BUMN UNTUK INDONESIA

PERTAMINA
NEW & RENEWABLE ENERGY

PRESENTED AT:

pipes 2025
PERTAGAS
INTEGRATED
PIPELINE AND
ENERGY SUMMIT

From Molecule to Market : How Indonesia’s Gas Pipelines Can Enable the Next Wave of Clean Energy Trade

Muhammad Taufik

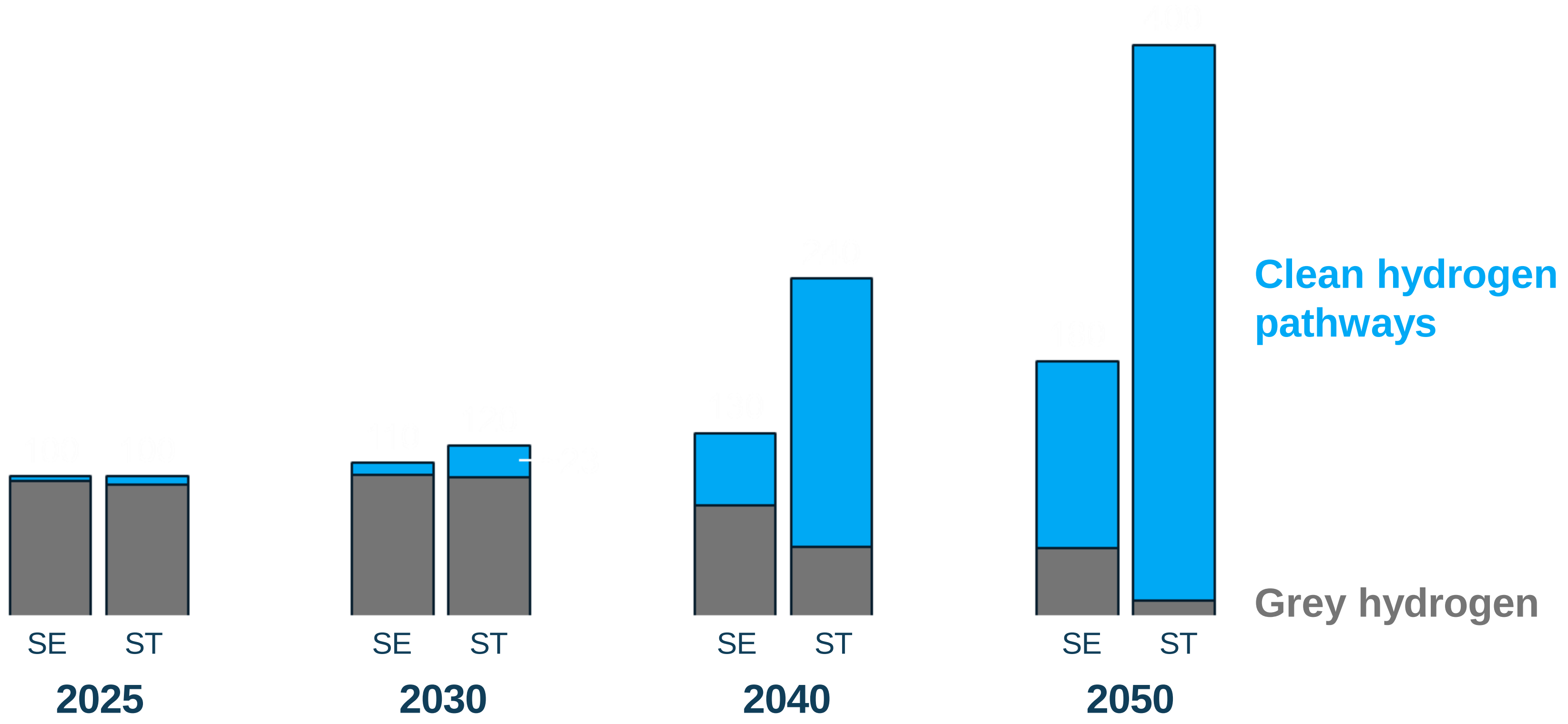
Future Business Manager

Pertamina New & Renewable Energy

17 Juni 2025

H2 demand projected to reach up to ~400 Mt p.a.[1] by 2050, of which nearly 97%[2] could be from clean pathways

Global hydrogen demand outlook by clean pathways vs grey, Slow Evolution (SE) vs Sustainable Transformation (ST), Mt p.a.



2-4x

Potential increase in hydrogen demand from 2025 to 2050

up to 23 Mtp.a.

2030 global clean hydrogen demand in a 1.8° scenario

50-90%

reduction in grey hydrogen use in current sectors by 2050

---

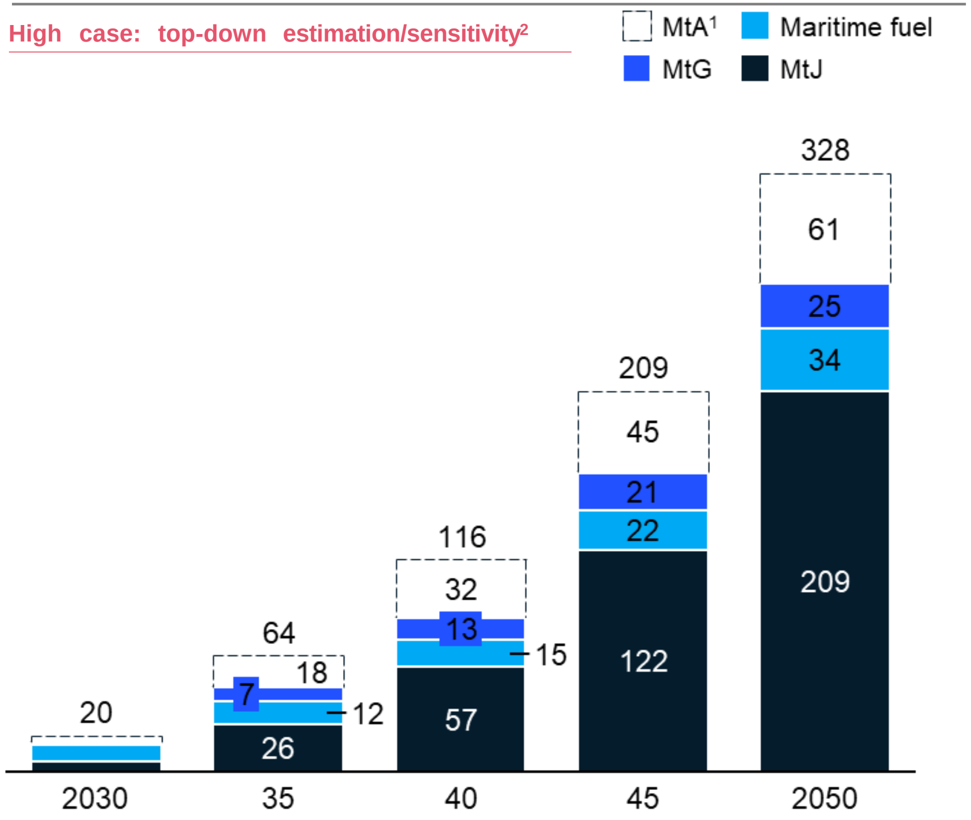
1. Projection for total hydrogen demand under the GEP 2024 Sustainable Transformation vs Slow Evolution scenarios
2. 130-390 Mt p.a. of potential clean demand depending on underlying warming scenario

Source: McKinsey Energy Solutions Global Energy Perspective 2024

New uses: Maritime is creating significant green H2 demand, with high upside expected in aviation & chemicals as a route to plastics

High case for new hydrogen derivatives (e-methanol) use demand (2020-50), mtpa

High case: top-down estimation/sensitivity[2]



Rationale

Maritime

- Several initiatives (e.g., RFNBO) are stimulating uptake of methanol
- Increasing orders of methanol vessels by industry leaders
- Alternatives (e.g., Ammonia) currently unavailable

Aviation (MtJ)

- Increasing mandates for synthetic SAF use (e.g. EU RED III)
- Limited supply of alternative biological SAF (e.g HEFA)
- Economics vs FT route TBD, but MtJ has flexibility advantages

Gasoline road transport (MtG)

- Niche market potential for vintage vehicles & possible requirements to meet targets if EV supply limitations prevent full electrification

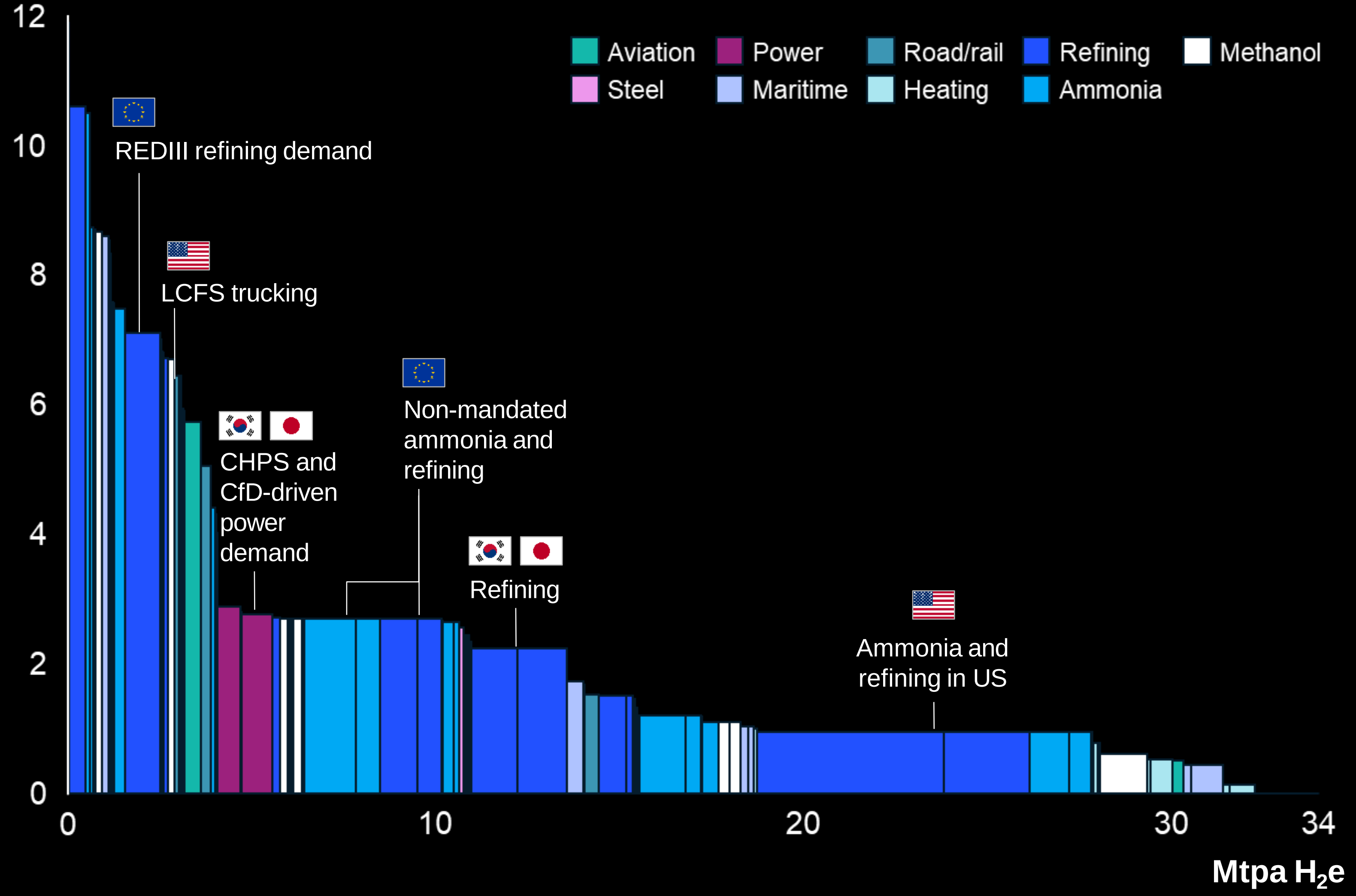
Chemicals (MtA)

- Worldwide regulation on the production of virgin MtA utilizing green energy and feedstock
- Sharp cost down trajectory for virgin MtA production from methanol

1. MtA values to be considered an upper bound. MtA route seen as highly likely to meet new aromatics needs - however green share and competitiveness vs Bio-Naphtha TBC, so left as upside with highest values representing 5/50% share of new capacity at 2030/50, 20/50% green methanol vs grey.
2. Based on adjusted Achieved Commitments scenario: assuming 25% other advanced kerosene and 50% PtL kerosene to be MtJ; 10% advanced gasoline to be MtG;

Demand curve: Policy impact could drive up value-in-use for clean H2 from ~1-2 USD/kg to over 10 USD/kg for some segments

EU, US, East Asia hydrogen demand and value-in-use split by end-use segment, 2030, USD/kg H_2e[1]



PRESENTED AT:

PERTAGAS INTEGRATED PIPELINE AND ENERGY SUMMIT

~1-12 $/kg

Potential end user value in use driven by demand-side policies by 2030, depending on sector and geography (highest driven by REDIII)

~50%

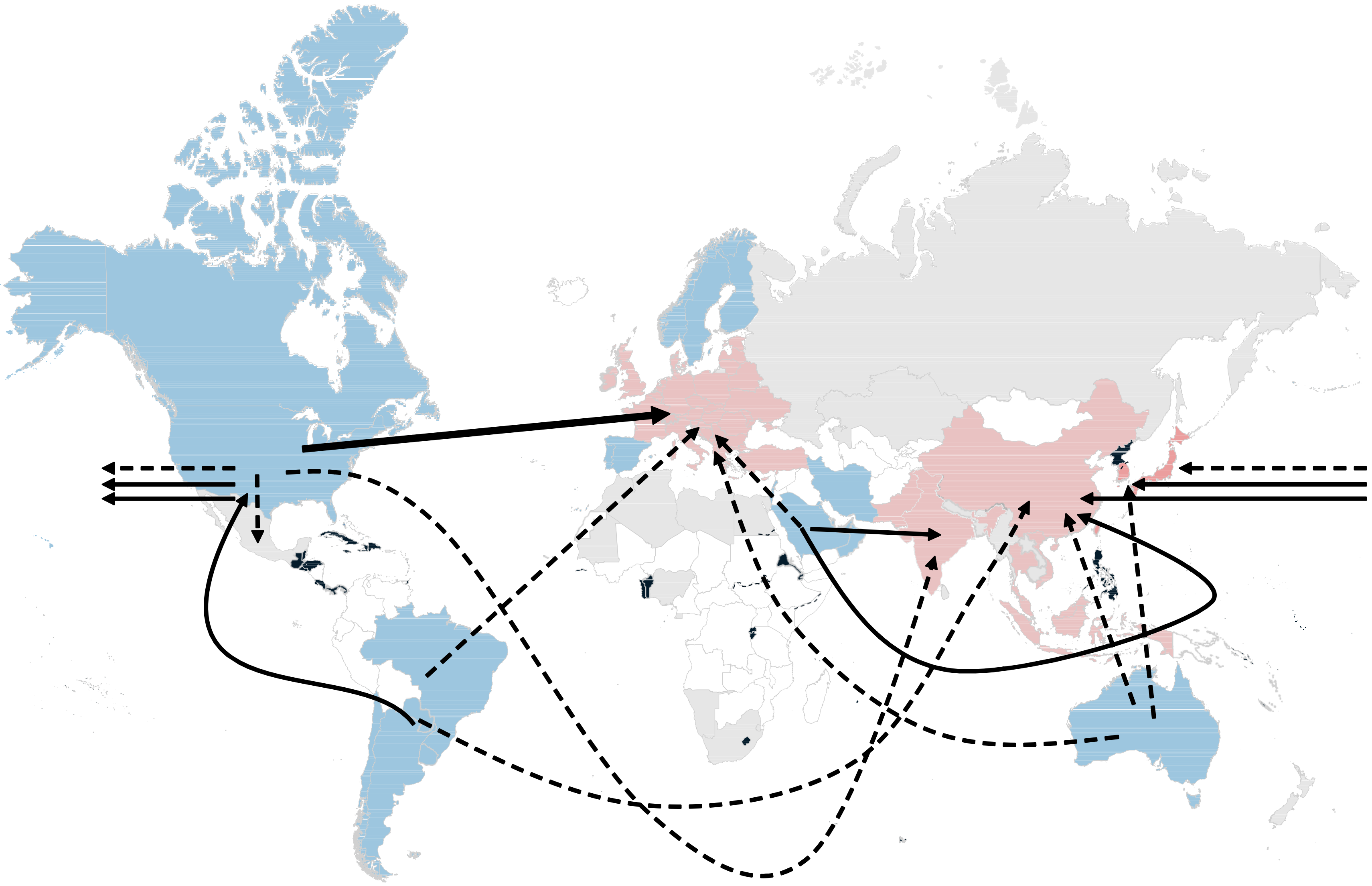
Portion of 2030 demand in the US where value in use largely between 1-1.5 $/kg given lack of demand-side policies outside of LCFS

---

1. Includes hydrogen demand from all pathways; analysis tied to 2024 McKinsey Global Energy Perspective scenarios; Sustainable Transformation scenario assumes adoption of MEPC 80 guidance for maritime sector;

By 2030, early trade routes for the clean H2 will have been established

Major trade flows of hydrogen and derivatives in 2030, Mtpa H_2 equivalent – Sustainable Transformation



🟥 Region consumes more than it produces

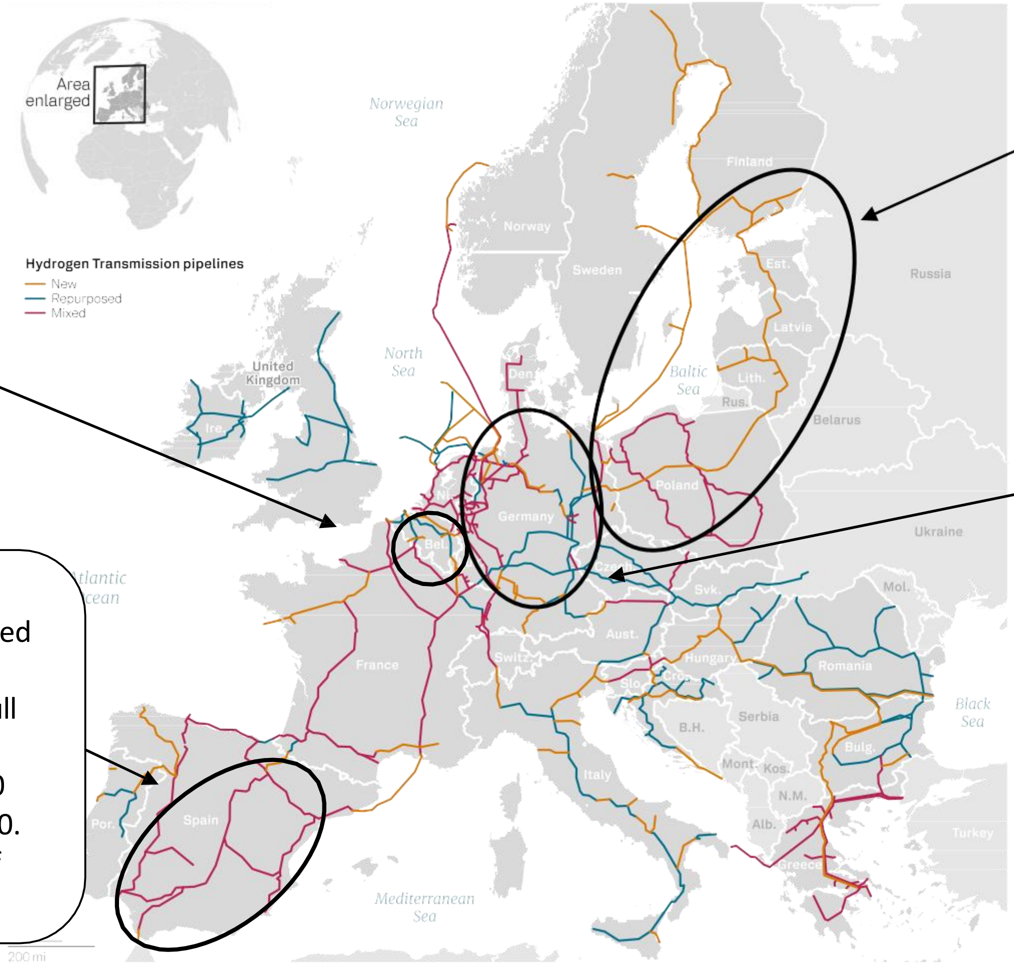
⬜ Neutral

🟦 Region produces more than it consumes

Net trade flows, Mtpa H_2

- >10
- 5-10
- 2-5
- 1-2
- 0.3-1

Infrastructure : European backbone initiative already moving forward on building the initial stages of H2 Infrastructure



Belgium

- Fluxys breaks ground on first section of Belgium network in ports of Antwerp and Ghent

H2Med

- Call for interest results announced in Feb 2025
- Strong interest in supply, with full capacity reached in 2032
- Demand lags, with only 900,000 mt/yr demand in France by 2050. German offtakers to take half of capacity by 2035

Nordic-Baltic corridor

- Pre-feasibility study completed in September 2024

Germany

- Government makes first payment of €172 million to hydrogen TSOs
- Nowega commissions 55km pipeline in Lower Saxony
- Gascade commences initial filling of first section of Flow pipeline

Outside Europe:

- **Oman** planning 300-400 km pipeline, FID expected 2027

Data compiled May, 2025.

IPCEI = Important Projects of Common European Interest; PCI = Projects of Common Interest; PMI = Project of Mutual Interest.

Source: S&P Global Commodity Insights. H2Infra.eu

Infrastructure: The optimal H2 transportation mode depends on distance, terrain and end-use

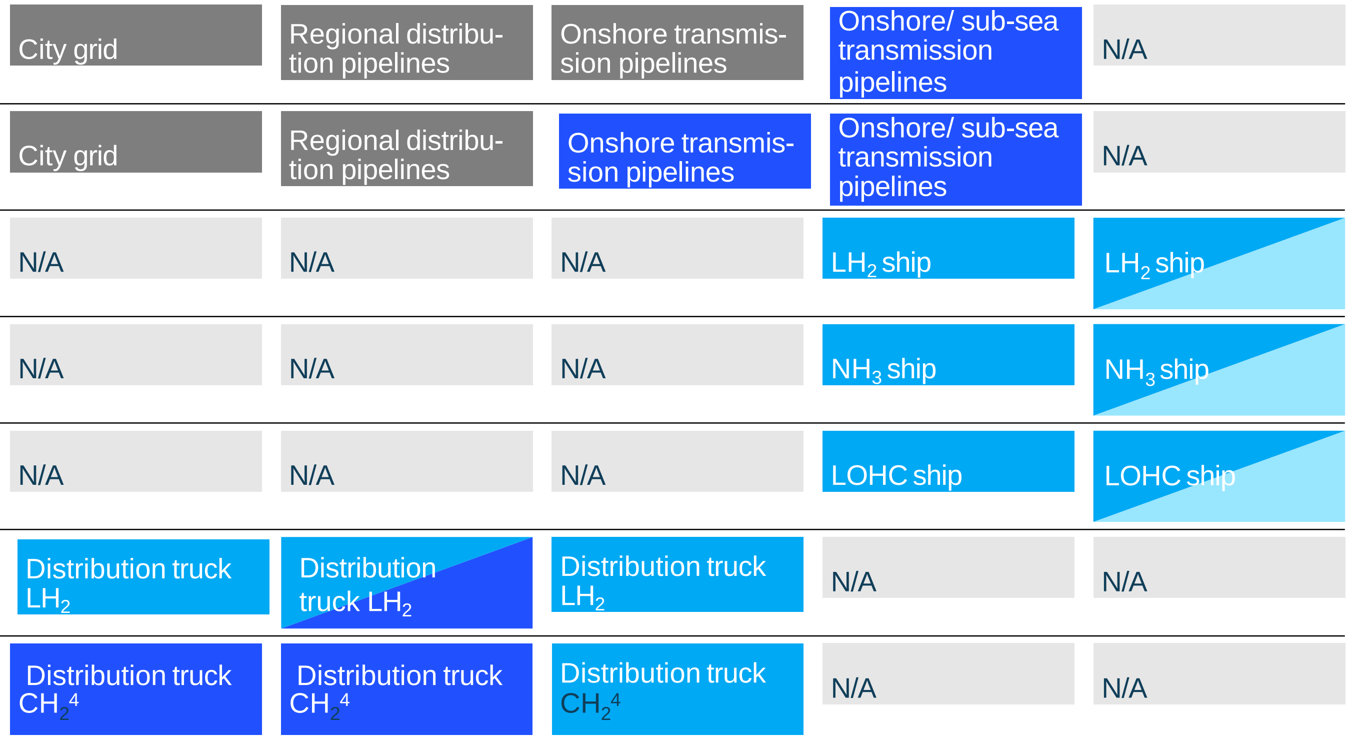
H2 can be **transported** through **pipelines, shipping or trucking,** and with **different carriers**[1]

Currently **LH2, Liquid Organic Hydrogen Carriers** (LOHC) and **ammonia** have the **most traction**

While **optimal transport choice** depends on **end-use, terrain** and **requirements** (e.g., purity), there are rules on **preferred solutions** as a **function of distance**

Overview of distribution options

⬛ <0.1 USD/kg 🟦 0.1-1 USD/kg ▨ 1-2 USD/kg ◩ >2 USD/kg



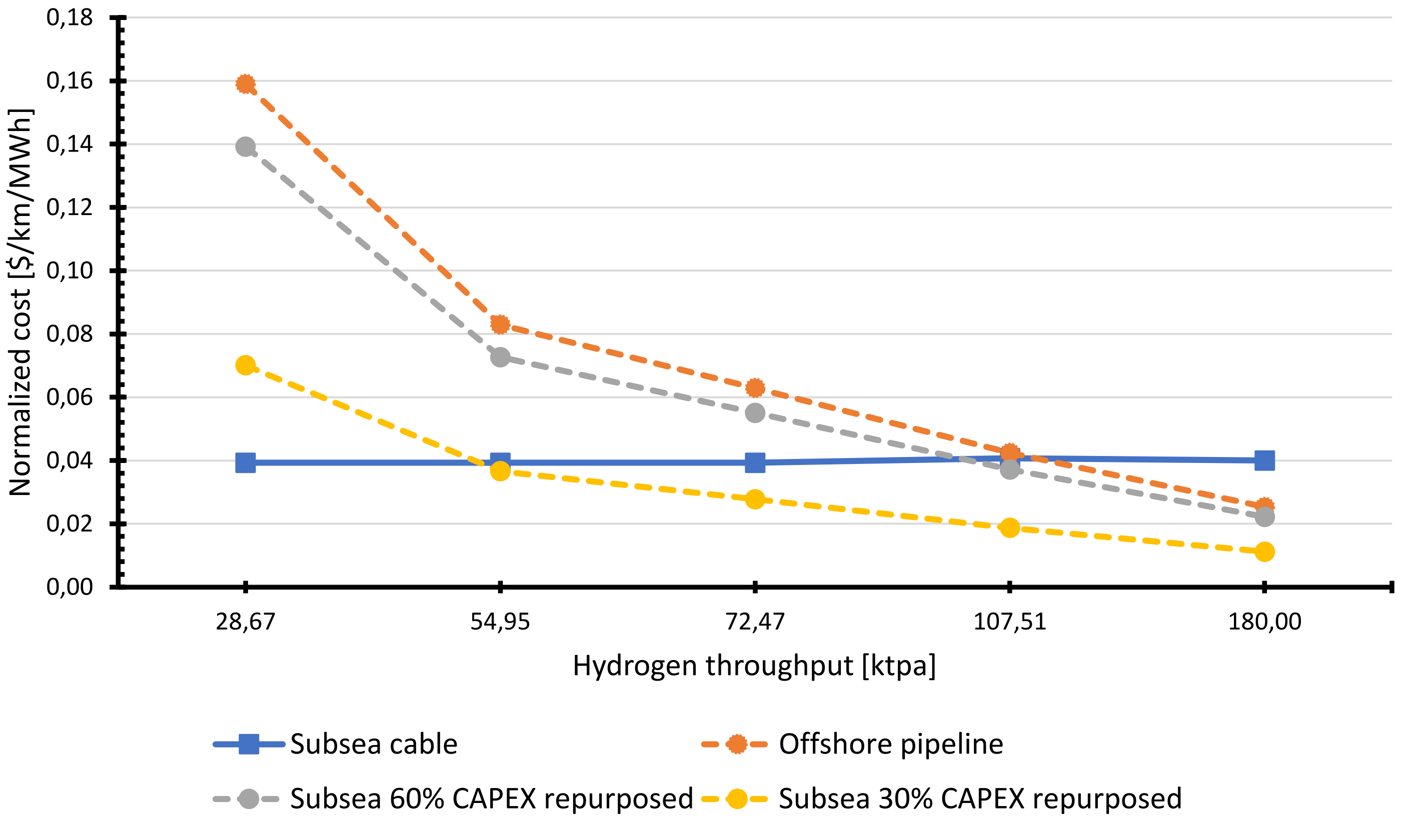
		Costs by 2030				
		Distribution		Transmission		
		0-50 km	51-100 km	101-500 km	>1,000 km	>5,000 km
Pipelines[2]	**Retrofitted**	City grid	Regional distribution pipelines	Onshore transmission pipelines	Onshore/ sub-sea transmission pipelines	N/A
	New	City grid	Regional distribution pipelines	Onshore transmission pipelines	Onshore/ sub-sea transmission pipelines	N/A
Shipping	**LH_2**	N/A	N/A	N/A	LH_2 ship	LH_2 ship
	NH_3[3]	N/A	N/A	N/A	NH_3 ship	NH_3 ship
	LOHC[3]	N/A	N/A	N/A	LOHC ship	LOHC ship
Trucking	**LH_2 trucking**	Distribution truck LH_2	Distribution truck LH_2	Distribution truck LH_2	N/A	N/A
	Gaseous trucking	Distribution truck CH_2[4]	Distribution truck CH_2[4]	Distribution truck CH_2[4]	N/A	N/A

---

1. Gaseous Hydrogen, Liquid Hydrogen LH2, Liquid Organic Hydrogen Carriers (LOHC), ammonia (NH3), Methanol, LNG/LCO2 (dual-use vessels carrying liquefied natural gas on one trip and liquid CO2 on the return trip) and solid hydrogen storage; 2. Assuming high utilization; 3. Including reconversion to H2: LOHC cost dependent on benefits for last mile distribution and storage; 4. Compressed gaseous hydrogen

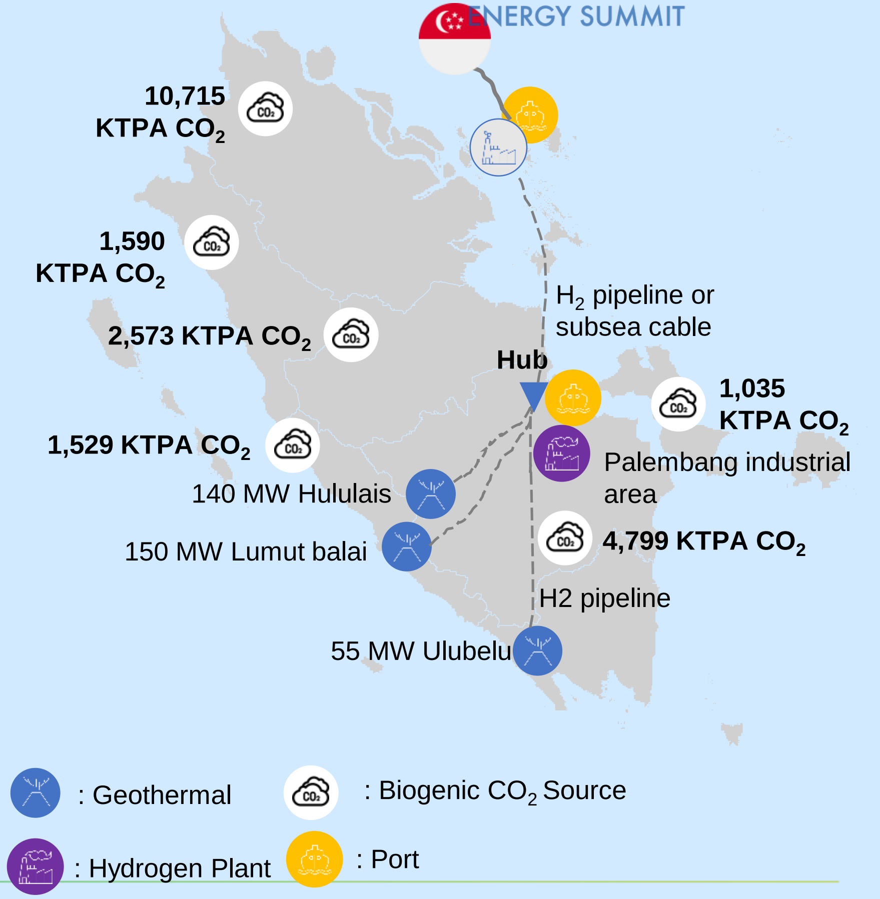
PNRE has completed study[1] for H2 transport from Sumatera to Singapore. Repurposing the current 586 km pipeline could reduce infrastructure CAPEX by up to 70%.

Hydrogen Transportation Costs By Pipeline



PRESENTED AT:

PERTAGAS INTEGRATED PIPELINE AND ENERGY SUMMIT



---

1. Final Report DNV 2023 for PNRE Feasibility Study on Hydrogen Export to Singapore

Developing green hydrogen infrastructure requires addressing technical, environmental, economic, and social factors.

PRESENTED AT:

pipes 2025 PERTAGAS INTEGRATED PIPELINE AND ENERGY SUMMIT

Community Engagement

Renewable Energy Integration

Green hydrogen production via electrolysis demands a consistent and substantial supply of renewable energy. Ensuring access to affordable and stable renewable electricity is crucial.

Water Resource Management

Electrolysis requires significant water input. It's vital to assess water availability and implement sustainable management practices to prevent adverse effects on local water resources.

Infrastructure Development

Designing safe and efficient hydrogen storage systems is essential. Establishing robust distribution infrastructure, including pipelines and transportation systems, ensures reliable delivery of hydrogen to end-users.

Regulatory Compliance

Implementing quality infrastructure systems, encompassing standards, metrology, testing, and certification, ensures the safety and reliability of hydrogen technologies.

Economic Viability

Addressing the high capital and operational costs associated with green hydrogen production is essential. Strategies include securing government incentives, optimizing production processes, and developing financial models that attract investment.

Takeaways

Stakeholder Involvement

Engaging local communities early in the planning process builds trust and addresses concerns related to safety, environmental impact, and economic benefits.

Technological Innovation

Investing in R&D to improve electrolyzer efficiency and developing advanced materials for hydrogen storage and transportation can enhance safety and efficiency.

PRESENTED AT:

pipes 2025
PERTAGAS
INTEGRATED
PIPELINE AND
ENERGY SUMMIT

THANK YOU