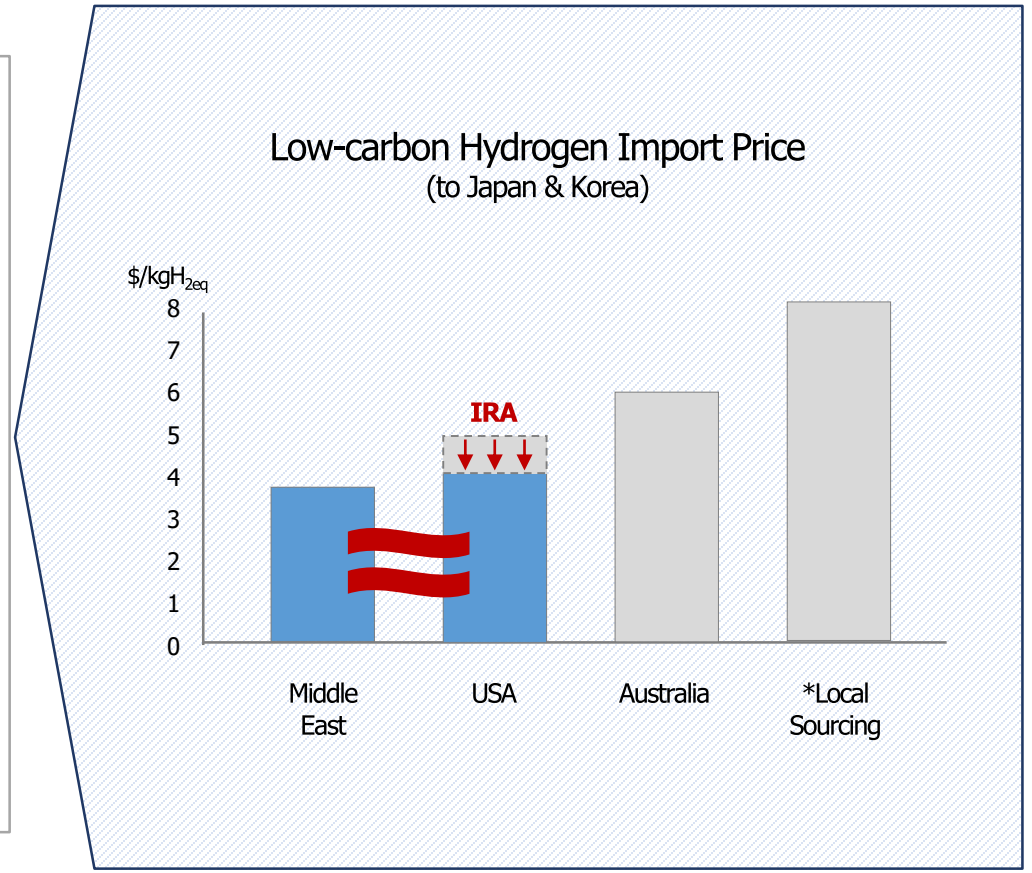
Unifying the divergent clean hydrogen standards, including stances on ammonia, would mark the beginning of cooperation and market scale-up.



Trilateral cooperation's clear synergies

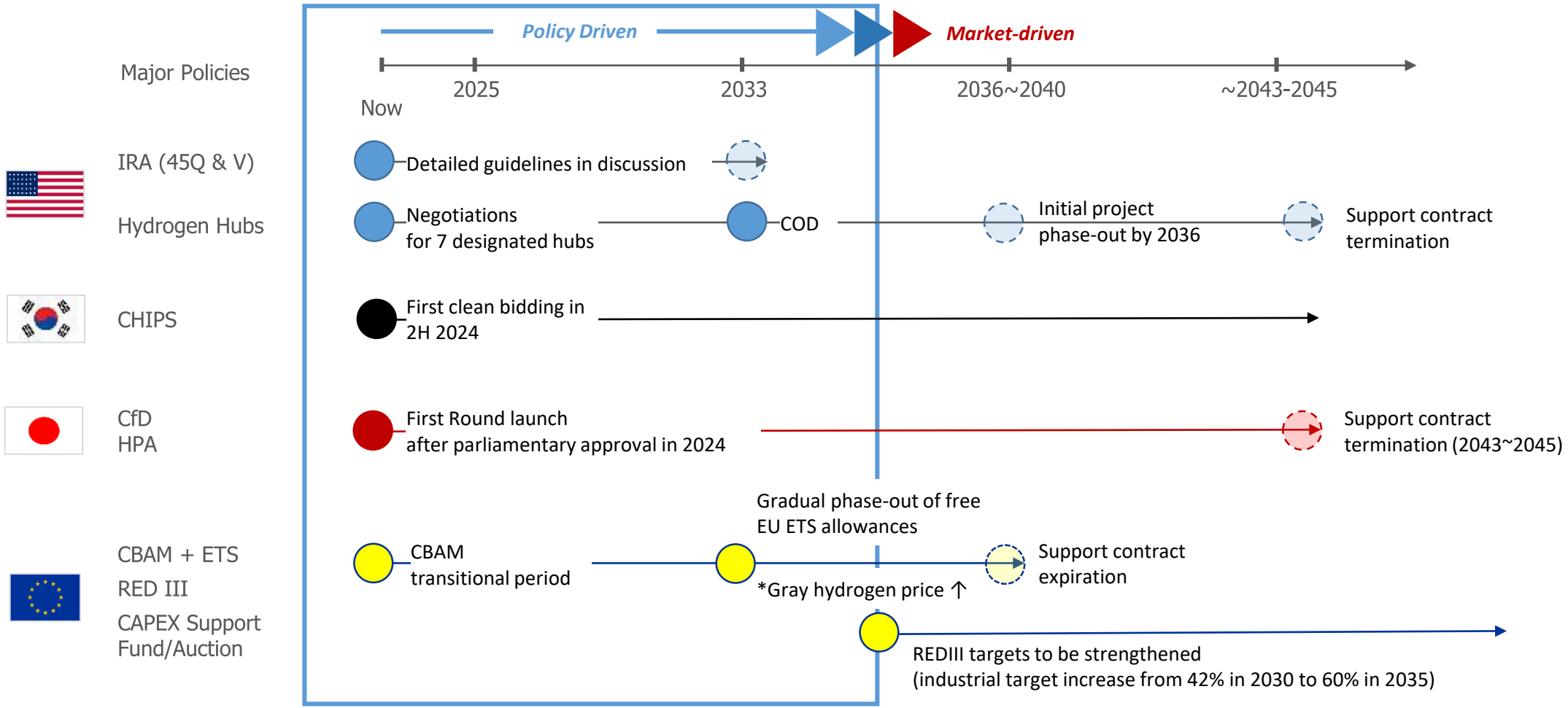
Korea and Japan would form the world's second-largest hydrogen market, while the U.S., supported by the IRA, can supply competitive clean hydrogen.





Trilateral Cooperation & Market Leadership

Coordination in policies & cooperation in the market could establish KOR-US-JPN as global hydrogen market leaders and rule setters



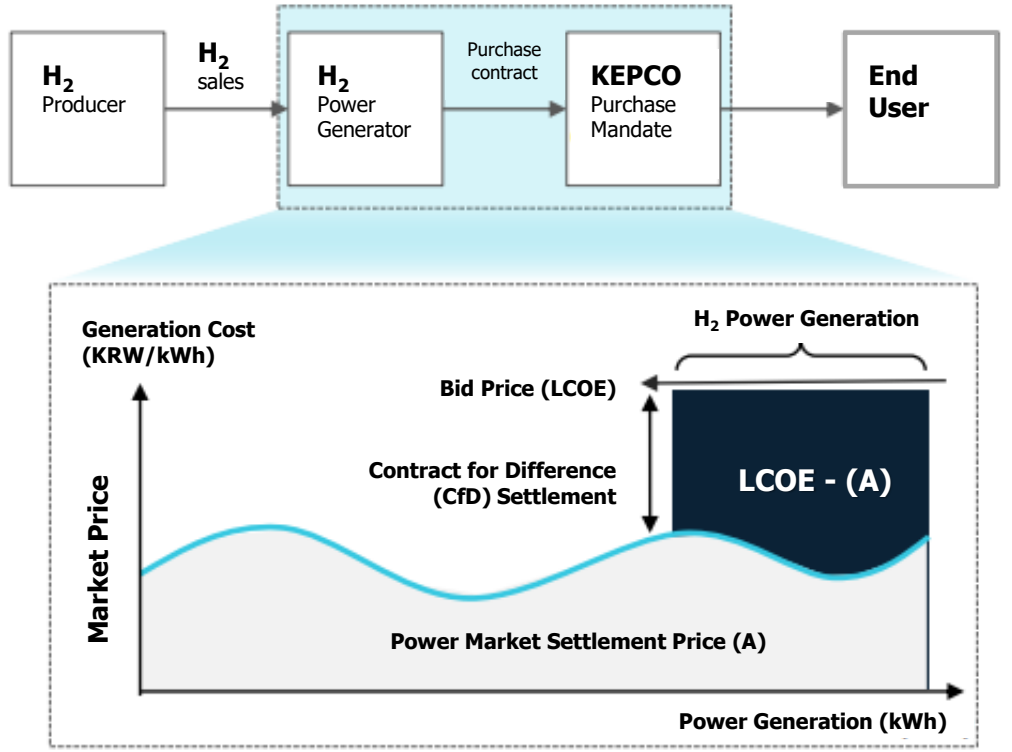
Clean Hydrogen Energy Portfolio Standards (Korea)

Korea has implemented a hydrogen portfolio standard, CHPS, that subsidizes the cost difference in hydrogen power generation.

Bidding Process Timeline

Dec 2022	Hydrogen Act Amendment implemented
May 2023	Legal framework established, including annual purchase volume notification
May 2024	Bidding market opened (target 65,000 GWh, 350–400KT of hydrogen, 20% + co-firing rate)
Dec 2024	Bid winners selection
By 2028	***Commercial operation must begin***

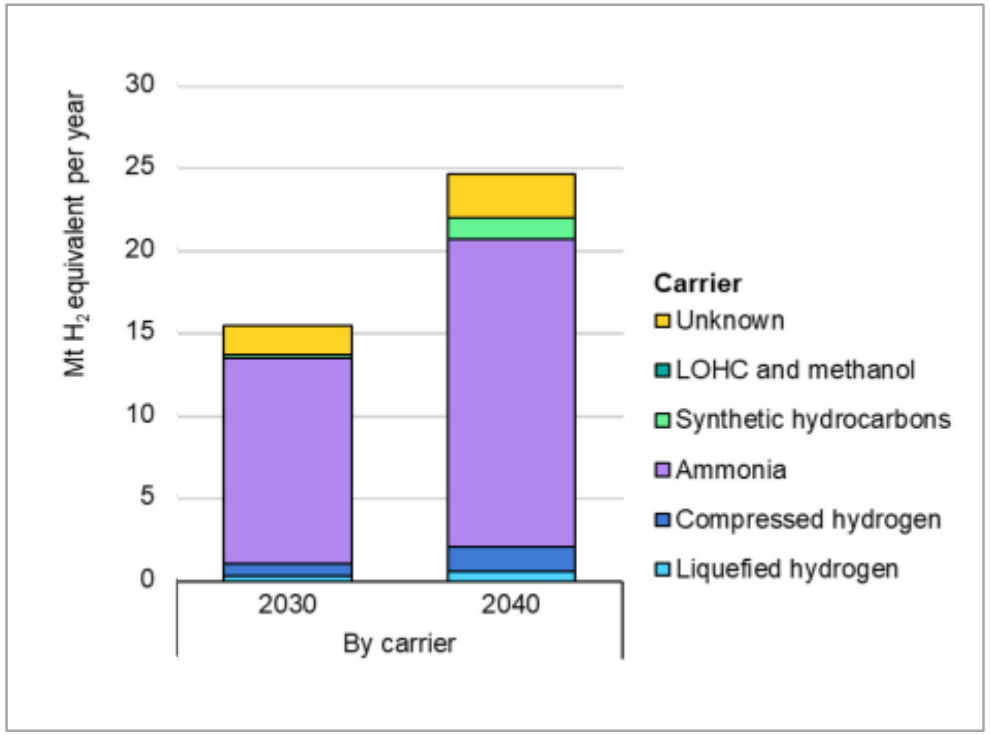
Cost Compensation Structure



Hydrogen & Ammonia

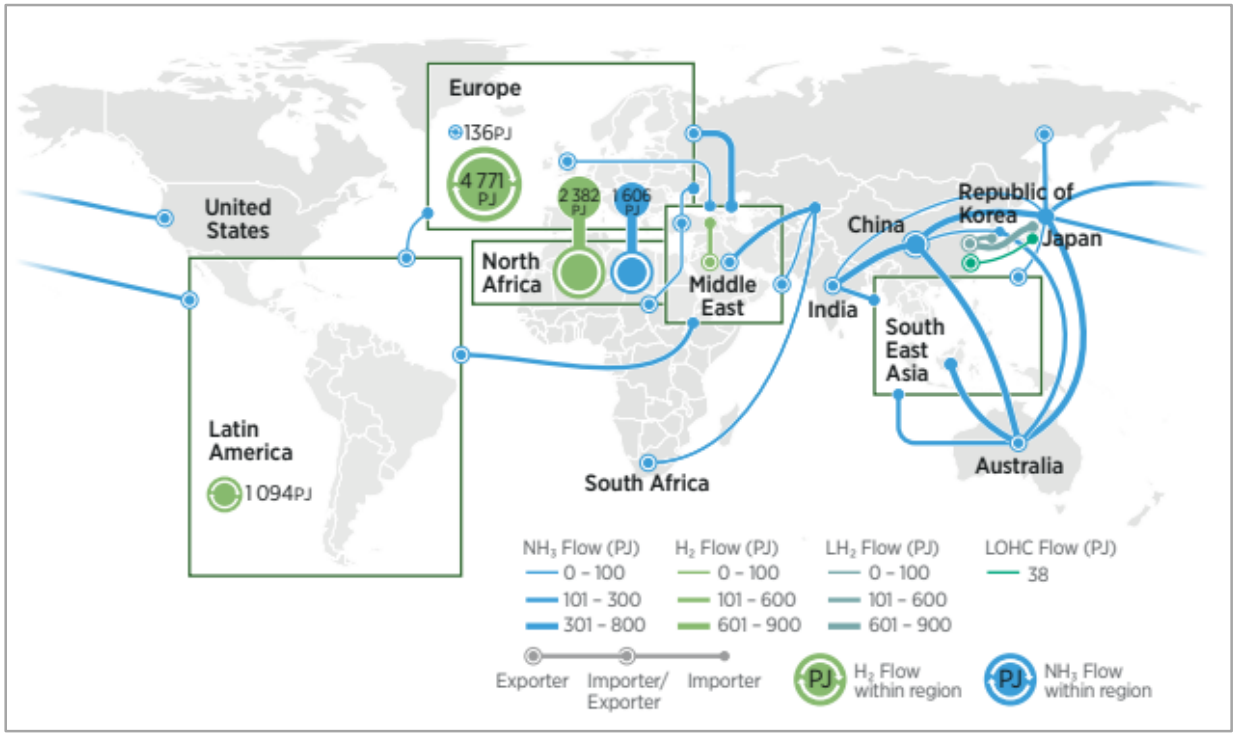
As of today, ammonia remains the most viable and cost-effective solution for hydrogen transportation across the globe.

Low-emission Hydrogen Trade by Carrier



IEA (2023) Global Hydrogen Review 2023

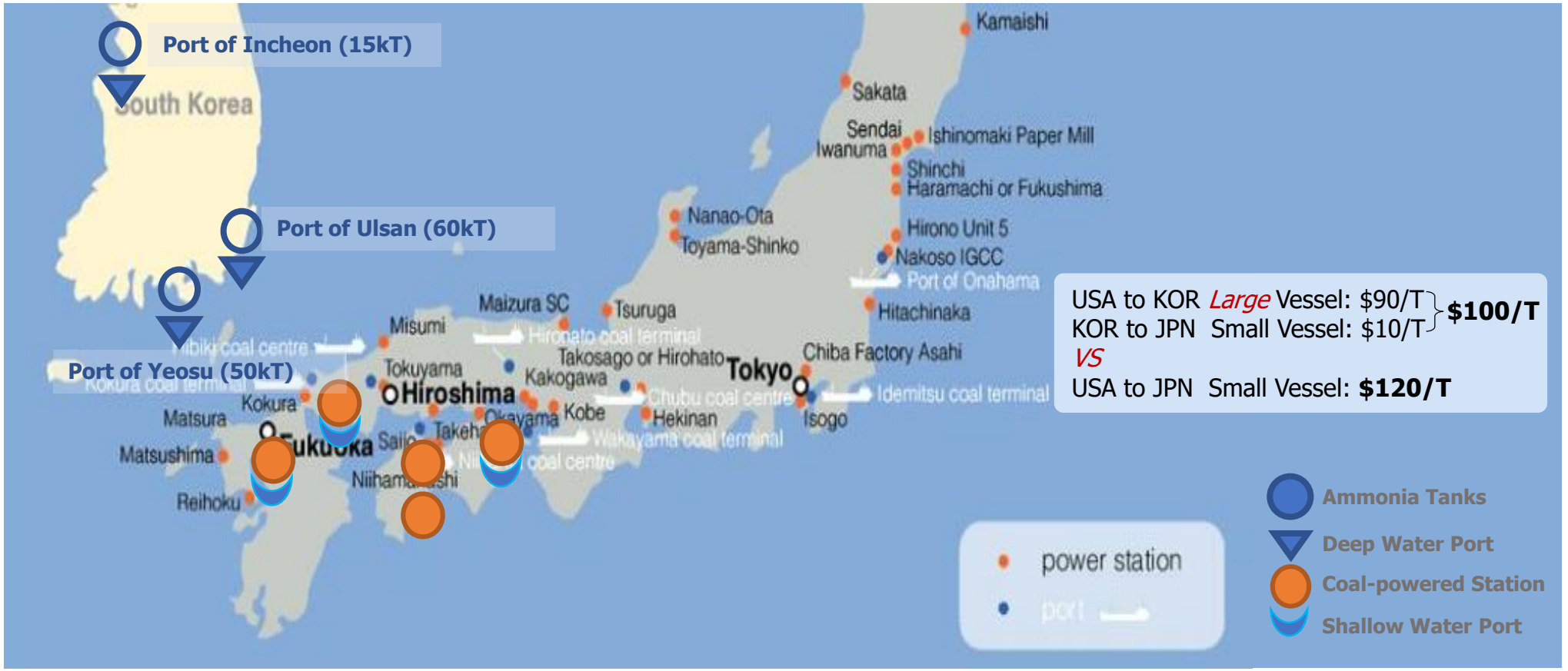
Global Hydrogen & Ammonia Trade Map



IRENA (2022) Global Hydrogen Trade to Meet the 1.5C Climate Goal

Joint procurement example (ammonia)

By utilizing existing infrastructure for large-scale imports and sharing, economic efficiency and supply stability can be simultaneously pursued.



Building long-term cooperation

Collaborative technology development and global market standardization will drive down costs, boost demand, and accelerate hydrogen market growth.

Tech. Innovation	Rule Setting
Joint development of **PEMEC** and **SOEC** technologies	Leading **global standards** and **certification process** for clean hydrogen
Scaling up **liquefied hydrogen production equipment**	**Establishing "Global Hydrogen Exchange"** jointly among the three countries
Joint development of **pink hydrogen** technology	Inclusion and global recognition of **blue hydrogen** as "**Carbon Free"** energy source
Liquefied hydrogen storage tank technology with BOG reduction	Mandatory use of hydrogen, similar to fuel blending standards for SAF or biodiesel

Intangible yet invaluable infrastructure

Hamm Institute for American Energy

TRILATERAL ENERGY SECURITY COMMITTEE (TESC)

ありがとうございます

Thank you

감사합니다