GIIGNL New Gas Supply Chains Study Phase 2

October 2025

The Momentum for New Gases is Growing Despite Pipeline Attrition and Widespread Pessimism

New gases projects are moving forward around the world, particularly in areas where clear policy drivers and optimal commercial factors are in play, such as the EU, United States, Japan/South Korea, and especially China

>$110B
In global committed investment for clean H_2 projects until 2030

>500
Clean H_2 and derivatives projects beyond FID worldwide

97%
of FID+ projects have either production or offtake located in regions with explicit H_2 policies

~50
Clean H_2 and derivatives projects have been publicly canceled in the past 18 months (~3% of the pipeline)

+$35B
Increase in committed investment from 2024

8 Mtpa
of policy-enabled clean H_2 demand commitments in EU, US, and East Asia by 2030

1 Mtpa
Supply capacity operational with 300 ktpa renewable (2.7 GW, 56% in China) 700 ktpa low–carbon (93% North America

74%
H_2 CEOs indicated investment appetite in H_2 has either remained stable or increased in the last two years

Insights derived from interviews and surveys conducted with over 70 leaders from a subset of H2 Council members, released Sept 2025: H2 Council 2025

Contents and Main Findings of Phase 2

Since Phase 1 in July 2024, many changes in project pipeline, regulatory framework, and economic expectations have occurred. In Phase 2, many updates were made to the model to improve its functionality and regional specificity to obtain certain insights. A benchmark of costs was performed, resulting in an update of new gas costs presented in WP2. Additionally, a critical analysis of each study regions readiness to export, and regulatory framework was performed and presented in WP1 and WP3 respectively

WP1 - Regional Analysis of Readiness to Export

1. The Middle East and US are in a **class of their own as exporting regions**, due to the outsized availability of capital, export projects beyond FID, existing infrastructure, and economics
2. Green and blue NH_3 are set to be the **most cost-effective value chains** established at scale early on **(between 2027-2030)**
3. **2025 will be a critical year for project FIDs** in Australia, Brazil, Chile, the US, and Middle East, most of which are driven by demand side incentives (H2Global and Japan CfD auctions)

WP2 - Results Benchmark and Comparative Analysis

1. Green and blue H_2 and NH_3 imports are **expected to become competitive with unabated domestic H_2 production by 2040 in Europe**, with a **carbon tax of ~$152tCO_2$**. The gap is not expected to close for imports into Japan until 2050 due to a lower carbon price outlook
2. Hybrid solar and wind power is the most cost-effective way to produce RES-based new gases; however, **less uniform generation profiles lead to higher LCOx**, due to higher storage and oversizing needs (**Brazil Ceara region - 200% above average H_2 storage costs**)

WP3 - Regulatory Analysis and Market Framework Assessment

1. Most regulatory frameworks are largely conducive to new gas exports, **with the major barriers coming from the EU Delegated Acts and US Three Pillars** environmental stringency. Green NH_3 delivered costs could be **almost twice as expensive** when complying with these rules (H2Global Fertiglobe Egypt **~$935tNH_3$** vs SECI auctions in India **~$550tNH_3$**)
2. Since July 2024, **new billion-dollar incentives for new gases have been rolled out** (or are in process) in Australia, Japan, Chile, Europe, Brazil, Saudi Arabia and Oman, **while some tax incentives (45V) are rolled back in the US**

Readiness to Export Ranking

The Middle East has a unique approach, in which **regulatory hurdles are minimal**, and state energy companies and their international partners benefit

Chile, Australia, the Middle East (except UAE), and North Africa have **predominantly export-focused strategies**, leaving project development reliant on offtake contracts with Europe and East Asia. The UAE, US, and Brazil are focusing on bolstering domestic demand to provide an anchor for exports, which adds stability in light of increasingly dynamic geopolitics

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Regional Export Readiness Ranking, Strengths, and Weaknesses

Importer	Score	Strengths	Weaknesses
Middle East	8.8	Direct investment, **low regulatory complexity**, business conducive	**Strong sovereign partnerships required**; regional instability poses threat to shipping lanes
US Gulf Coast	8.7	**Largest availability of incentives** even with IRA scope reductions	**Political uncertainty**. Difficulty meeting Three Pillars and wage/content adders for full 45V incentive
Australia	6.1	**Ramping government support**, world class diurnal solar and wind resource, land availability	High natural gas costs, **funding pulls, and pipeline attrition**
Chile	5.8	Highest solar and wind capacity factors and **most competitive LCOx**, political stability	High capital costs, **significant infrastructure development required** in remote regions (1/3 of projects)
Brazil	4.9	**Lowest carbon intensity grid in scope**, attracting European investors looking to simplify RFNBO qualification. Plentiful biomass	**Bureaucratic delays, permitting challenges, and occasionally local opposition**. Fiscal situation could limit public co-investment or tax breaks; high capital costs
North Africa	4.5	**Proximity to Europe reducing midstream costs**, world class renewable resources, existing LNG export and pipelines	Nascent regulatory frameworks and investor clarity, land leases, and profit repatriation. **Water scarcity, major infra upgrades**

Top Near-Term New Gas Value Chains

Ammonia value chains are expected to establish the first major flows between regions, with favourable pricing, acceptable carbon intensity (CI) in both Europe and Japan, and a handful of projects beyond FID

Gas	Exporter	Importer	Timeline	Cost ($/MMBtu)[1]	CI ($kgCO_2$/MMBtu)[2]	Development
Green Ammonia	Middle East	Europe	2027-2030	54-62	9	**NEOM project at 80% construction** as of June 2025, with preliminary agreements signed with European offtakers expected 2027; **Oman has many large projects expecting FID in 2025-2027**
Blue Ammonia	Middle East	Japan	2028-2030	35-36	22	UAE's ADNOC and Saudi firms pilot cargoes to Japan (2021–2022) and to South Korea and China (2023). **ADNOC-led TA'ZIZ project in the UAE reached FID in 2022**, Mitsui & Co as offtaker
Blue Ammonia	USGC	Japan	2028-2030	40-42	28	Ample CCS infra and incentives (IRA 45Q) drive a **pipeline of 15 blue ammonia projects planned in Texas and Louisiana**. Baytown Blue NH_3 (Exxon, Marubeni) and Blue Point Ammonia JV (CF, JERA, Mitsui) **have reached FID targeting export to Japan by 2030**
Green Ammonia	North Africa	Europe	2028-2030	50-56	5	H2Global import tender award to Fertiglobe for green NH_3 from Egypt to Europe, **flows originally expected 2027 but FID delayed**
Blue Ammonia	Australia	Japan	2028-2030	58-59	24	Pilot exports of blue NH_3 shipped to Japanese utilities in 2022. **Four main blue hydrogen/ammonia export projects** in advanced pre-FEED or FEED stages
Green Ammonia	Brazil	Europe	2029-2030	57-64	7	Pecem (Ceara state) projects aim for operation by 2028-2030, and multiple other ports (Açu, Suape) could be shipping to Europe and Asia by 2030 if MoUs become contracts (interest signaled by Japan's METI). **EU support is strong, aligning with RFNBO standards**

[1]Lower and upper bound of the estimated delivered cost in 2030 produced with hybrid solar and onshore wind, range corresponding to low and high bound LCOE

[2]Production powered purely by renewables and value chain using local average annual grid intensity projections for 2030 (whole lifecycle considered)

EU New Gas Import Timing

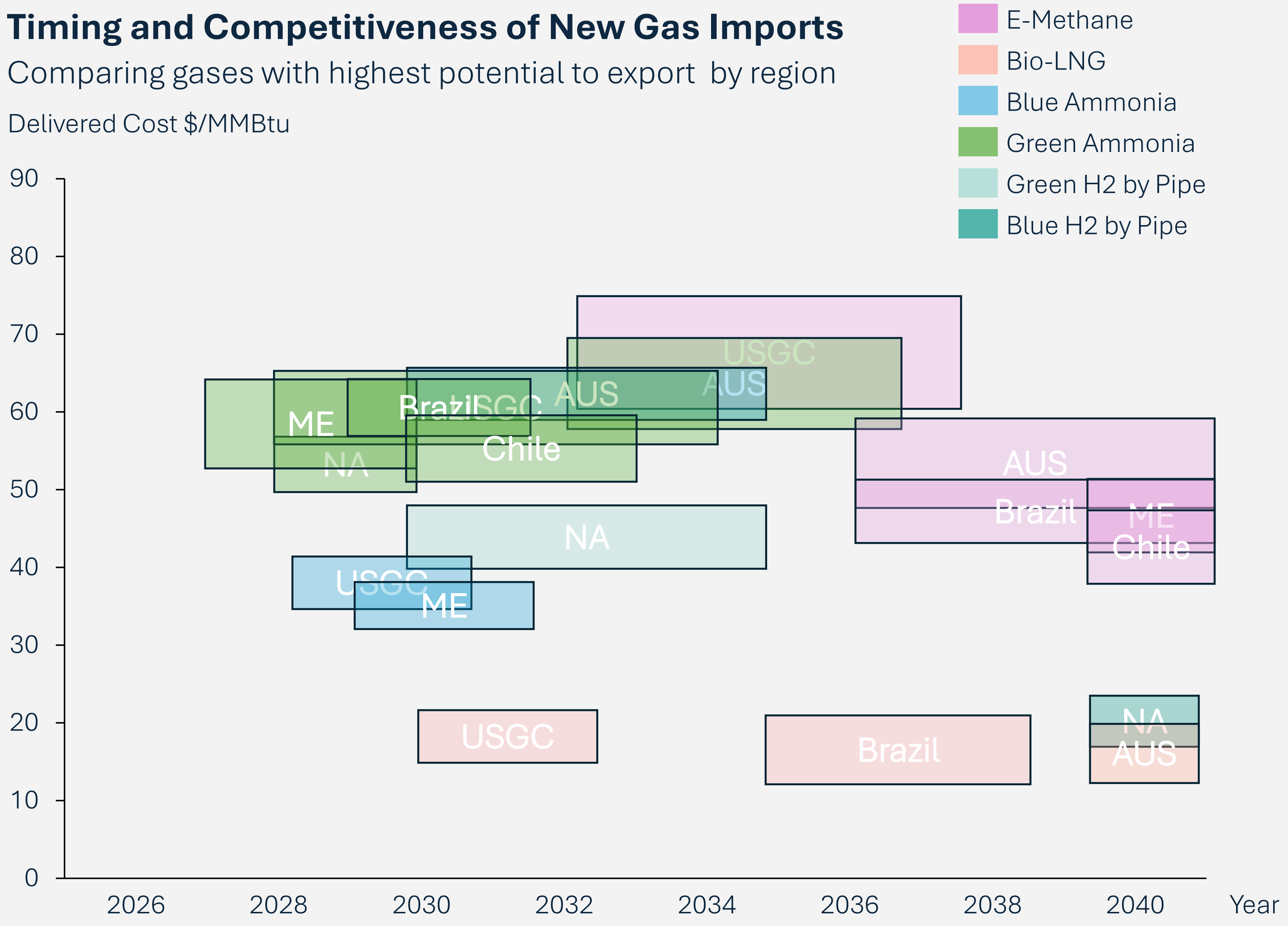
The first **demo imports have occurred** – e.g. in 2022 a small cargo of blue NH_3 from the UAE was received by Germany for use in steelmaking trials

Commercial deliveries are likely to commence between 2027 and 2029: **Germany's H2Global will bring in tens of thousands of tons of green NH_3 from 2028 onward**

By 2030, Europe aims to be importing **multiple Mt of NH_3** – this relies on dozens of NH_3 ships offloading at North Sea and Mediterranean ports. E-methane imports reflect cost reductions towards 2040

Timing and Competitiveness of New Gas Imports

Comparing gases with highest potential to export by region



[1]Range of costs captured in verticality of the square, based on high and low LCOE scenarios. Range of timeline based on horizontal spread of the square, represents the window in which there is likely to be the first commercial deliveries

Japan New Gas Import Timing

Blue NH_3 is likely to be the most cost-effective near-term import, along with bio-LNG, depending on supply availability and domestic demand for biomethane in export regions. Green NH_3 will also be is another key import but **will require subsidization in the near term,** potentially through Japan's CfD mechanism

Japanese gas companies aim to inject 1% (0.6 Mtpa) of city gas demand as e-methane by 2030, which **could soon be transposed into law as an obligation by METI, supported by corresponding financial incentives.** All significant amounts of e-methane and bio-LNG are expected to be imported

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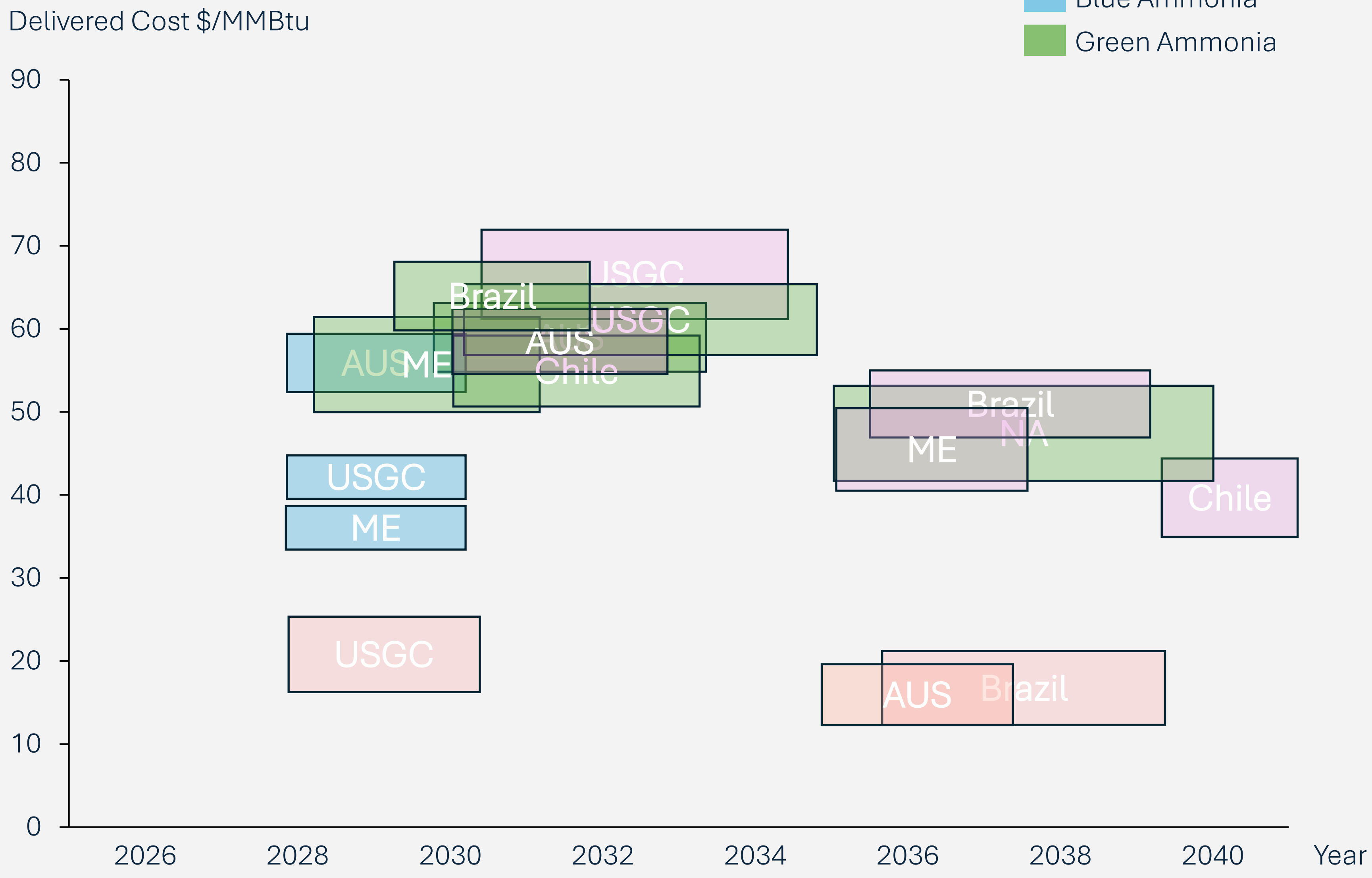
Timing and Competitiveness of New Gas Imports

Comparing gases with highest potential to export by region



[1]Range of costs captured in verticality of the square, based on high and low LCOE scenarios. Range of timeline based on horizontal spread of the square, represents the window in which there is likely to be the first commercial deliveries

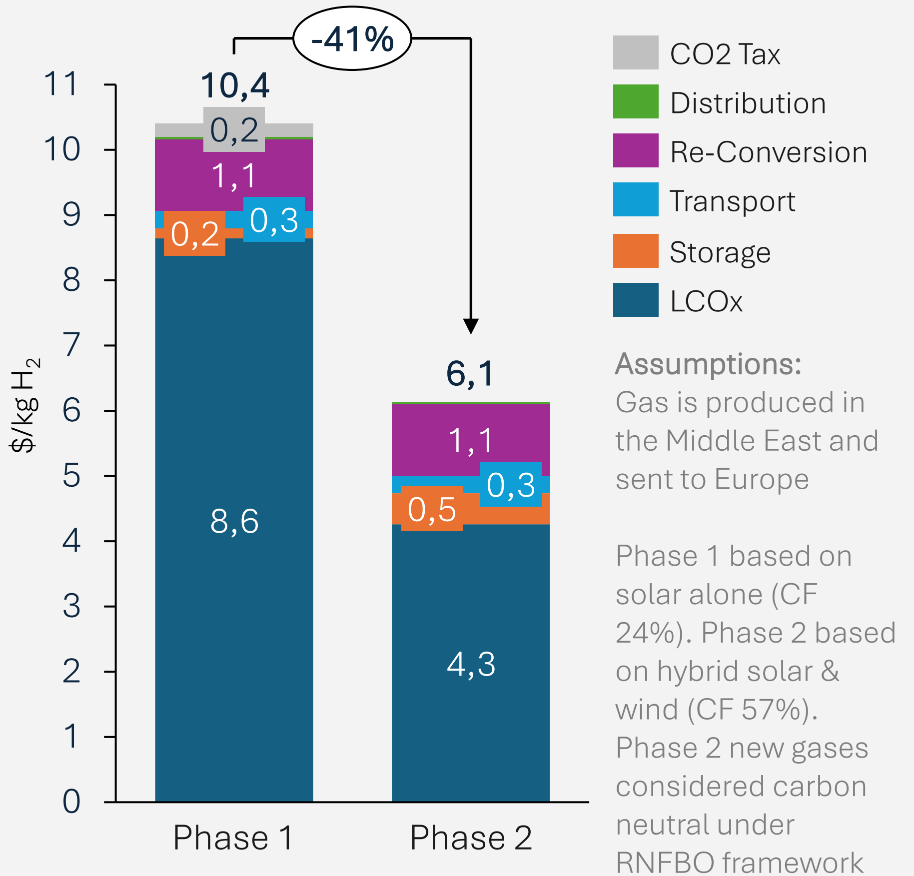
Sample of Key Model Assumption Updates and Impact

Significant cost reductions were recognized as a result of a series of updates and benchmarking in Phase 2

Phase 2 Update	Rationale	Effect
Electrolysis CAPEX increased • $814 to $1,150/kWe 2030 • $589 to $950/kWe 2040 • $447 to 750/kWe 2050	Hydrogen Council and McKinsey's near-term outlook and recent cost increases of 30-65%. Forecasted outlook for 2040 and 2050 based on TNO learning curve assessment, assuming global capacities reaches 1TW by 2050	Across all of these updates to RES-based value chains (green H_2, green NH_3, and e-methane): • An average reduction in LCOx for green NH_3 and e-methane of **40% in 2030** and **25% in 2050** compared to Phase 1 • An average reduction in LCOx for liquefied and piped green H_2 of **25% in 2030** and **5% in 2050** compared to Phase 1
E-methane CAPEX increased • $440 to $761/$kW_{SNG}$ 2030 • $320 to $568/$kW_{SNG}$ 2040 • $280 to $456/$kW_{SNG}$ 2050	Aligning with results on WP3 benchmark, choosing values from a large benchmark of many studies: juser.fz	
Region-specific capacity factors and oversizing ratios for solar, onshore wind, and hybrid solar & wind	Done to increase the regional specificity of costs, compared to Phase 1, which used solar in the Middle East as a production profile proxy for all regions	
O&M as a % of CAPEX • 5% to 3% for green H_2 • 4.7% to 3% for green NH_3 • 5% to 3% for e-methane	Done to align with WP3 benchmark results, which are on average lower than Phase 1 estimates	
Increase in cost of unabated fossil H_2 and natural gas benchmarks with increasing carbon price in Europe and Japan was modeled in Phase 2	Done to better account for the real opportunity cost of new gases with an increasing carbon price	Increase in competitiveness for new gases by 2040 and 2050, especially in Europe, where parity is reached for many new gases

Delivered Cost of Green NH_3 Reconverted 2030

Comparing GIIGNL Phase 1&2 ($/kg H_2)



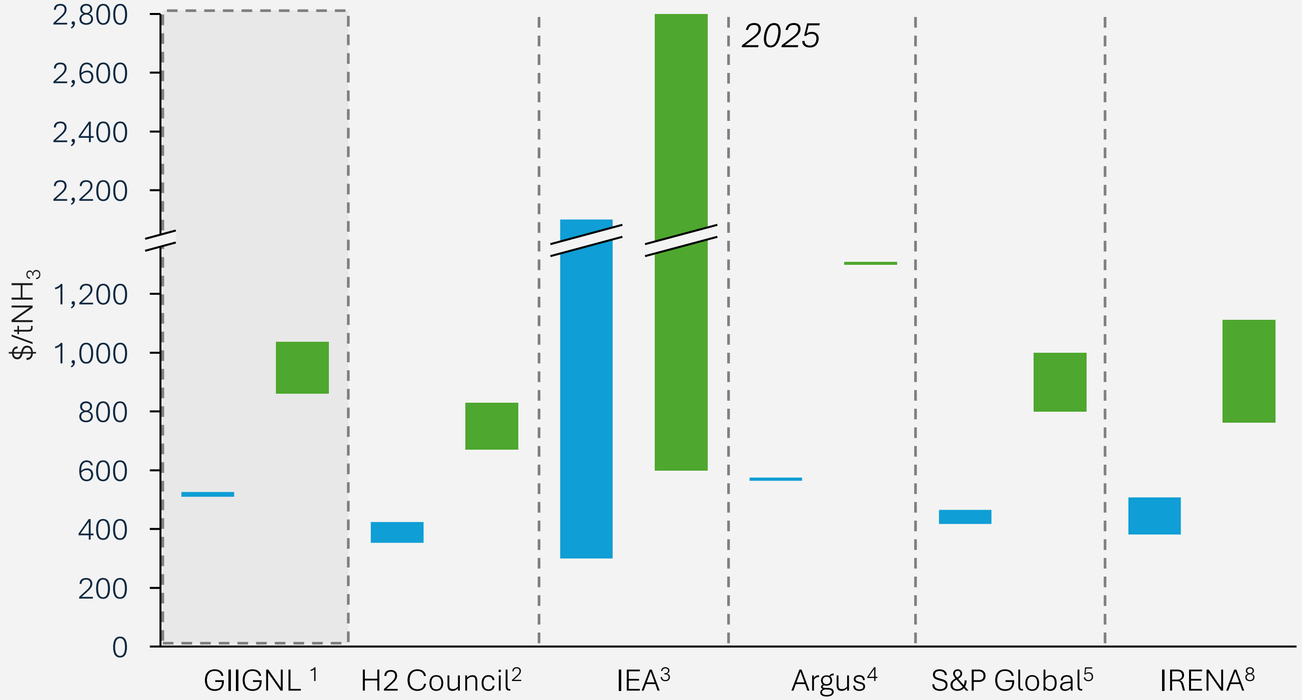
Assumptions:
Gas is produced in the Middle East and sent to Europe

Phase 1 based on solar alone (CF 24%). Phase 2 based on hybrid solar & wind (CF 57%). Phase 2 new gases considered carbon neutral under RNFBO framework

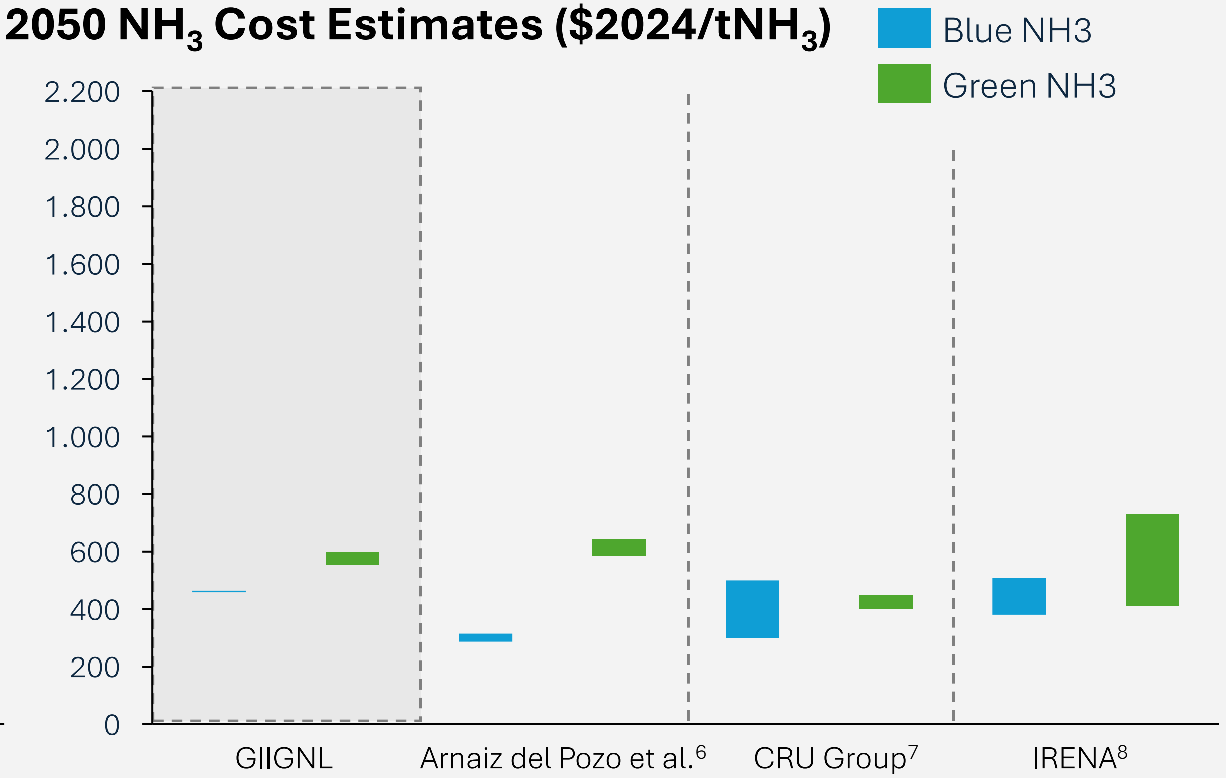
Levelized Cost of NH_3 Production Across Reports

The reported costs of NH_3 is equally as variable as pure H_2, with the GIIGNL Phase 2 model landing in the **middle range** as well. Outside of modeled costs, recent NH_3 auctions are providing some price discovery, such as the H2Global **~\$935/tNH_3 (€811) auction for green NH_3 production in Egypt**, and the recent auctions run by SECI in India with initially auction winners coming in between **\$590/tNH_3 and \$641/tNH_3**. Critically, the Egyptian NH_3 price is unsubsidized and meets hourly correlation requirements for RFNBO status, while the Indian NH_3 prices factor in \$85-106/tNH_3 subsidies for the first three years and are taking 12-month grid averages via "grid-banking" allowing them to operate electrolyzer at near baseload, thus reducing capital expenditures on new RES[9]

2025-2030 NH_3 Cost Estimates (\$2024/tNH_3)



2050 NH_3 Cost Estimates (\$2024/tNH_3)



[1]Upper and lower bound based on renewable energy cost range in the model, produced in USGC. [2]2025 estimate of production in the USGC Hydrogen Insights 2025 [3]Range of LCOA from wide ranging renewable energy costs IEA 2024 [4]Reported costs of USGC production in 2025 from diurnal RES, range corresponding to spread between May and April 2025. Green H_2 from PEM and Blue NH_3 is ATR+CCS based. Argus Sample H2. [5]Indicative values of offers from the USGC between 2023 and 2025 for green NH_3 S&P Global and range of previous three months blue NH_3 USGC pricing S&P Global [6]ScienceDirect [7]CRU Group [8]IRENA 2021 [9]Renewable ammonia price discoveries: a closer look at the H2Global and SECI auctions

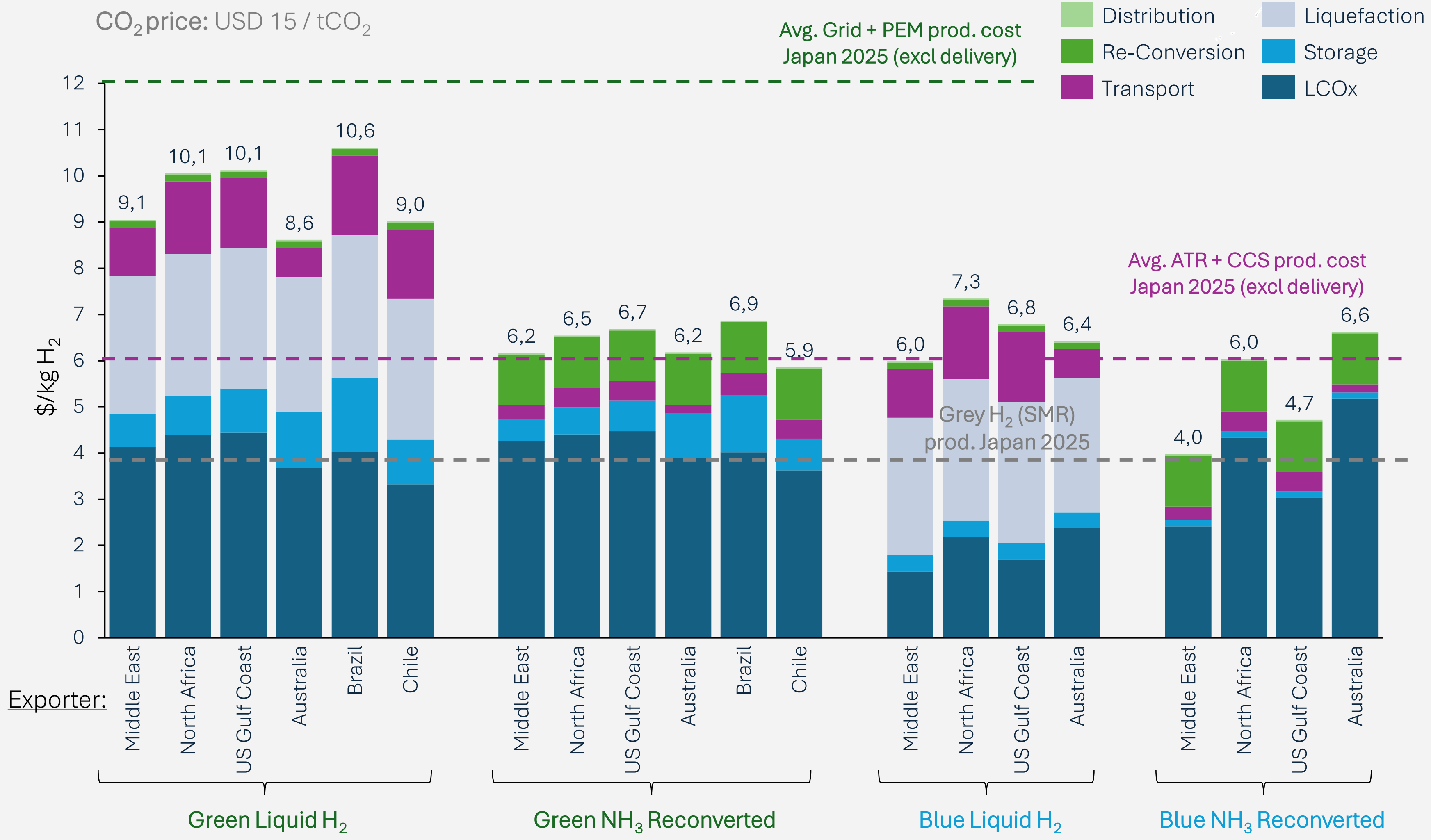
Delivered cost of H_2 to Japan 2030

For Japan, Australia, Chile, and the Middle East are the most competitive suppliers of most H_2 molecules out of the regions in scope

Green and blue NH_3 reconverted into H_2 costs less than domestically produced green H_2 in Japan, **which could catalyze investment into key technological bottlenecks along the supply chain such as NH_3 cracking, and the demand side such as NH_3 co-fired power, green steel production, transport and more**. Despite competitiveness of imports, uptake will come down to willingness to pay and government support particularly in the form of the CfD program set to kick off in 2025[1]

Similar to Europe, a price premium persists for imported H_2 compared to domestic grey or blue H_2 production

Delivered cost of gas to Japan by exporting region in 2030



Energy prices, capacity factors, and oversizing dimensions vary by region. Hybrid solar and onshore wind are used for all regions, along with a flat discount rate of 7%, and all cost estimates are without subsidy. Storage costs include H_2 storage during gas production and at the export terminal. Conversion of H_2 to NH_3 is counted in the LCOx bar, re-conversion includes regassification and NH_3 cracking. Regional capacity factor specificity: North Africa: Morocco, Middle East: Saudi Arabia, Brazil: Ceara, Chile: Magallanes, Australia: Pilbara

[1] The view from Japan: 2025

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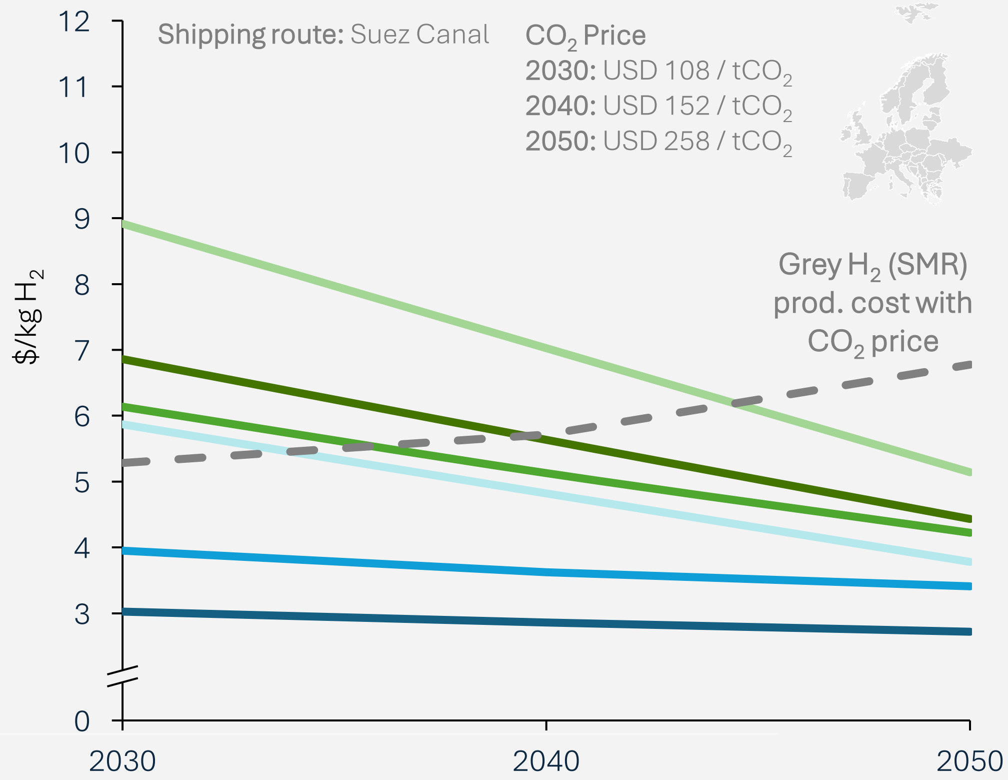
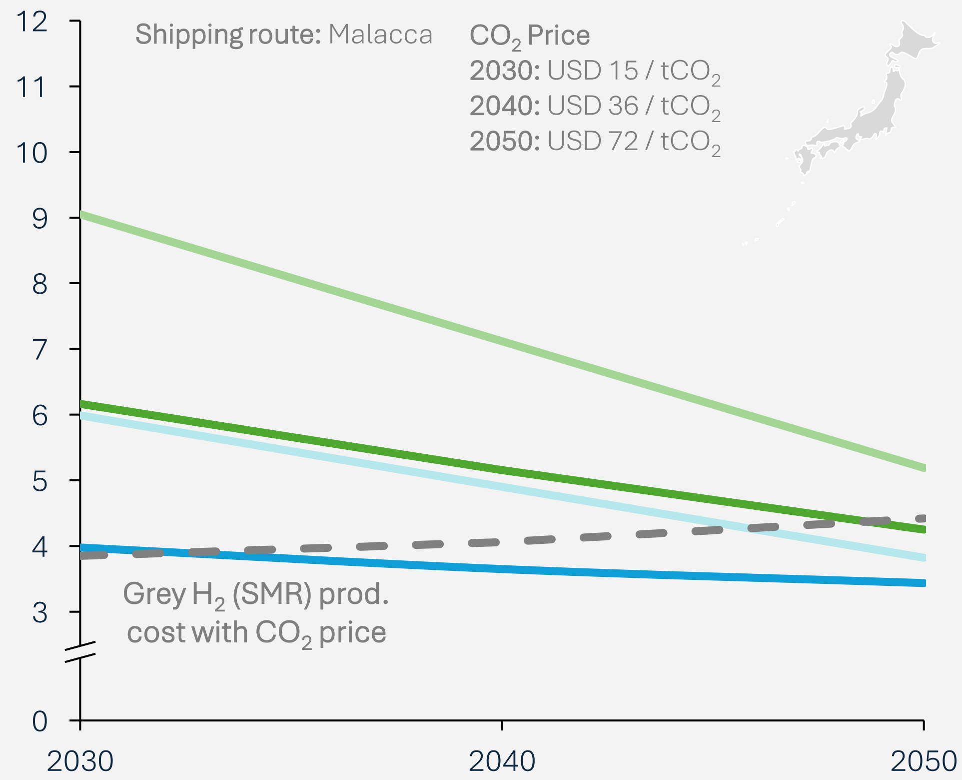
Clean H_2 supply chains are expected to become competitive with local grey H_2 production, and markets will need to adapt to price discovery over time

Large cost reductions are expected for green H_2-based supply chains due to marked improvements in **electrolyzer CAPEX (from ~$1,150/kW in 2030 to ~$750 /kW H_2 in 2050),** efficiency **(from 72% in 2030 to 80% in 2050),** and LCOE reductions **(-35% on average)**. As a result, reductions in OPEX and balancing costs (batteries and on-site H_2 storage) will occur, implying a need to implement flexible H_2 contracting reflecting economies of scale. A high carbon tax penalizes unabated hydrogen production to the extent **that most clean options are more economical in Europe by 2040**, however, the same is not expected to be true in Japan, based on a weaker carbon price outlook, **which could mean support schemes will still be necessary in 2040**, potentially weaning off towards 2050

Delivered cost of H_2 Middle East to Europe by year - $/kg H_2



Delivered cost of H_2 Middle East to Japan by year - $/kg H_2



- Blue H2 liquefied
- Blue H2 as NH3 reconverted
- Blue H2 by Pipeline (EU only)
- Green H2 Liquefied
- Green H2 as NH3 reconverted
- Green H2 by Pipeline (EU only)

Assumptions:
Gas is assumed to be produced in the Saudi Arabia NEOM region using hybrid solar and wind with a total capacity factor of 57% throughout the year. WACC of 7% assumed, subsidies not included

Oversizing of 2.5MW RES to 2MW electrolyzer to 1MW ammonia production assumed

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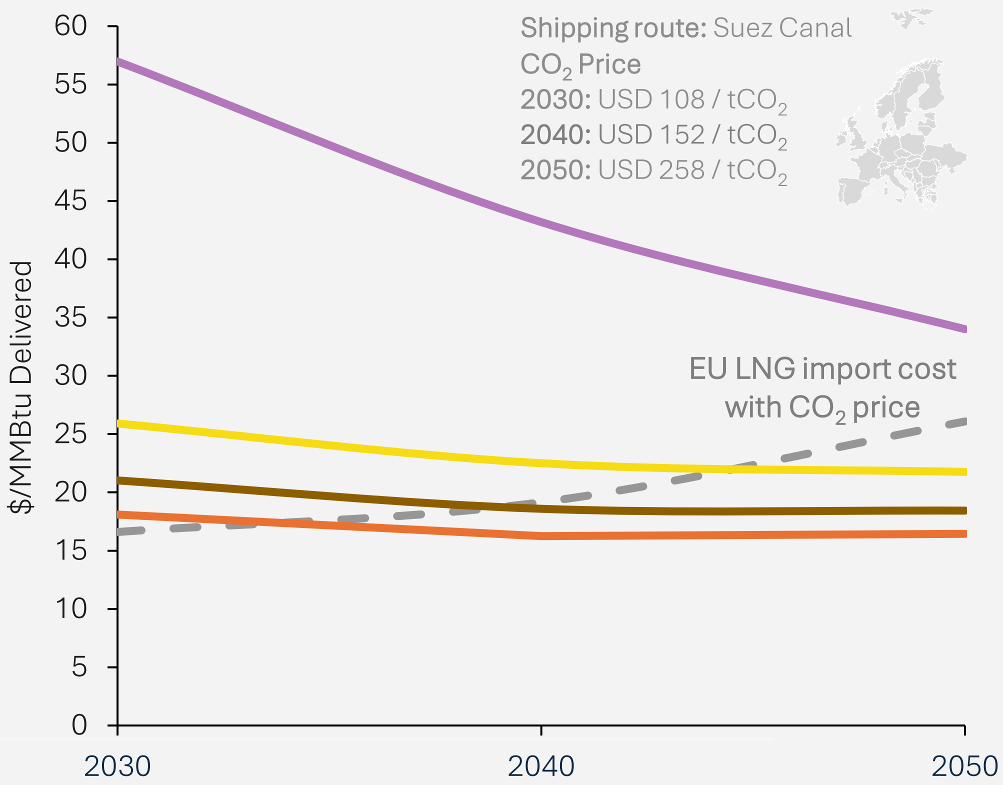
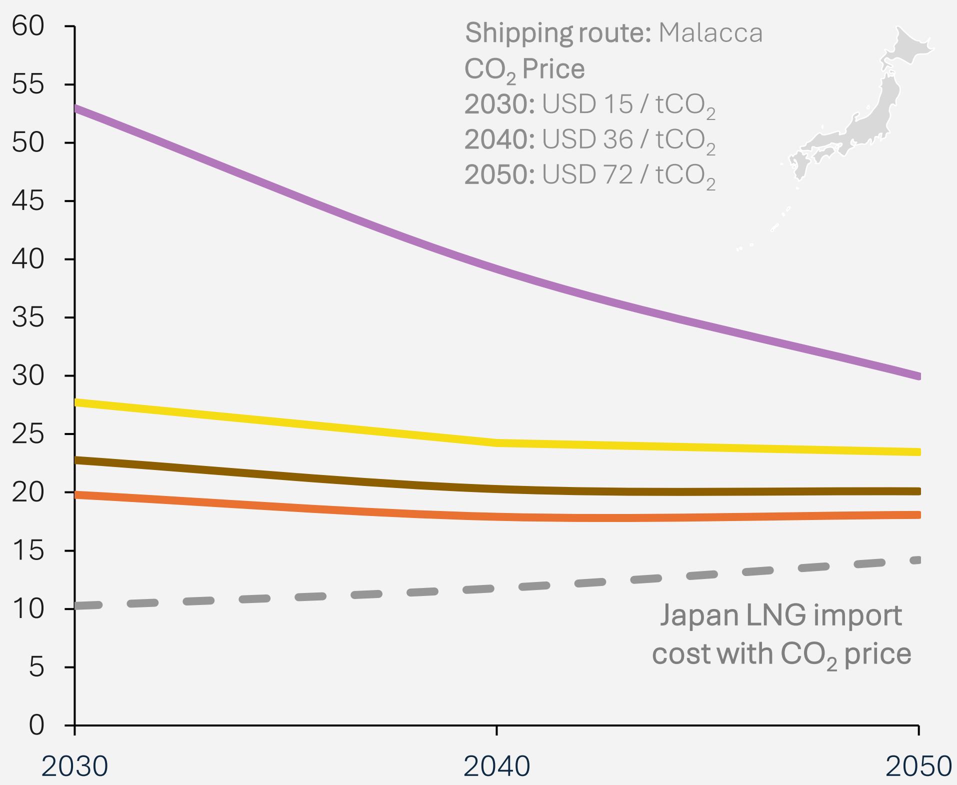
Costs converge towards 2050, opening up markets for decarbonized CH_4, however, economies of scale are needed to drive cost reductions

E-methane and bio-LNG imports into Europe will become increasingly competitive with fossil LNG moving forward as carbon prices increase. **E-methane import costs are expected to decrease by ~40% between 2030 and 2050** due to technological improvements and economies of scale, assuming **electrolysis CAPEX reduces from $1,150/kW in 2030 to $750/kW in 2050**, and **methanation CAPEX from $775/kW in 2030 to $465/kW in 2050.**[1] Japan currently sees a larger role for e-methane in meeting their long-term 90% carbon-neutralized city gas targets for 2050[2], however offtakers in Europe may compete for volumes for e-methane in ETS covered sectors as the cost premium tightens

Delivered cost of CH_4 US Gulf Coast to Europe - $/MMBtu



Delivered cost of CH_4 US Gulf Coast to Japan - $/MMBtu



- E-Methane: Dedicated RES and PPAs
- Bio-LNG: Municipal organic waste
- Bio-LNG: Wet manure
- Bio-LNG: Wet manure + maize (70-30)

Assumptions:

Energy prices, capacity factors, and oversizing dimensions vary by region. Hybrid solar and onshore wind are used for all regions, along with a flat discount rate of 7%, and all cost estimates are without subsidy

Biogenic CO_2 for e-methane exported to Japan sourced at $20/$tCO_2$ from a gas processing plant, while exports to the US are assumed to be using biogenic CO_2 from a pulp and paper plant at $200/$tCO_2$, **leading to a 16% increase in LCOx**

Feedstock cost ranges based on the cost curves of manure, MOW, and maize by region IEA

[1] juser.fz-juelich.de

[2] カーボンニュートラル チャレンジ

Competitive Imports to Europe 2030

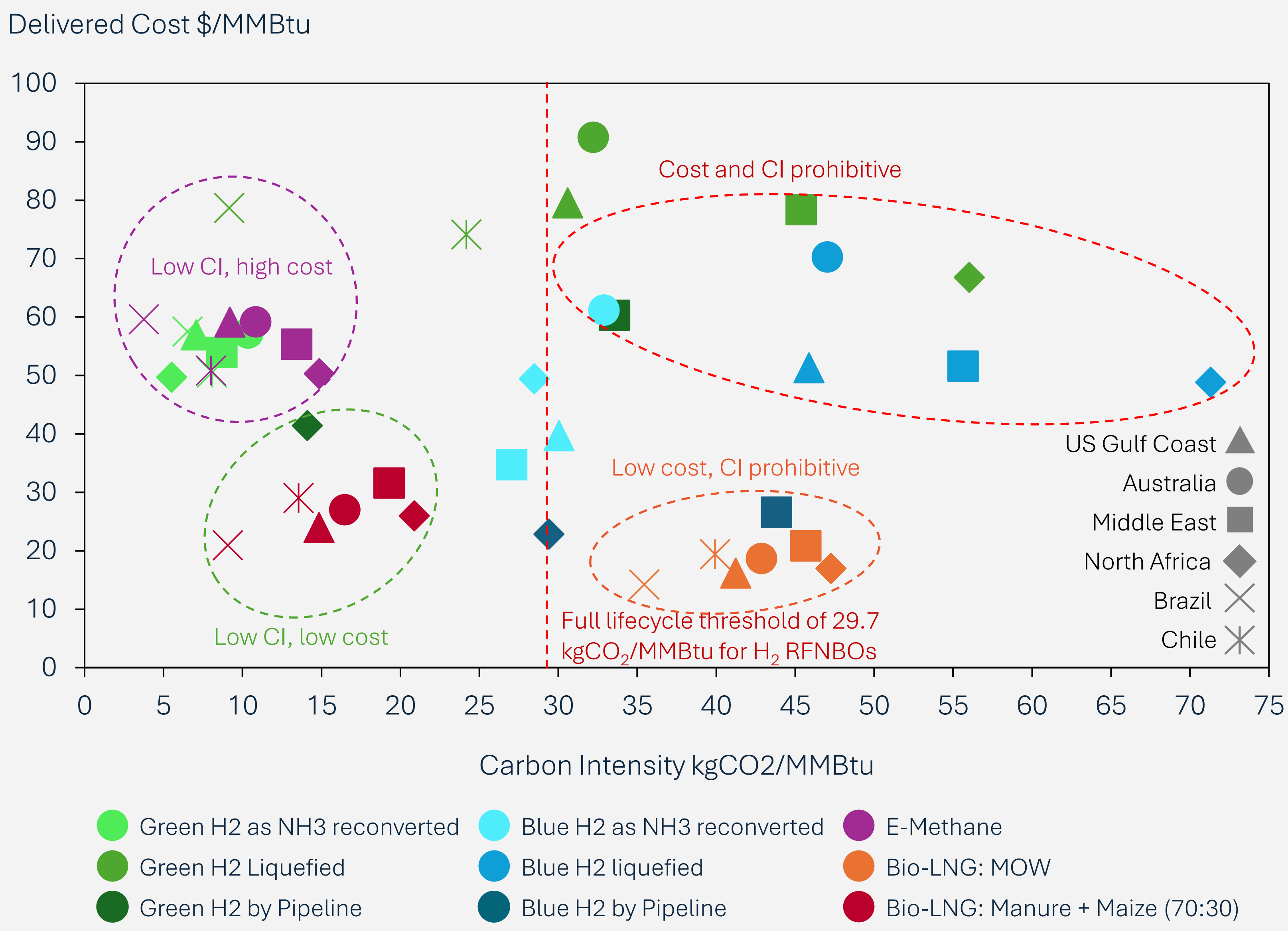
The most competitive and lowest carbon imports theoretically come from bio-LNG from either manure or partial manure feedstocks, **but not many regions are planning to export towards Europe. Piped green H_2** from North Africa and **blue NH_3** from the Middle East **are low cost and likely qualify as RFNBOs**

The least carbon intensive value chains, **green NH_3 and e-methane,** are expected to be higher cost in 2030. It is assumed that e-methane is produced using biogenic CO_2 in 2030 from a pulp and paper mill at \$200/tCO_2 as developers future-proof for RFNBO regulations

Liquid H_2 imports are exceedingly expensive and carbon intensive in 2030 is local grids power the value chain

Cost and Carbon Intensity of New Gases Delivered to Europe 2030

Renewable powered production and local grid powered value chains



Competitive Imports to Japan 2030

Similar to European imports, the most competitive and lowest carbon imports theoretically **come from manure-based bio-LNG**, however scant volumes are expected to materialize

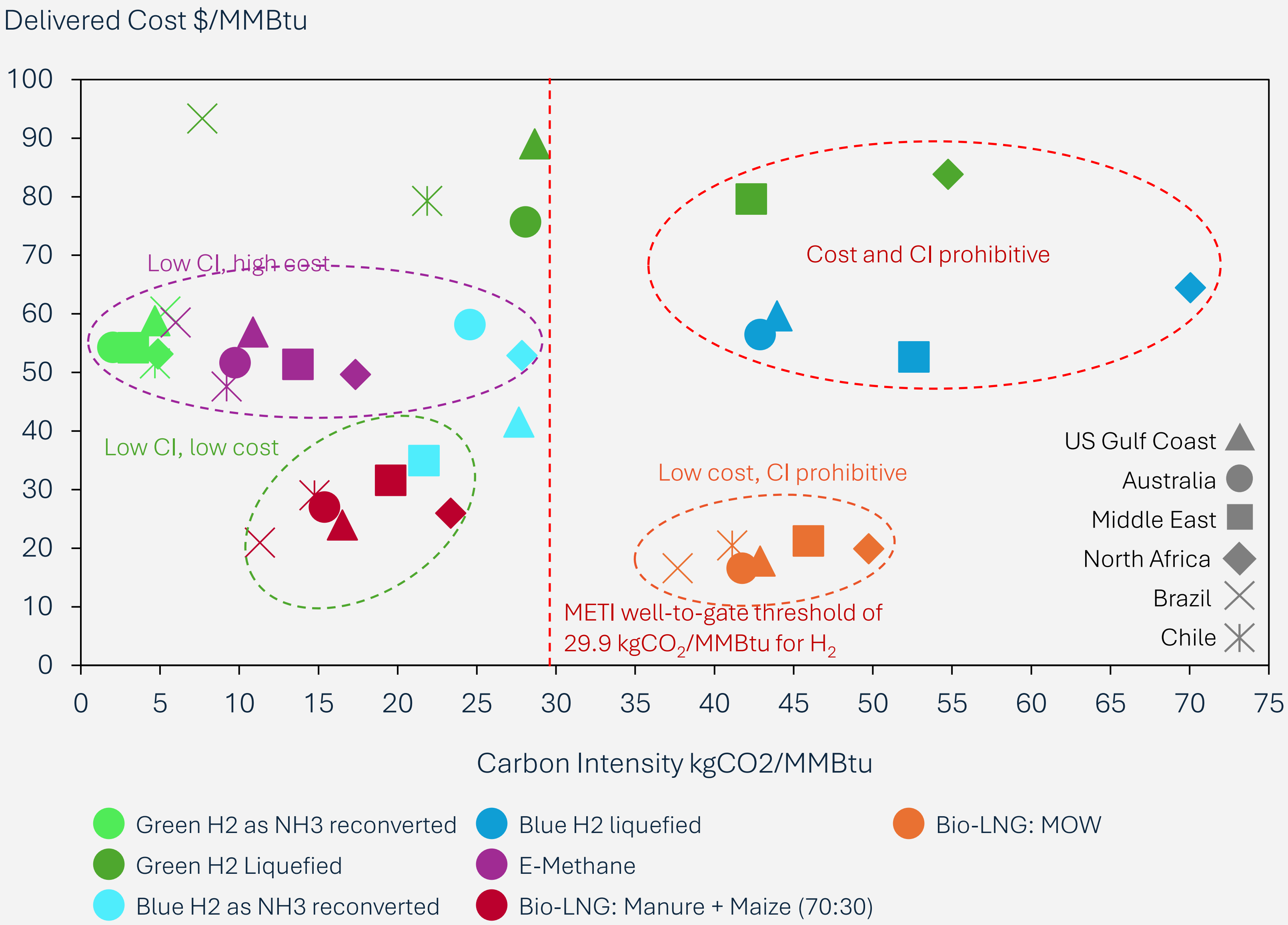
Blue and green NH_3 reconverted, and e-methane fall withing the carbon intensity thresholds, with **Australia and the Middle East being the most cost competitive suppliers for Japan**

E-methane is assumed to be produced using fossil CO_2 from a gas processing plant at $20/t$CO_2$

Liquid H_2 imports are exceedingly expensive and carbon intensive in 2030 even from Australia

Cost and Carbon Intensity of New Gases Delivered to Japan 2030

Renewable powered production and local grid powered value chains



Comparison of Regional New Gas Policy Frameworks

New gas regulatory frameworks are mostly supportive, with a large gap in terms of incentive budgets

Country	Description	Stability (x/25)[1]	Existence of Policy Barriers	Total Incentive Budgets
Middle East	Taken as a whole, governments in Saudi Arabia, Oman, and the UAE provide **world leading support** for new gas projects, as it is seen as a strategic priority	24	Demand side pull	>$50 billion
EU	**The EU has structured the widest panel of subsidies, incentives and financial instruments** for all new gases in scope. However, the approval process for granting these funds is long and complex, affecting project development	23	Complexity of Delegated Acts, implementation speed	>$100 billion[2]
Japan	Tight, targeted subsidy architecture with long-tenor support and capacity payments; **policy is strong, but project uptake/costs will determine buildout**	22	Minimal; lack of certification, many commercial barriers	$20-30 billion
US	**Strongest incentive packages for a single country**, although bias and uncertainty have been recently introduced, shaking up the outlook	19	45V reductions, "3 pillars" stringency, Jones Act	>$150 billion in next 10 years, depending on incentive uptake
Australia	**New Australian government is intent on advancing their new gases export push** by increasing incentives. Political and execution risks are present	19	Additional compliance via Safeguard Mechanism	~$7 billion
Chile	Chile's H_2 strategy enjoys **broad political support**, limited political blockers, long-term vision, and is **prudent with public funds**	17	Environmental concerns	~$3 billion
Brazil	Brazil's clean H_2 policy is in early stages, is a patchwork of policy support. A comprehensive legislative framework (covering guarantees of origin, tax incentives, etc.) **is still under development**	16	Nascent and unproven	~$4.4 billion
North Africa	North African regulatory frameworks **must evolve to ensure projects move from MoU to FID**. Countries rely heavily on Foreign investment	14	Incentives, roadmaps, stability	<$0.5 billion

[1]Detailed scoring found after each policy summary slide
[2]ey-hyvolution-ey-european-hydrogen-20250214.pdf

Many Policy Barriers	Some Policy Barriers	No Real Policy Barriers

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Major Policy Blockers for New Gas Value Chains

Restrictive policies identified involve environmental compliance stringency and a lack of certification/standardization

RED Delegated Acts on RFNBOs and GHG Accounting: Stringent RFNBO requirements ensure environmental integrity but raise costs for exporters who must invest in dedicated RES or PPAs compliant with stringent rules on additionality, temporal/geographic correlation, especially compared to place like Japan who do not mandate it

Also, electricity for RFNBOs cannot have been granted financial support. Physical connection is required for PPAs and biogenic CO_2 used for RFNBO. Book & claim would significantly reduce costs

Industry officials note that while draft transposition guidance for RED III transport targets is emerging, guidance for industry targets is still outstanding in most Member States

Delegated Act on Low-Carbon Hydrogen: Methodology for treating nuclear in grid-sourced H_2 production LCA deferred to 2028, potentially delaying such projects

Egyptian Law No. 2/2024 grants big incentives but with conditions that can limit eligibility: 5-year window for signing project agreements; ≥70% foreign-currency financing; ≥20% local components; tight timelines to reach COD

Three Pillars for 45V closely resemble stringent EU Delegated Act rules for green H_2 production. Developers have complained about difficulty and administrative burden of meeting apprenticeship and domestic cost content adders for IRA tax incentives like 45V

The Renewable Fuel Standard has created a strong domestic market for biomethane that is likely to out-compete, and adds compliance for potential bio-LNG exporters

The Jones Act Constraints on domestic marine movements: any coastwise shipment of LNG/alternative fuels (and future NH_3/H_2 bunkering) must use U.S.-built/flag/crewed vessels, a cost and availability hurdle for coastal supply chains

Safeguard Mechanism: Provides an incentive for lowest-CI production facilities, which can trade additional compliance credits. However, hampers gas-based pathways as facilities in scope lose capacity to monetize voluntary credits

Low-Carbon H_2 legal Framework sets a high threshold ($7kgCO_2/kgH_2$) misaligned with importers, and several implementing rules (measurement/LCA scope, chain-of-custody, interoperability) are still to be issued, which slows bankability

Production tax credit (PHBC) is capped and only runs 2028–2032; rules are still being detailed, creating timing gaps for projects trying to FID sooner

Insufficient market mechanisms: Book-and-claim for clean electricity, CH_4 and feedstocks such as biogenic CO_2 would drive cost reductions and development by allowing existing infrastructure to be fully leveraged (GHG Protocol)

*List is not exhaustive, see detailed policy assessment for more

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Compliance and Voluntary Certification

Global certification standards are plentiful, **especially for voluntary markets**. However, **none are truly universal**, as even the certification schemes used for compliance in the EU **must still obtain approval from the Japanese government**. CORSIA is an exception, as it is already viable in Japan. Multiple efforts are underway to work towards mutual recognition, such as the COP28 Declaration and the IPHE working group on hydrogen GHG accounting. **Further alignment is also needed on market mechanisms** such as book and claim for electricity, CO_2 and clean molecules, as heralded by the GHG Protocol

How to meet EU regulatory compliance:

1. **Use an EU-recognized voluntary scheme to obtain PoS**, of which there are 18. The EU relies on a system of Commission-recognized to certify compliance of fuels with sustainability and GHG criteria
2. **Upload Proof of Sustainability** (PoS) to Union Database

✓ Qualifies for **RED compliance quotas**, and (for renewable gases) **can unlock network tariff discounts** via the EU Hydrogen and Decarbonization Package

Voluntary/corporate claims:

- Pair an attribute certificate (AIB/CertifHy GO, ISCC PLUS, etc.) with a robust CI statement (GH2/RSB/ISCC LCA) and a clear chain-of-custody (mass balance or book-&-claim)

Japan CfD eligibility:

1. Build CI dossier (well-to-gate) that meets Hydrogen Act thresholds
2. **Secure METI/JOGMEC Business Plan approval**
3. Third-party global labels (e.g., GH2, ISCC PLUS) **can provide support**, but government approval remains the gatekeeper

Voluntary/corporate claims:

- Japan does not yet have a publicly available domestic GO system for hydrogen akin to the EU's, but is intent on developing one
- The GX League (a voluntary emissions trading system) could spur this: companies reducing emissions via clean hydrogen might earn extra credit. For now, **approvals are centralised via business plans**

Key Signposts for New Gas Value Chains by Geography (1/4)

Europe

- European demand forecasts are highly variable; official estimates by the European Commission have been adjusted downwards in the past two years **from 20 Mtpa H_2 to between 3 and 6 Mtpa H_2 by 2030**
- **European new gas markets are compliance-driven**, with elaborate quota and penalty schemes in place for the transport and industrial sectors (RED and FuelEU Maritime), and carbon pricing for industry, power, transport (ETS and ETS2)
- Despite the vast availability of incentives for new gases across the EU (>$100 billion), **their programs and certification schemes are criticized for being too complex and cumbersome** administratively
- **Some ramp-up is designed for the Delegated Acts**, production facilities may use existing renewable installations until 1 January 2028, monthly matching before 1 January 2030 (then hourly), recycled fossil CO_2 considered avoided up until 2035 for power production and 2040 for heat, industry, and chemical use (still qualifying as RFNBO)
- Given the stringency of European carbon intensity thresholds, most jurisdictions do not have average grid emissions intensities low enough (<19gCO_2/kWh) to produce RFNBOs without **Delegated Act compliant PPAs** along the value chain - i.e. for liquefaction, compression, re-conversion etc.

Japan

- Japan's regulatory framework is less mature but less cumbersome than Europe's, and has recently been updated with Hydrogen Society Promotion Act in 2024 to address concerns around **carbon intensity thresholds** (updated to align better with Europe) and **cost premium of imported fuels** with clearer and tighter thresholds and support schemes
- **A total of ~0.6Mt H_2e per year could be unlocked through the CfD program** spread over the 15-year lifetime of the program. Pivotal for meeting demand targets by 2030, in which FIDs are needed 2025-2027
- Private sector targets such as the **1% e-methane blending in town gas objective by 2030** are also driving project development, and there is talk of METI transposing the target into law
- The Green Transformation (GX) Programme (2024) is a comprehensive, legally-backed roadmap aiming to drive public-private investments of **¥ 150 trillion (~$1 trillion, nearly 3x the annual GDP investment % of the US IRA**) over 10 years to enable Japan’s transition to a net-zero economy by 2050. It provides a public finance spine of **¥20 trillion GX Economic/Climate Transition Bonds**, includes an **emissions trading system** (starting trials FY2026), carbon surcharges on fossil fuel importers (from FY2028) and emissions allowance auctions by power generators (FY2033)

Key Signposts for New Gas Value Chains by Geography (2/4)

US Gulf Coast

- The \$3/kg H_2 45V production tax credit has been **reduced by billions of dollars,** as start of construction date has been officially shortened from 2033 to 2028 with the passage of the Big Beautiful Bill.[1] Placing **60-70% of otherwise eligible renewable projects (0.55 Mtpa) at risk**[2]
- As such, green H_2/NH_3 projects in the US **shut down or consider doing so**. (Air Products \$4B project canceled, HIF Global \$7B hub at risk)
- Reduction in scope for IRA clean electricity credits also affect exports (particularly to Asia, where subsidized power is allowed in imports)
- Further threats to reduce H_2 Hub funding could **impede up to \$35B in private investment for H_2.**[3] Blocking of unawarded funding mostly in Democratic states has been proposed
- Although untouched and potentially benefiting from a shifting bias towards oil and gas, **blue H_2/NH_3 are also affected by the knock-on effect on the broader market**, noted one ExxonMobil official
- Uncertainty around US tariffs are making developers and investors weary, and **could raise construction costs for new gas facilities**. LSB put their proposed 1.1Mt blue NH3 in Houston on hold in Q1 2025. Even projects beyond FID such as CF Industries, JERA and Mitsui Blue Point Complex in Louisiana could face higher costs. Tariffs may make meeting domestic content adder easier for IRA tax credits

Australia

- **Largest pipeline for giga scale projects by capacity** mostly in the form of green and blue NH_3, **none have reached FID**, but pilots have been shipped (liquefied green H_2 and blue NH_3 to Japan 2022)
- **Widespread project cancelation or delay** is occurring in Australia largely due to cost and feasibility issues. Several Australian green-H_2/NH_3 ventures have been scaled back or cancelled in 2024–25 (**Fortescue canceled two projects post-FID**)[4]
- **Reversals of funding allocation is a risk especially at the state-level,** with re-allocation to other industries such as the \$600 million Whyalla steelworks, and \$1 billon Gladstone project subsidy withdrawal
- Regardless, **government support for new gas exports is increasing,** with a new **A\$2/kg PTC for green H_2 production** launched in 2025 under purview of the new labor government
- **Developers must engage early and deeply with Traditional Owners to secure long-term social license.** Heritage issues have caused delays and reputational risk (e.g., Nullarbor – Western Green Energy Hub, Traditional Owners hold 10% stake and must grant approval to develop)[5]

[1] Reuters [2] Hydrogen-Council-Global-Hydrogen-Compass-2025.pdf [3] US weighs funding cuts [4] Green H2 stalled in Australia [5] Labor landslide keeps green hydrogen dream alive

Key Signposts for New Gas Value Chains by Geography (3/4)

Middle East

- Rather than traditional tax incentives, Saudi Arabia, the UAE, and Oman provide support via **direct investment**, access to **inexpensive feedstock and land**, and other **favorable terms** for development
- Some believe direct backing of state-owned companies (Aramco, ADNOC, Oman's Hydrom) in these countries will result **in LCOx "likely even cheaper than subsidized US production"**[3]
- Most policies are supportive; most constraints come from external market rules (e.g., EU import criteria), which can be planned and met as **additional dedicated renewables can be built easily**
- **Demand-side pull is the main limiting factor**, which means regions are in competition and are steadily expanding their incentive structures for new gases beyond direct investment alone, such as the UAE voluntary carbon markets and potential CfDs
- **The Hydrom Auctions in Oman are a success story.** Eight large-scale green H_2 initiatives with the potential to produce 1.38 Mtpa of green H_2 by 2030 have been awarded direct investment, land leases, tax holidays, and more in two auctions so far. **The next auctions in 2025 will feature increased benefits**

[1]S&P

North Africa

- Morocco and Egypt setting the pace and Algeria, Mauritania, Tunisia, and Libya following
- Progress on new gas policy is uneven: rules for guarantees of origin, certification, and grid/water access are advancing but not yet uniform, and subsidy models **rely more on land, tax relief, and multilateral finance than on long-term price support**, as countries cannot bankroll multi-billion projects alone, **relying on investors in the EU and Gulf**
- **Managing water supply for electrolysis is a concern** (North Africa is water-scarce; Morocco and Egypt plan desalination for H_2). Projects must also plan for port and grid upgrades
- Egypt and Morocco see new gases as long-term growth areas, **but do not have fully established roadmaps for achieving their long-term targes** (Egypt announced +$60 B of projects at COP27)
- **Access to EU markets is strong via MoUs and hydrogen diplomacy,** but competition is stiff, and financing requires guarantees. Also, **bureaucracy can delay large investments**
- Compliance with EU RFNBO standards adds additional complexity and may be less well tolerated in countries without dedicated monitoring, reporting, and verification frameworks (Morocco has set up a GO system)

Key Signposts for New Gas Value Chains by Geography (4/4)

Brazil

- Regions such as Ceara in the Northeast have **average grid CI below the 18gCO_2/MJ threshold set by the EU Delegated Acts additionality clause**, easing restrictions; corresponding PPAs, temporal and geographic correlation must still be met
- **Policy developments are recent, and the system is still maturing;** secondary rules, transmission and water infrastructure, and mutual recognition of certificates will determine the pace to export FIDs
- Hydrogen Legal Framework passed Aug 2024 defines H_2 and sets a carbon-intensity cap of 7 kgCO_2e per kg H_2. This is however quite far from the European and Japanese standards of 3.4 kgCO2e per kg H_2, which could create misalignment
- The proposed Low-Carbon Hydrogen Development Program (PHBC) would create a competitive program of tax credits of up to BRL 18.3 billion ($3.4 B between 2028–2032) **to stimulate production of low-carbon H_2 and derivatives, including large-scale export FIDs**. Parts of the original bill were vetoed and are being reworked
- Many of Brazil's large-scale export projects could **announce FID by COP30 in November 2025**
- Capital costs in Brazil are **typically higher** than other markets in scope

Chile

- Chile has a multi-layered policy framework covering high-level strategy, granular action plans, tax incentives, and trade agreements
- In August 2025, Chile proposed a bill aimed at spurring H_2 and derivative value chains with tax incentives (**$2.8 billion production tax credit for domestic purchases only to spur local demand**), **special tax regimes** particularly in the Magallanes region, and a new **Green Investment Tax Credit Fund**
- Chile's government is highly supportive of project development, granting concessions for infrastructure development (**3 alone in 2025 for Magallanes green NH_3 projects**) to **build missing infrastructure** such as port terminals, pipelines, and desalination plants
- Notable political consensus on green H_2 importance, and desire to remain an energy exporter, considering expected plateau in copper exports
- Formal international agreements between the EU and UK establish Chile as a preferred partner for new gas export and line up investment (**$6.7 billion in UK Export Finance credit for Chilean H_2 projects**)
- **Chile is also channeling green funds from climate finance sources** ($1B World Bank fund expected to catalyse $12.5 billion) but is prudent with public funds and reliant on foreign investment