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ITA INDUSTRIAL TRANSITION ACCELERATOR

Clean industry rising: the foundation of resilient value chains

Global Project Tracker Update | JUNE 2026

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Foreword

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Economic resilience has moved to the top of the agenda for governments and businesses. Geopolitical tensions, trade fragmentation, energy shocks, supply chain disruptions and climate impacts are no longer marginal risks; they have become the norm – shaping prices and impacting economies in real time. While they rush to safeguard economies, businesses and livelihoods, political, corporate and finance leaders also need to address the structural vulnerabilities dramatically exposed by recurring crises.

The findings in this edition of Mission Possible Partnership's Global Project Tracker should be read in that context. Despite a more volatile global environment, clean industry investment has accelerated. 19 projects reached final investment decision in the last six months, over double the equivalent period a year earlier. And just outside of our reporting period, on 21st May, Acelen Renewables secured investment on their biorefinery to produce sustainable aviation fuel in Brazil, a project supported by the ITA.

This acceleration is happening because the strategic case for clean fuels, chemicals and materials is strengthening. Fossil fuel dependence is a structural vulnerability, exposing economies to price shocks, supply disruption and inflation. These risks may not be priced appropriately yet, but they do influence national and corporate strategies and investments.

Low-to-no-emissions solutions for energy-intensive industries have long suffered from their so-called "green premium" against fossil fuel based production. This premium shrinks when prices of conventional products skyrocket and market volatility is priced in and it would disappear entirely if the long-term economic impacts of greenhouse gas emissions were appropriately priced. When geopolitical tensions, oil and gas market shocks and climate breakdown fuel high inflation, the cost of the transition to clean industry increasingly appears as a small, manageable and predictable insurance price against more disruptive forces.

China continues to forge ahead, concentrating 45% of commercial-scale, clean industry projects past final investment decision. The scale of its domestic market and the strategic coordination across entire value chains, underpinned by five-year plans, have enabled clean industrial technologies to move through deployment and into production at speed. That has consolidated China's leadership not only in clean commodities production, but in the equipment and technologies that underpin clean industrial value chains.

Yet alongside China, a second group of clean industry leaders is emerging across the new industrial sunbelt: renewables-rich economies with the resource base to convert clean energy advantage into industrial competitiveness. India's rapidly expanding pipeline, alongside first-of-a-kind projects such as ATOME's Villeta pioneering green fertiliser plant in Paraguay, show how clean industry can serve domestic needs, reduce exposure to volatile imports, open new export markets and boost industrial growth.

For advanced industrial economies, the choices are more complex, but just as urgent. Clean industry cannot be built by ignoring Chinese technological leadership and the abundant, low-cost, clean energy potential of the emerging sunbelt – but cost competitiveness is no longer the sole objective of industrial strategies and should be balanced with economic development, resilience and security imperatives. Governments need to decide where to build and protect domestic capability, where to partner internationally, with whom and how to use the power of demand to strategically shape supply chains.

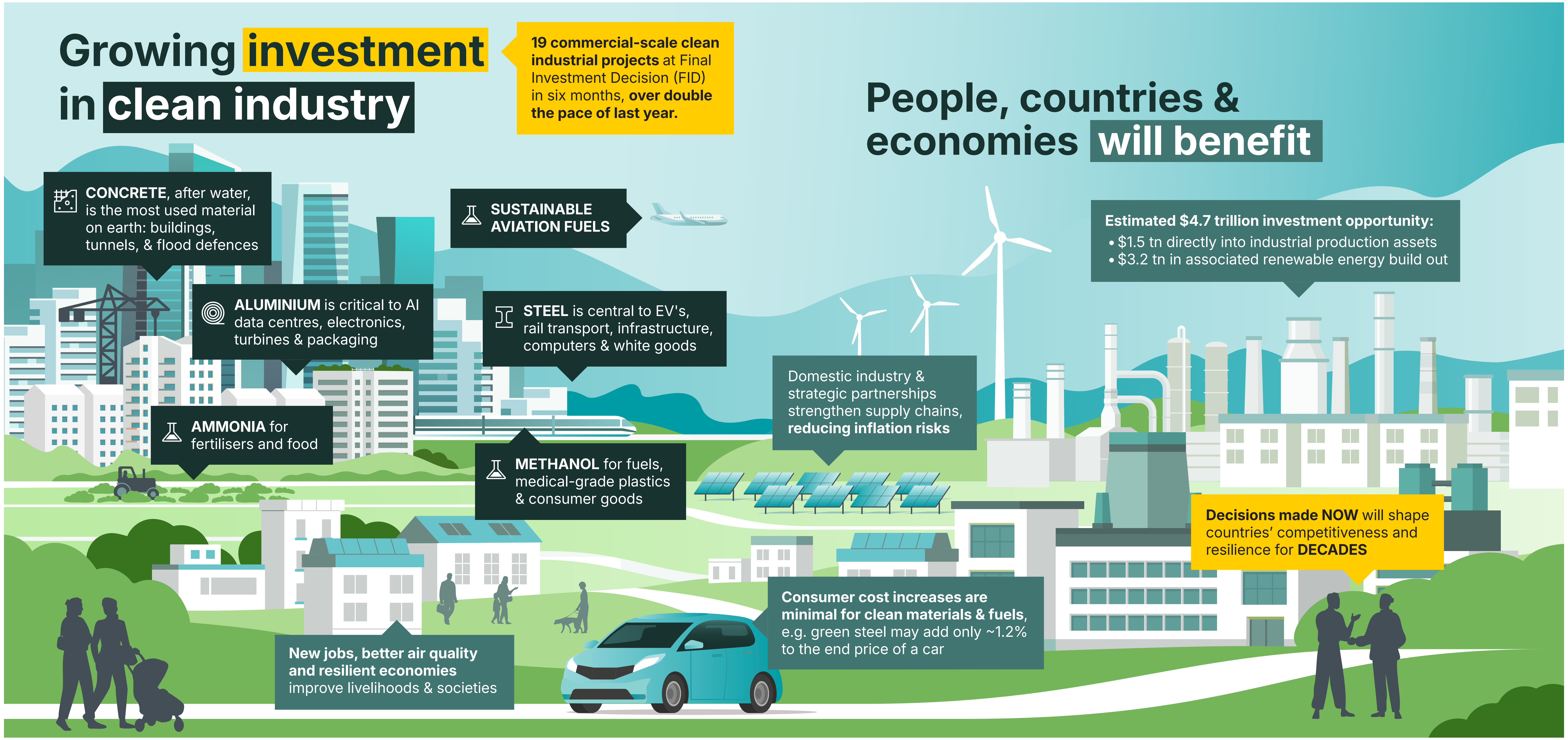
Markets are the linchpin of this transition. Without predictable demand for clean fuels, chemicals and materials, clean industry will not scale – no matter how many subsidies governments put on the table. With offtakes, announced projects can become bankable investments, assets under construction and value-creating plants. The rise of sustainable aviation fuels, where binding mandates are giving investors confidence in future revenues, is a powerful demonstration of the importance of demand-side policies. Markets determine which technologies scale, where production happens and who captures value.

First-of-a-kind and second-of-a-kind clean industrial plants attract the limelight, but successful first movers build entire value chains, from equipment, fuel and feedstock supply to long-term offtakes across manufacturing sectors. Early trade and commercial relationships provide the foundations for scale. As clean fuels, chemicals and materials move towards industrial tipping points, countries and companies that act early win a lasting advantage.

Clean industry is rising. The question is who will shape it, build it, benefit from it and who will be left adapting to new value chains designed by others.

Industry underpins modern life. Clean industry secures our future.

Industry provides the fuels, chemicals and materials that power our economies.
Now, clean industry is emerging as a strategic advantage – strengthening supply chains, driving competitiveness and unlocking the next wave of growth.
Momentum is building – and the biggest gains come when technology, policy, capital and markets align.



Executive summary

Energy is power and economic systems powered by fossil fuel energy are under pressure, now the cracks are showing. Despite these geopolitical and macroeconomic headwinds, investment into clean industry, powered by clean energy, has not slowed, in fact it has accelerated.

1. **More than double the number of new Financial Investment Decisions recorded**
2. **New clean industry value chains are taking shape worth an estimated $4.7 trillion**
3. **Momentum is gaining: China is moving fast and India's pipeline has grown by 30% in six months**
4. **Cross border trade alliances turn comparative advantage into long-term resilience**
5. **Countries that take a strategic approach to their role in supply chains will be best placed to shape the market terms of tomorrow's clean industrial economies**

Nineteen new Final Investment Decisions (FIDs) were recorded in the last six months, over double the equivalent period a year earlier, putting 2026 on track to be the strongest year for clean industry investment to date. Across sectors, capital is being committed, not because conditions are easy, but because the strategic case has strengthened. Clean fuels, chemicals and materials, produced domestically or sourced from diverse, trusted partners, materially reduce exposure to fossil-fuel price shocks.

Clean industry is gaining ground and new value chains are shaping up

This fifth edition of the Global Project Tracker records 161 landmark clean industrial projects now in operation or being built, on top of the more than 800 in development worldwide. The global pipeline represents an estimated ~$4.7 tn investment opportunity: around $1.5tn directly into industrial production assets and around $3.2 tn in associated renewable energy build-out (renewables and batteries). Clean industry projects are not isolated assets. Each FID reached triggers demand for clean energy provision, infrastructure, equipment, pulls in technology suppliers, energy developers, commodity traders and financiers to serve clients close and far across interconnected value chains. Forward-looking countries are already positioning themselves to capture this opportunity across the full ecosystem, not just at the project level.

China is continuing to lead

China remains the clearest demonstration of what strategically-coordinated industrial strategy can achieve, accounting for 45% of projects passed FID. Its strategy of sustained value chain scale-up is producing a steady stream of investment: 13 of the 19 new FIDs in the most recent period, confirming China's high share of new FIDs over the past two years (>60%). Other economies have yet to match such scale and steadiness of progress. China's maturing pipeline of projects is also enabling the country to solidify its clean technology leadership. China already provides >80% of the renewable energy equipment used directly by clean industry projects passed FID across the globe and, by serving its own pipeline, 45% of the clean industrial plant equipment. Europe and the US respectively seized 30% and <20% of the global clean industry equipment market to date.

India takes the lead in the New Industrial Sunbelt

The story for the coming period is what is building beyond China. India's announced pipeline grew by 30% in just six months, making it the third-largest national pipeline globally by some distance. Countries across the New Industrial Sunbelt - from Brazil and Chile to Egypt, Oman and Australia - collectively hold 39% of announced projects worldwide, underpinned by renewable resource endowments that dwarf their domestic energy needs. These are competitive industrial economies with the resource base to produce clean commodities at globally advantageous cost and the strategic interest to do so. →

Trade alliances turn comparative advantage into enduring power.
The strongest value chains will often be built across borders, not within them. The conditions that, combined, make clean industry most cost-competitive – low-cost renewable energy, best-in-class equipment, engineering expertise and proximity to large end markets – rarely coexist within a single country. Sourcing clean iron from renewables-rich locations, for example, could halve the cost of clean steel for European consumers, while retaining >95% of European steel jobs and opening up markets abroad for European clean technology providers. Recent examples such as AM Green's Kakinada project in India show that the projects reaching FID fastest are those that align favourable conditions through long-term cross-border partnerships.

En route to scale markets and unlock clean industry tipping points
The fuels sector is proving that policy can stimulate demand and convert a pipeline into investment reality. Aviation now has more clean industry projects passed FID than any other sector (except for legacy low-carbon aluminium assets), a reflection that binding long-term mandates are a clear market signal that converts future offtake into revenue confidence and removes the uncertainty that most often hinders a project's bankability. The cumulative production capacity of projects passed FID has doubled since the EU's ReFuelEU mandate was adopted in October 2023. Such momentum could be unlocked in other sectors if a small group of major economies simultaneously pursued the scale-up of lead markets for materials and chemicals.

Countries that strategically define their role in clean supply chains now will shape their competitiveness and resilience for the next decade.
Those who wait, or are forced to wait due to institutional or economic circumstances, will continue to be vulnerable to geopolitically-exposed supply chains and will eventually inherit the market terms others have set in new, clean industrial value chains.

The current energy system disruptions are not a blip, they are the start of shifting power dynamics and system-wide change. Countries that moved earliest to build domestic clean energy and early industrial capacity are now materially less exposed to the price shocks that have repeatedly destabilised fossil-dependent economies. Even if not by design, Spain's conversion of its renewable endowment into clean energy advantage and now clean industry, is beginning to show greater resilience to global market shocks and to attract investment flows. The opportunities ahead across clean industry value chains remain vastly underappreciated. The technologies are proven, the business case is strengthening and costs are moving in the right direction.

We are at a strategic inflection point; the prize for those early movers extends beyond balance sheets and trade balances to the price of food on supermarket shelves and durable home-grown industry. The question for governments and companies is not whether to act, but how to leverage the clean industry revolution to protect and boost their economy and their citizens' quality of life.

Attribution

This report was led and prepared by **Mission Possible Partnership** (MPP). Learn more at www.missionpossiblepartnership.org. This report has been made possible with the support of QCF.

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Atoma Research is an independent climate technology analytics company combining AI-driven data acquisition with proprietary datasets to deliver deep insights across energy, aviation, shipping and carbon removal. Atoma works with us to find projects and project information.

Systemiq is a system change company working to scale sustainable economic systems. Systemiq works with us on high-value chemicals and provides support to the Global Project Tracker webpage.

Citation and rights

Data sources

Ammonia: Low-Emission Ammonia Data (LEAD): Plants (February 2026), © 2026 by Ammonia Energy Association is licensed under CC BY-NC-SA 4.0.

Methanol: E-Methanol, Biomethanol and Low Carbon (blue) Methanol Plants (2026), Methanol Institute and Gena (2026) https://www.methanol.org/renewable/;

High Value Chemicals: Systemiq primary research; IEA Hydrogen Production and Infrastructure Projects Database; IEA CCUS Projects Database; The Global Partners for Plastics Circularity Progress Tracker

Aviation: Atoma Research; MPP primary research

Aluminium: MPP primary research; International Aluminium Institute, Innovations in the Aluminium Industry (2025)

Steel: MPP primary research; Rocky Mountain Institute (RMI); CISRI; LeadIT. (2026). Green Steel Tracker. Leadership Group for Industry Transition. https://www.industrytransition.org/green-steel-tracker/

Cement: MPP primary research; Historical data from: Lorea, C; Sanchez, F; Torres-Morales, E. 2025. Green Cement Technology Tracker, Version May 2025 (05/2025) , Stockholm, Dataset, https://www.industrytransition.org/green-cement-technology-tracker

Building clean industry

A route to resilience in a volatile world

Fossil fuel dependence is the weak link in global supply chains

In a world where crisis has become the norm, import-dependent industrial supply chains are suffering, affecting growth and livelihoods

The vulnerability of fossil fuels importers

Since the industrial revolution, economies have been powered primarily by fossil fuels. Yet many countries lack sufficient domestic fossil resources for their energy needs. This leaves them structurally dependent on imports, particularly oil and gas.

Today, around 75% of the world's population lives in countries that rely on imported fossil fuels to power their economies. For many, this dependence is acute: more than 60 countries import all of their oil, 89 import at least 80% and 65 countries import all their gas, 83 import 80% or more.[1]

This high reliance on imported fossil fuels creates a persistent vulnerability: these economies are exposed to higher and more volatile energy costs, increased energy insecurity and poverty. This, in turn, can constrain economic growth, fuel inflation and impact livelihoods.

Dependencies across industrial value chains

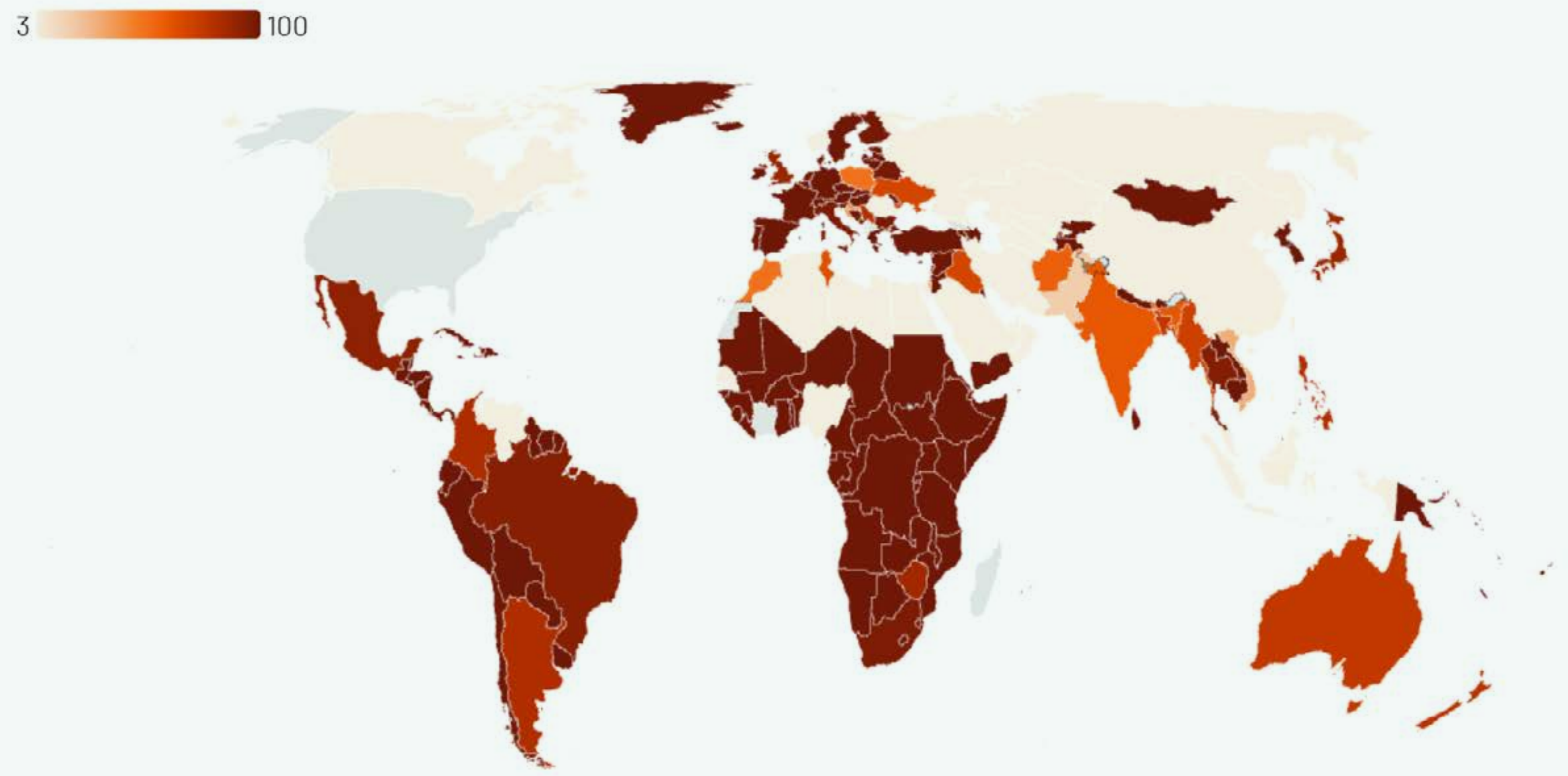
Fossil fuel dependence extends well beyond direct energy use by individual consumers. Industrial value chains are deeply exposed to fossil inputs, both as fuels and as feedstocks.

Many economies depend on fossil fuel imports not only for transport fuels, essential to move people and goods, but also for the production of key materials such as the steel, cement and aluminium used in buildings, infrastructure and defence; chemicals used to produce plastics for medical supplies, packaging and consumer goods; and the fertilisers that underpin food production. Oil and gas market volatility and disruptions can interrupt these supply chains, undermine competitiveness and even bring industrial production to a standstill.

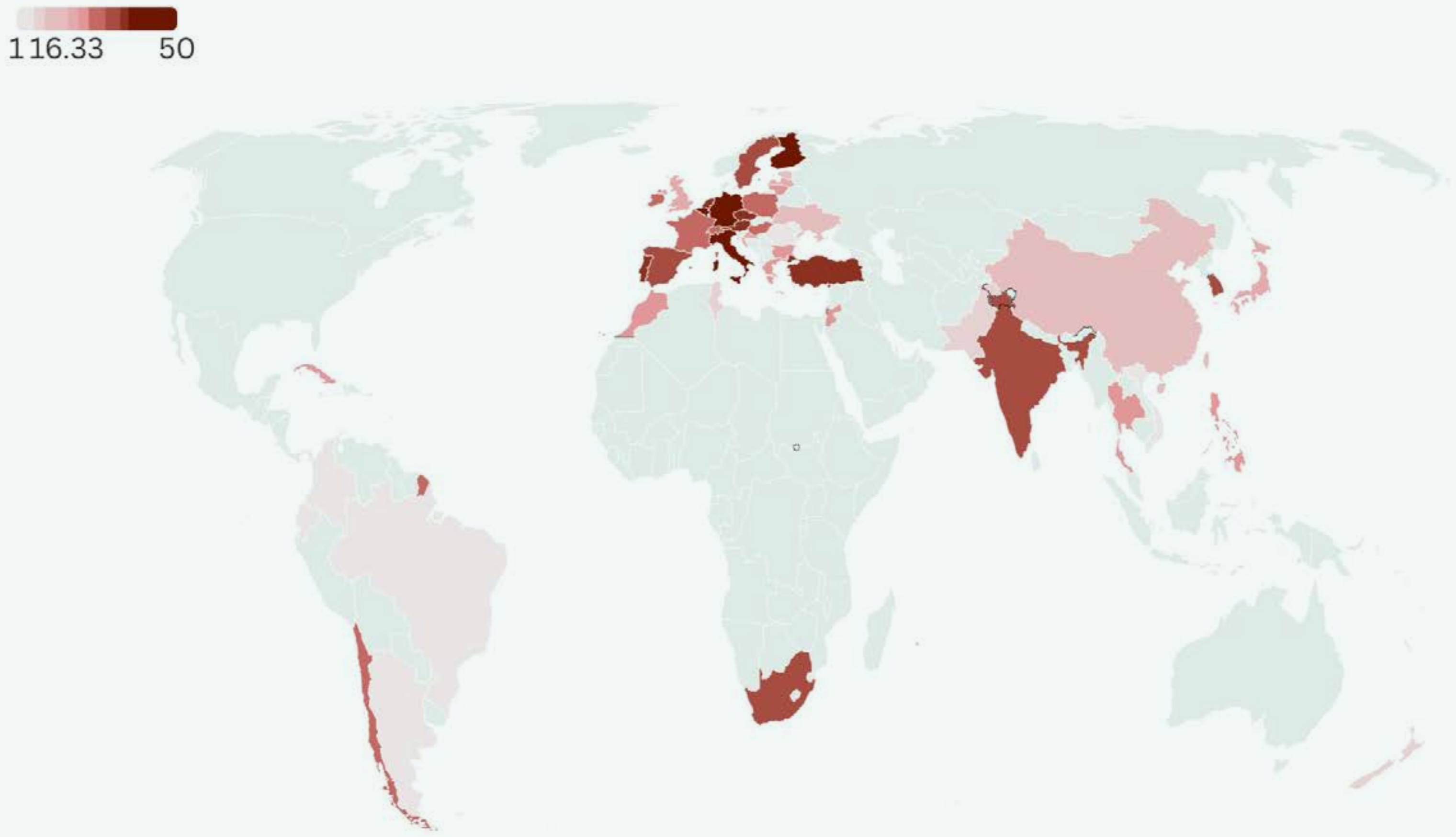
In many regions, particularly across the Global South, dependence on imported fertilisers and imported gas to produce fertilisers locally further amplifies exposure to global energy markets, extending vulnerability into food systems and weakening food security.

Dependence on external sources for energy and feedstock makes many regions highly vulnerable to global shocks

Fertiliser supply chain vulnerability index (2025, %)[2]



Vulnerability of industrial gas consumption in net gas importing countries (2023, %)[3]



1. Ember. "Three facts that show how solar and wind strengthen energy security", (April2025), Ember, The energy security fallout: from fossil fuel fragility to electric independence (March 2026). **2.** Data focuses on dependence on imported fertiliser and natural gas when defining vulnerability index because coal-based ammonia productionis primarily concentrated in China, which has a vast domestic coal supply **3.**MPP analysis based on IEA data; Estimated as Exposed Industrial Gas (EJ) = Total Gas Consumed (EJ) * Industrial Share % * Gas Import Dependency %; Estimation treats imported gas as proportionally distributed across all end-uses in the same ratio as total gas consumption. * Includes crude oil, NGLs, refinery feedstocks, additive/oxygenates (including biofuels) and other hydrocarbons (such as synthetic crude oil from oil sands) and petroleum products

Repeated energy crises create severe inflationary shocks

Energy shocks are not isolated; they ripple across every sector of the economy

Energy crises are not isolated events

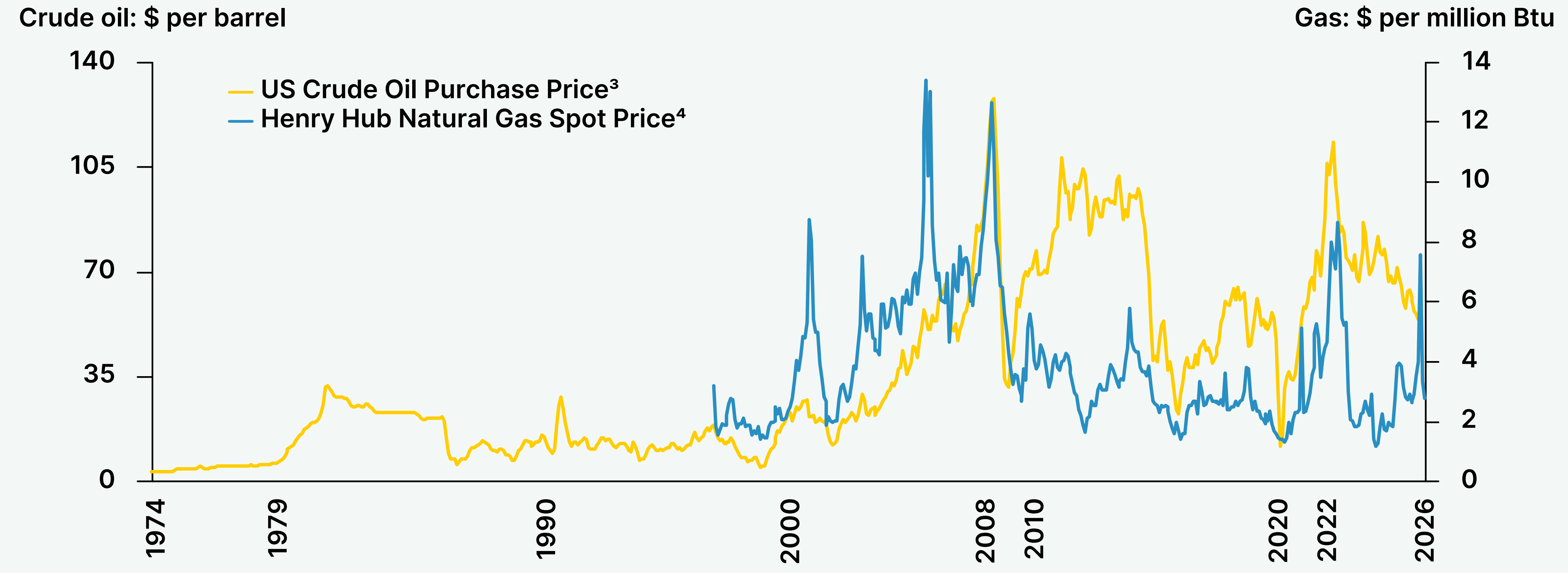
Since 2000, successive fossil energy shocks have translated into cost-of-living and industrial crises across the global economy. Oil and gas prices have been volatile for decades, with price spikes of 250-500% on a number of occasions. The COVID-19 crisis and Russia's invasion of Ukraine triggered sharp energy price spikes with cascading impacts across electricity, transport, food and industry. Most recently, escalating conflict in the Middle East, beyond its human and economic consequences, has again highlighted how exposed many economies remain to fragile fossil fuel supply chains. These crises reflect structural vulnerabilities that fossil fuel dependence creates and that repeatedly resurface through the disruption to supply chains caused by geopolitical tensions.

Inflationary shocks disrupt livelihoods and supply chains

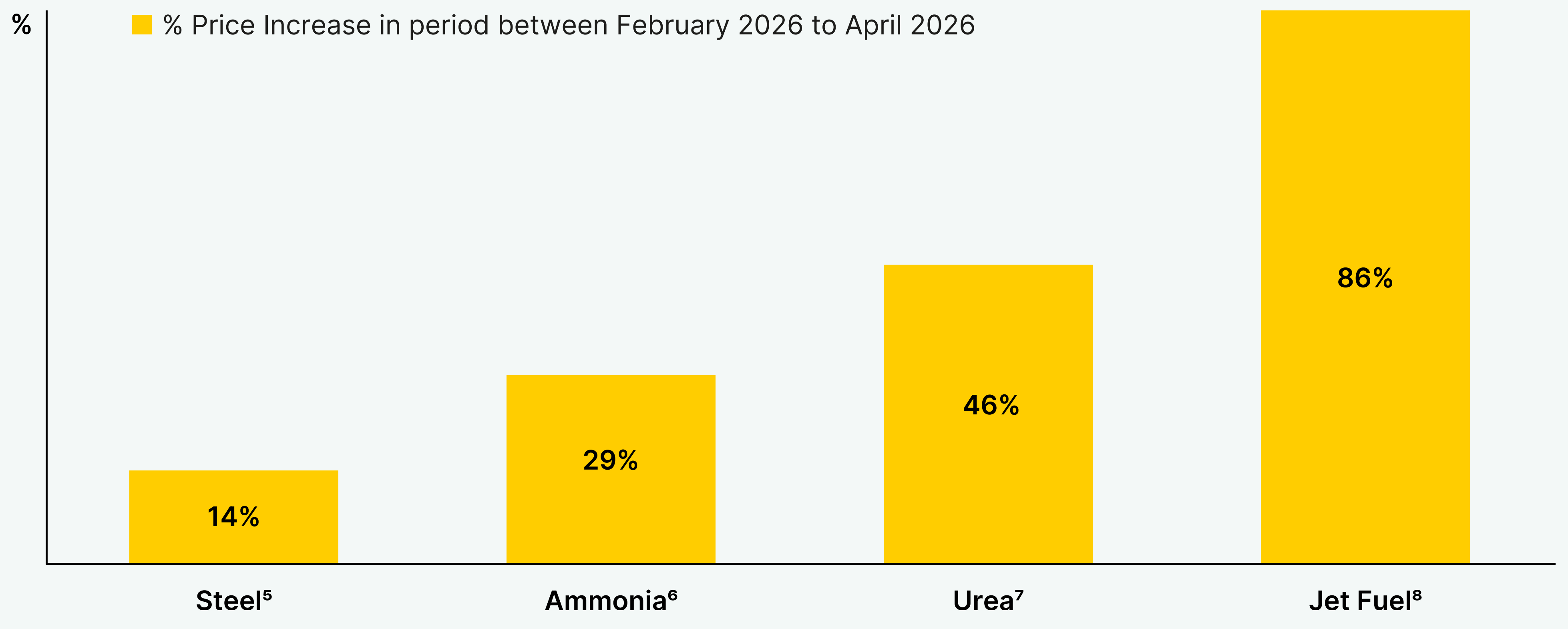
The recent conflict in the Middle East provides a stark example of the widespread inflationary shock of disruptions on oil and gas markets. Estimates of the likely impact on the global economy range from $300bn–$1.5tn.[1] In just weeks, prices surged and supplies dried up, triggering price spikes across many industrial commodities, either directly because of higher cost of fuels and feedstocks, or indirectly because of higher electricity prices. The downstream effects are expected to persist for months; experts note that impacts on the fertiliser supply chain and on food prices could extend for years.[2]

Fossil fuels in the US historically show volatile price fluctuations

US crude oil and natural gas prices over time, $USD



The recent Middle East crisis increased prices across sectors



1. "War darkens global economic outlook and reshapes policy priorities", IMF, (Apr 2026). **2.** "Chokepoint: How the War with Iran Threatens Global Food Security", Center for Strategic and International Studies (CSIS), (Mar 2026) **3.** "U.S. Crude Oil First Purchase Price", EIA (Apr 2026) **4.** "Henry Hub Natural Gas Spot Price", EIA (Apr 2026); **5.** Hot Rollled Coil used as proxy for crude steel price benchmark, calculated global price increase for period between Feb 2025, 2026 to April 30, 2026, source:"Hot Rolled Coil", Trading Economics (Apr 26) **6.** US based price increase of anhydrous ammonia cited for period between Feb 16 ,2026 to Apr,13 2026.: "Middle East Ceasefire Fails to Ease U.S. Fertilizer Price Pressure on Farmers", Successful Farming (Apr 2026) **7.** Calculated global urea price increase for period between Feb 25 2026 to April 30 2026; , source: "Urea", Trading Econoomics (Apr 2026) **8.** Calculated price increase of average jet fuel for major metropolitan cities in the US in period between Feb 25 2026 to April 30 2026, source: Argus U.S. Jet Fuel Index, Argus Media (Apr 2026)

At $2 tn per energy crisis, clean industry offers a path to greater stability and resilience - a macroeconomic insurance policy

Upfront costs to transform energy-intensive industries are high, but investments can be planned and ongoing operations are less than 1% of GDP[1,2]

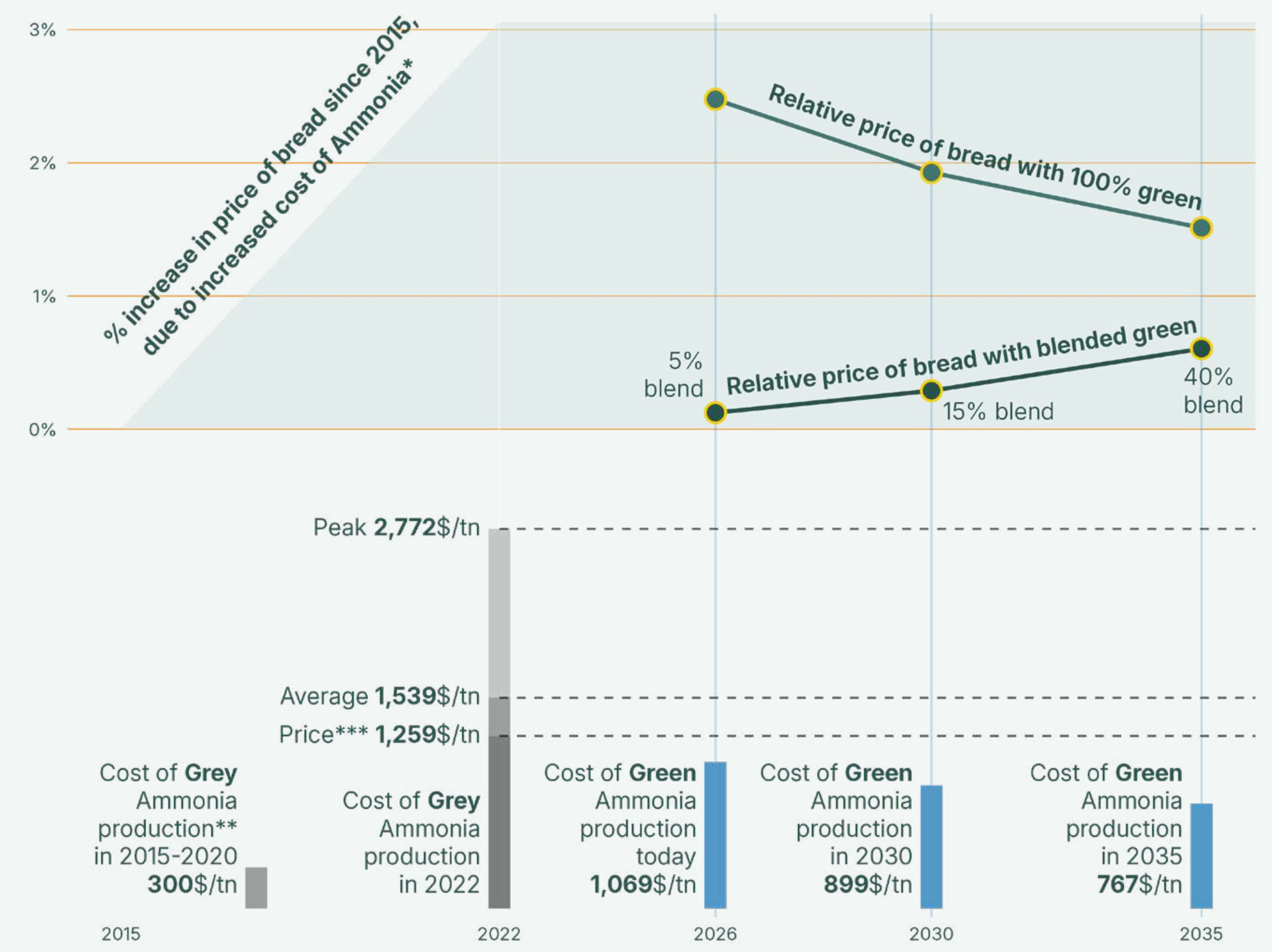
Towards cleaner and more resilient supply chains
In a world of persistent disruption, it is just as critical that industrial supply chains are stable as that they are competitive. The fertiliser supply chain offers the most compelling example. In recent shocks, energy-driven disruptions have been linked to jumps in fertiliser production cost, leading to, for example, bread price increases of several percentage points (>3%), disproportionately affecting lower-income households in import-dependent economies. Climate impacts further amplify food insecurity by reducing yields and disrupting supplies. IPCC shows that climate impacts could increase global food prices by up to 84% by 2050,[3] and that climate driven events are already causing widespread production losses and will heighten food system volatility.[4]

A progressive shift to green fertiliser production would raise prices modestly, at a controlled pace that can be designed to be manageable – starting with lower percentages of substitution today and increasing over time as prices comes down. This transition would both reduce the exposure of local food production to volatile global fossil fuel markets and contribute to reducing greenhouse gas emissions of a sector – fertiliser production – that currently represents 1-1.3% of global emissions.

Clean industry as a macroeconomic insurance
At the macroeconomic level, the contrast is even starker. Fossil energy crises and climate-related crises impose large, unplanned economic costs through spikes in inflation, fiscal pressure and deteriorating trade balances. Recent energy crises have generated trillions of dollars in economic damage, while climate impacts have reached over $2tn a year in recent years.

While the clean energy transition requires substantial investment (~$3.5tn per year), it has a fundamentally different cost profile. Investments can be planned and phased over time, rather than be unexpected and destabilising.[5] Ongoing operational costs are concentrated in a limited set of industrial sectors, remain small relative to GDP (~0.5% of GDP) and will come down over time thanks to technology learnings and economies of scale.[6]

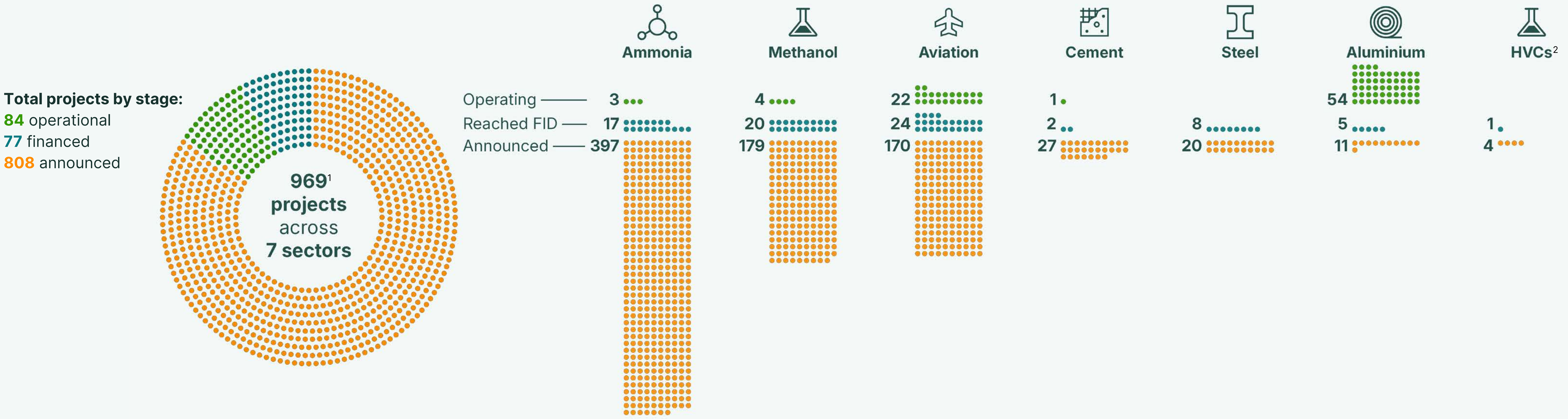
Clean commodities have smaller, more predictable price effects vs grey counterparts



* The fluctuations between 2015 and 2022 are not captured in this graph; the slope highlights the difference between the start and end of this period | ** Average cost of production over this period | *** Price with producers operating at a loss

Sources: MPP analysis based on World Bank (2025), Business Analytiq, Argus, S&P, Czapp.
Notes: 1. Assumed average exchange rate of 1 EUR = 1.08 USD; **2.** Costs depend on the production location within Europe. Sweden and Spain have been used as examples here. **3.** Porter, J. R., et al. Food security and food production systems Impacts, Adaptation and Vulnerability (WGII, Chapter 7, (2014); **4.** IPCC. (2023). Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report, used in MPP analysis to calculate impact on bread price. **5.** McKinsey Global Institute. (2022). The net-zero transition: What it would cost, what it could bring. **6.** ETC.(2020). Making Mission Possible: Dilivering a Net-Zero Economy **7.** Figures shown on the graph are median values. Depending on the location, the production cost of green ammonia is estimated to be ± 25% today, ± 45% in 2030 and ± 45% in 2035. That range in green production cost translates into a range for the relative price of bread. For both 100% green ammonia use and partial green blending, bread price increase are given with a range of ± 35% for today, ± 70% in 2030 and ± 70% in 2035.

Clean industry rising: 161 landmark commercial-scale, deep decarbonisation projects are now financed or built worldwide, with a further 800+ in development



1. Projects include in-scope Category 1: Deep Decarbonisation projects only. For further definition on scoping please refer to methodology section; **2.** HVC: High value chemicals include Olefins (Ethylene, Propylene, Butadiene) and Aromatics (Benzene, Toulene, Xylene)
Source: MPP Global Project Tracker

From raw materials to finished goods: new industrial value chains are emerging – creating growing opportunities for countries, companies and investors

Clean technology provision: Clean technology for industry is a new investment frontier.

There is a ~$4.7 trillion investment opportunity up for grabs for project developers and technology suppliers: ~$1.5 trillion of direct investment in industrial plants (including equipment such as electrolysers, ammonia loops, furnaces, fuel refining...) and ~$3.2 trillion in associated renewable energy build-out (renewables, batteries). China, Europe and the US are leading the technology race to date.

Clean commodity production: Project pipelines are progressing in old and new industrial powers.

Global production of clean fuels, chemicals and materials is progressing. Final investment decisions (FIDs) are on the rise with an unprecedented 19 new projects unlocked in the past six months. China is in the lead, followed by Europe. Countries of the new industrial sunbelt benefit from their renewable energy potential and hold a third of the global pipeline.

Clean markets: Countries with the biggest demand for fuels, chemicals and materials have the power to shape their value chains.

China, India, Europe and the US are the most prominent market-shapers. Through their industry and trade policies, they can decide what they want to produce domestically, what they are happy to import, from whom and with which technologies. By scaling their lead markets for low-carbon products simultaneously, they can also precipitate global cost tipping points.

Trade alliances are key to resilient and cost-competitive value chains. By combining the respective competitive advantages of different countries across three stages of the value chain (technology, commodity production and proximity to end markets), they can establish lower-cost, stable, clean industrial value chains which cement long-term economic power.

Aviation fuel

Clean commodities

An accelerating opportunity for industrial players old and new

Clean commodity pipelines are maturing – reshaping industrial leadership

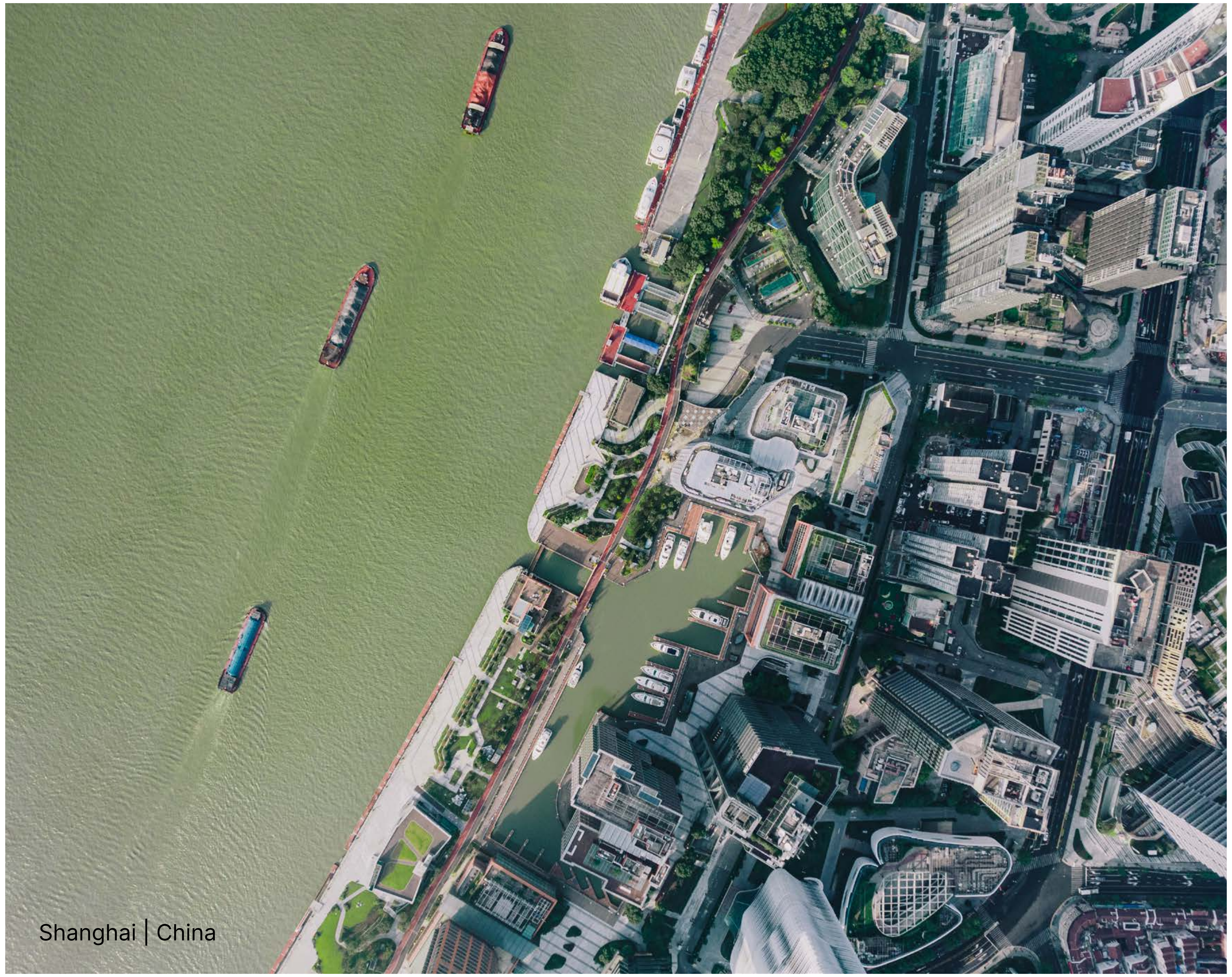
Across regions the clean industrial revolution is taking shape: China is scaling, Europe is in transition and the New Industrial Sunbelt can convert its clean energy resources into clean industrialisation

The pipeline of projects is large and maturing
Clean industrial project pipelines now span every continent. The number of projects reaching final investment decisions is accelerating – with a record 19 new FIDs between November '25 and April '26 – bringing the total number of projects passed FID to 161.

China continues to scale
Project data shows China is widening its lead, closing 13 FIDs in the last six months, compared with three in Europe and one in the US. It now concentrates 45% of projects passed FID. China's emergence as an 'electro-state' is reflected in its industrial pipeline, dominated by both direct electrification and indirect electrification through hydrogen-based production routes; while use of locally available biomass also contributes to its strategy of energy diversification.

The Sunbelt can industrialise
At the same time, emerging countries that are part of the New Industrial Sunbelt, such as India, Brazil, Egypt and Chile, leverage strong renewable energy endowments to underpin growing clean industry project pipelines. This leaves them well placed to turn clean energy advantage into green industrialisation, reducing dependence on oil and gas imports across fuels, materials and food systems, while opening up new export opportunities. India has stepped up the pace, increasing its announced pipeline by 30% in the last six months.

Leadership is anchored in domestic renewable resources and diversified supply chains
A third of the global project pipeline is in the New Industrial Sunbelt, showing that clean industrial leadership is often grounded in access to low-cost, domestic renewables. Regions with more limited renewable scale-up potential, such as Europe, tend to pursue a more diversified portfolio of technology options – including electrification, hydrogen, biomass and carbon capture – underpinned by a mix of domestic energy resources and diversified imports.

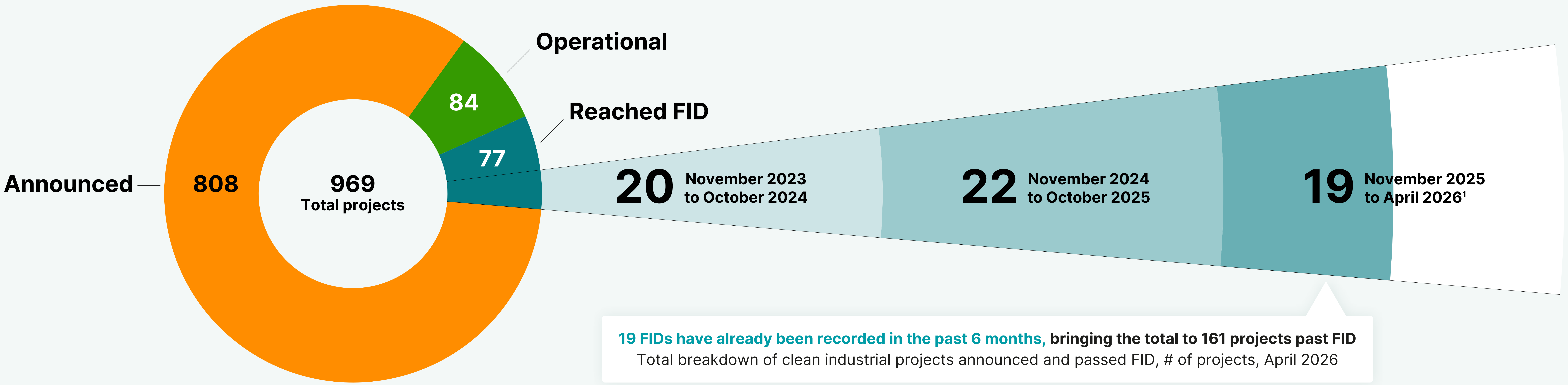


Shanghai | China

A record 19 projects reach financial close in six months. The transformation is on.

Momentum is building and 2026 is on track to be the biggest year to date.

19 new final investment decisions (FIDs) on commercial-scale, deep-decarbonisation projects have been recorded since November 2025. This is double the number of projects announced in the same period in the previous year (eight FIDs between November '24 – April '25).



19 FIDs have already been recorded in the past 6 months, bringing the total to 161 projects past FID
Total breakdown of clean industrial projects announced and passed FID, # of projects, April 2026

1. 19 only represents the first half of the 2026 year. Projected number for Nov 25 – Oct 26 would be double assuming a consistent rate
* Note that given updates in the pipeline figures and methodology, comparisons against the previous Tracker are not directly made. Pipeline changes include newly sourced data, project pauses and cancellations. For full methodology, see Appendix.
Source: MPP Global Project Tracker

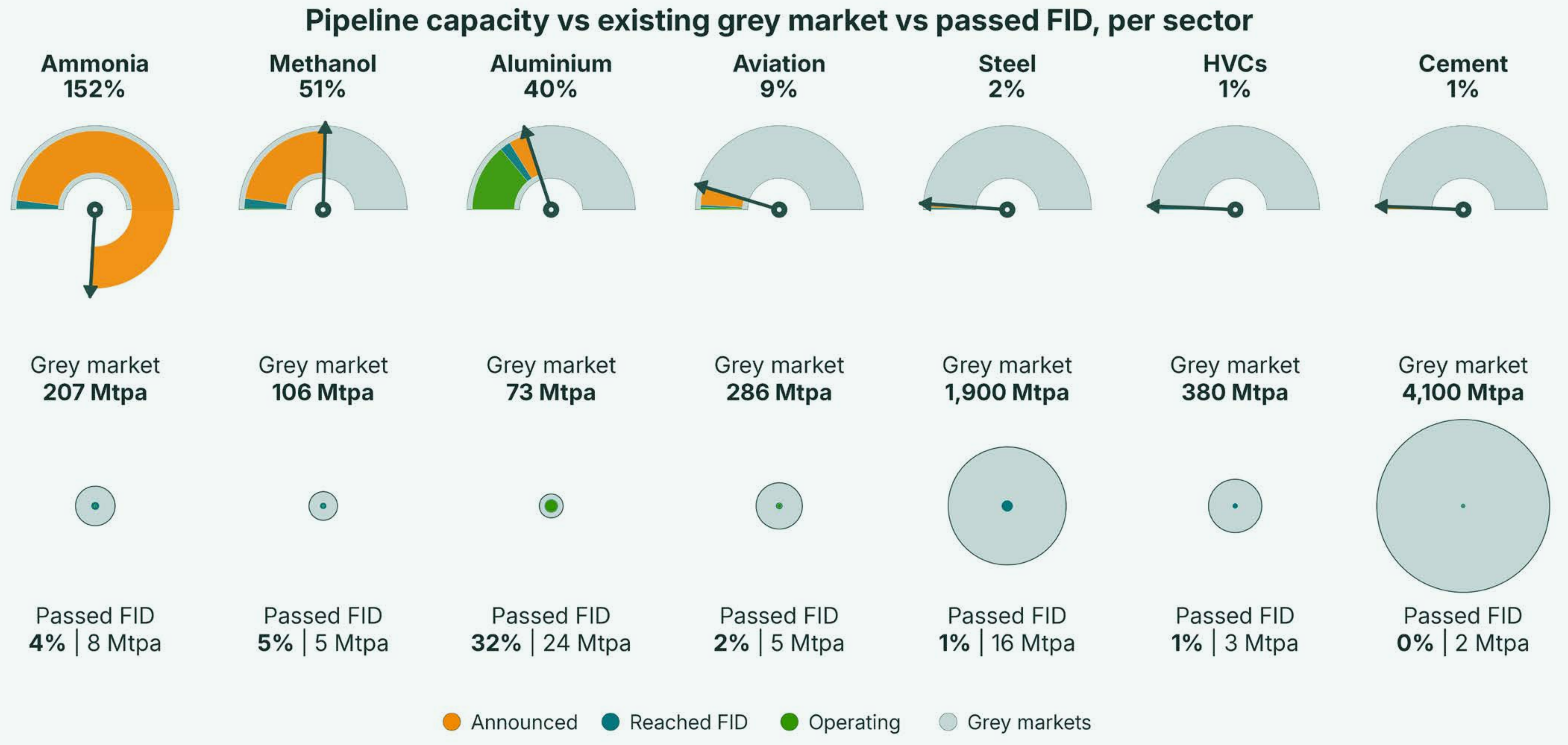
Progress in chemicals and fuels moves up a gear, but remains limited in materials sectors

Fuels and chemicals continue to lead project and investment momentum. Out of the 19 new FIDs delivered in the past six months, 16 were in the fuels and chemicals sectors: nine methanol, four sustainable aviation fuel and three ammonia projects.

The ammonia pipeline alone covers about 1.5x global ammonia demand (including IMO projected shipping demand by 2030). Methanol projects cover roughly 50% of demand (also including shipping projections). Importantly, projects passed FID will soon cover nearly 5% of global demand in both sectors.

Materials sectors are slower to progress.
Only one steel and two aluminium FIDs are recorded in the first part of 2026, all in China. Aluminium stands apart because many legacy smelters are already powered by hydropower, giving it a head start on low-carbon production. However, the sector has seen limited shifts from grey to green in recent years outside of China. Beyond aluminium, clean steel and cement projects that have reached FID represent only ~1% or less of current grey demand. And at this stage of the transition, even modest additions to clean steel and cement volumes could unlock technology learning and cost reductions.

Fuels and chemicals continue to lead the transition
Project pipeline capacity by sector and project stage, Mtpa, April 2026



Source: MPP Global Project Tracker, MPP analysis

China is scaling rapidly, preparing for industry dominance, while India is also accelerating

The industrial order is being reset and opening the window for players old or new to decouple from unstable fossil fuels

China is moving fast.
China accounts for 21% of the total global clean-industry pipeline – a number likely underestimated due to lack of visibility on early-stage projects compared to other geographies – and 45% of projects passed FID, reflecting sustained scale-up across fuels, chemicals and materials. Since November, China has unlocked 13 of the 19 new global FIDs, representing >60% of all FIDs reached in the last six months, a similar share as for FIDs achieved in 2024 and 2025. Pipeline momentum and recent FID activity indicate continued acceleration in the new clean economy as China positions itself for global leadership.

Europe is showing progress, but conversion remains slower.
Representing 26% of the total global pipeline and 24% of passed-FID capacity, Europe saw three new FIDs in the past six months, equivalent to 16% of recent global investments. All these new FIDs were concentrated in the aviation sector, which benefits from the EU's blending mandate driving predictable demand for Sustainable Aviation Fuels.

The New Industrial Sunbelt has superb potential to scale, but FIDs remain limited.
Renewables-rich Sunbelt countries account for 39% of the total global pipeline, yet only 12% of projects passed FID. So far in 2026, two FIDs have been unlocked – two ammonia projects in Thailand and Paraguay – equivalent to 11% of recent global FIDs. These countries' energy advantages will only translate into new clean industries if they can convert their promising pipelines into realised investments.

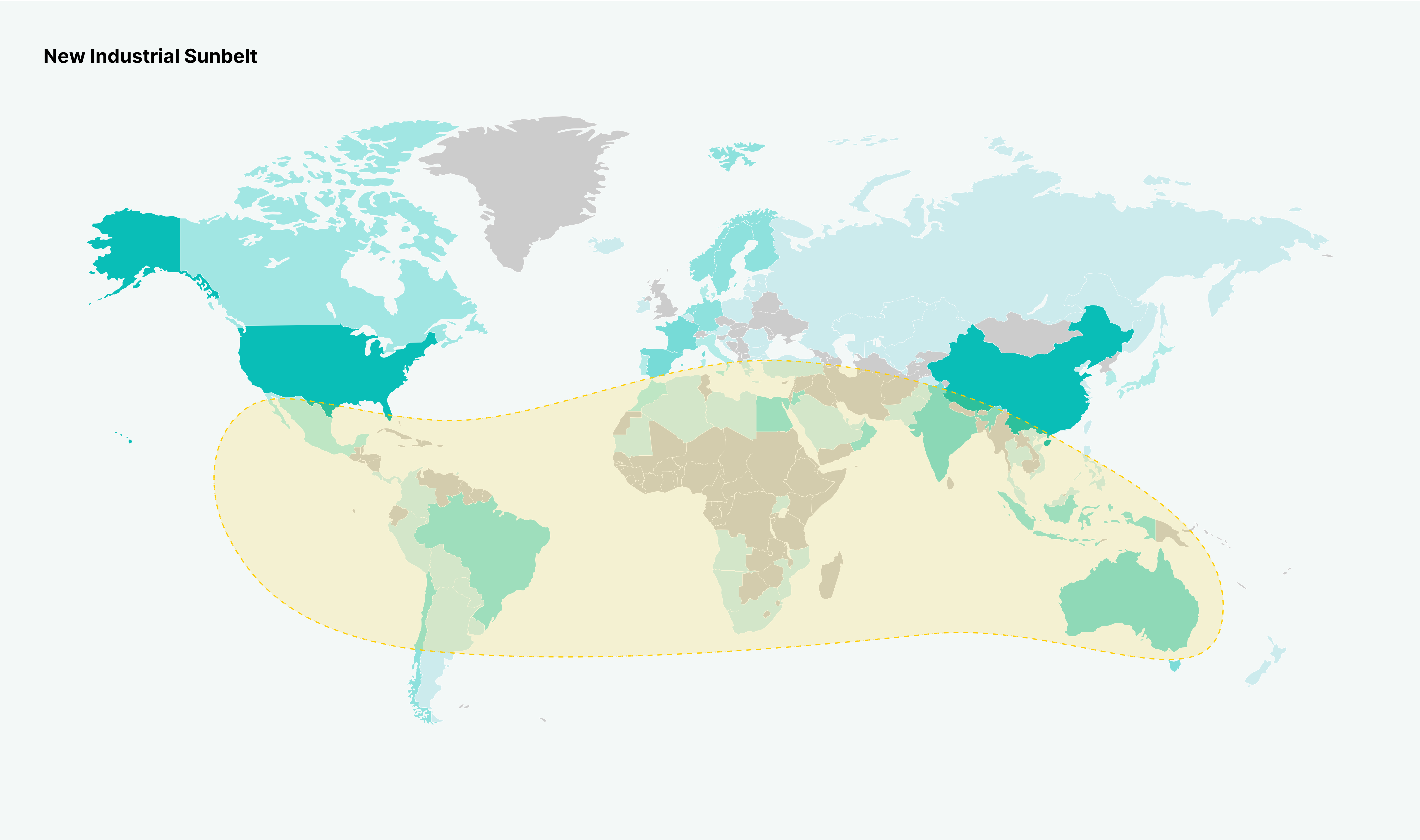
Project financing in the United States is losing momentum.
The United States has a significant pipeline, but is losing relative momentum. Its pipeline of announced projects has dropped from 92 to 72 in the past 12 months. The US holds 9% of the global pipeline and represents 7% of projects passed FID and only one new FID in the last six months.

Source: MPP Global Project Tracker, MPP analysis

Countries leading in clean industry development can reduce fossil fuel dependence, diversify their economies – or both

Governments are leveraging the development of clean industry to pursue diverse strategic objectives, including domestic resilience and economic diversification, depending on their fossil fuel exposure. Among the top 20 clean industry leaders by size of pipeline, examples include:

- Renewables-rich countries that have historically been disproportionally exposed to volatile fossil fuel imports, including:
  - Emerging countries of the sunbelt such as India, Chile and Morocco – with four projects already unlocked, India's pipeline has jumped from 47 to 61 planned projects in the past six months, making it the third-largest (65 projects) overall; and
- Countries with significant hydropower, such as Finland and Sweden. Their clean industry pipelines now represent a chance to turn domestic clean energy resources into energy security and new industrial capacity to both serve their domestic markets and pursue new export markets;
- Countries highly dependent on fossil fuels imports which can reduce their fossil fuel dependence through a shift to clean industry, even though they may need a diversified mix of domestic and imported clean energy sources to underpin this transition, such as France, the UK, the Netherlands, or Germany;
- Fossil-rich countries that can diversify their economies by leveraging their renewable energy potential – solar, wind, or hydro – to develop clean industrial production, at this stage often alongside fossil-fuel-based value chains. These include developed economies such as the United States, Canada and Norway, as well as emerging economies like Egypt or Oman.



Clean industrial pipeline leaders include countries with high fossil fuel exposure as well as net fossil fuel exporters with favourable natural endowments

% of net fossil fuel imports (2023), # of projects, April 2026

Imported Gas share	Imported Oil share	Imported Coal share	Country	Total projects	Announced	Passed FID
40%	73%	7%	China	243	Announced 170	Passed FID 73
-	20%	5%	United States[1]	84	72	12
48%	87%	25%	India	65	61	4
-	-	-	Australia[2]	46	45	1
99%	99%	95%	Spain	45	41	4
-	-	-	Canada	42	32	10
97%	99%	98%	France	37	34	3
5%	-	15%	Brazil	34	31	3
-	-	90%	Norway	28	20	8
-	-	80%	Egypt	25	25	
55%	50%	95%	United Kingdom	21	19	2
-	-	-	Oman	20	19	1
100%	100%	90%	Finland	20	19	1
100%	100%	80%	Sweden	16	13	3
100%	99%	98%	Chile	16	16	
90%	97%	95%	Netherlands	14	10	4
100%	100%	98%	Morocco	14	14	
80%	100%	100%	Jordan	14	14	
100%	100%	100%	Portugal	11	10	1
14%	52%	109%	Denmark	11	11	

Non-EMDE in the new industrial sunbelt

EMDE in the new industrial sunbelt

Where no Imported Share value is stated, the country is a Net Exporter

1. The United States is net importer of crude oil while still being a net exporter of refiner products since many of its refineries are built to process heavy crude as opposed to lighter crude produced within the country. The US also imports small amounts of coal due to chemical and physical properties of coal needed for end users such as steel **2.** Australia is a peculiarity due to its high dependency on imports for refined products even if it's a net oil (light crude) exporter due to a lack of refining capacity and lack of heavy crude required for fuel production; **Source:** MPP Global Project Tracker; IEA, World Energy Balances, (2023); * Oil defined as crude oil, NGLs, refinery feedstocks, additive/oxygenates (including biofuels) and other hydrocarbons (such as synthetic crude oil from oil sands)

Technology choices across projects show that countries align their industries with their natural endowment

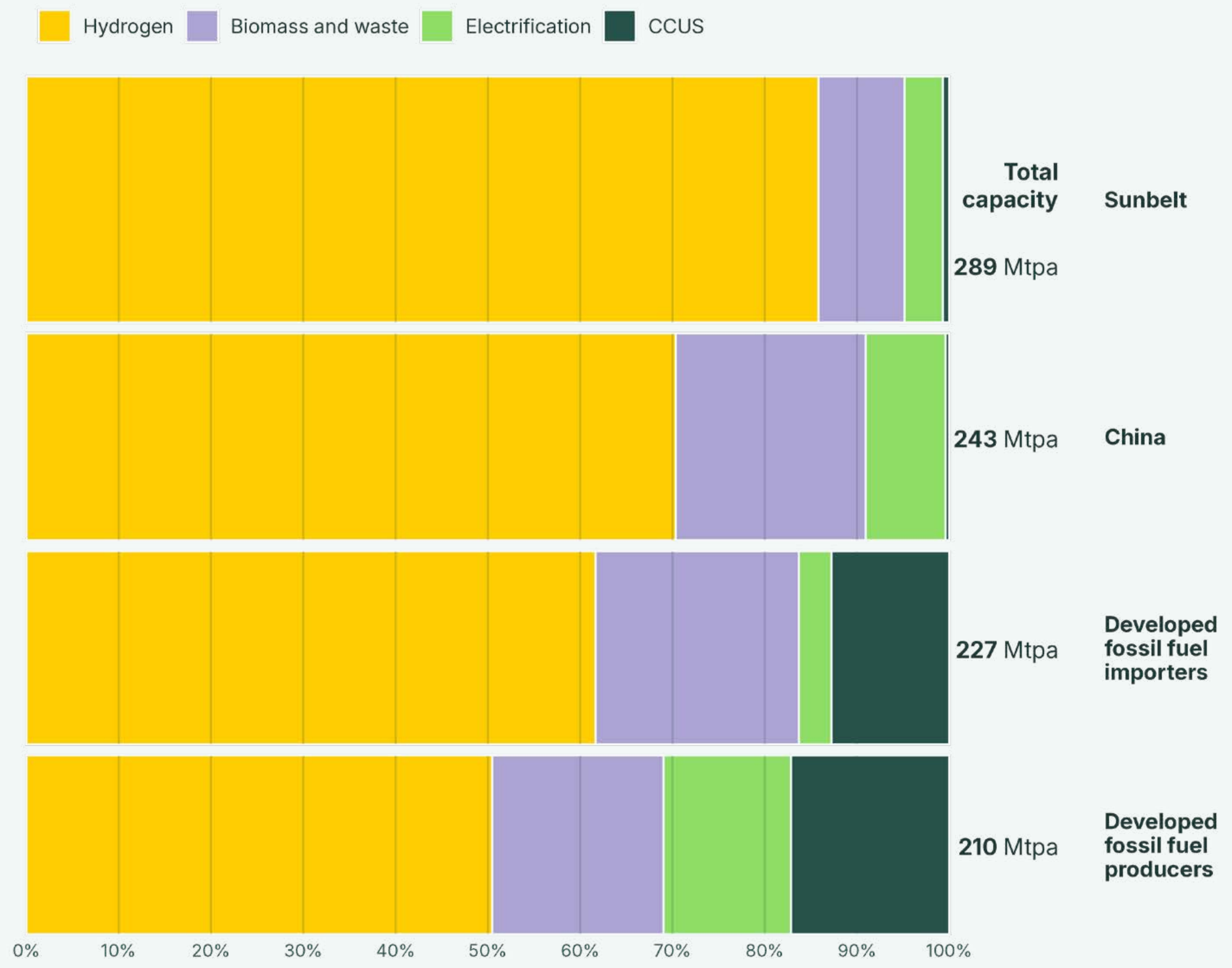
Countries of the New Industrial Sunbelt predominantly pursue direct and indirect electrification projects, with green hydrogen representing 86% of their projects. This reflects their strong competitive advantage when it comes to providing abundant, cheap, clean electricity to energy-intensive industrial players.

China is similarly curbing its dependence on fossil fuels by doubling down on direct and indirect electrification (hydrogen representing 69% of known projects) alongside some use of biomass (21%) for further diversification.

Developed economies that are currently net fossil fuel importers pursue a more diversified portfolio. Hydrogen-based projects dominate their pipeline (62% of projects). Such projects would enable these countries to reduce dependence on volatile fossil fuels while likely being served by a mix of domestic hydrogen production and diversified imports. Hydrogen-based projects are complemented by projects using biomass and waste (24%) and carbon capture (13%).

Developed economies that are fossil fuel producers also pursue a diversified portfolio, but with a higher share of carbon capture projects (17%) leveraging their preexisting fossil fuel value chain. These countries also have a higher share of direct electrification projects (14%) compared to other developed economies, reflecting their additional natural endowments: solar in Australia, hydropower in countries such as Canada, Russia, or Norway, which hold a significant share of legacy low-carbon aluminium smelters and a diverse renewable energy mix in the United States.

Hydrogen-based projects are the most prolific announced projects globally, especially in renewables-rich regions

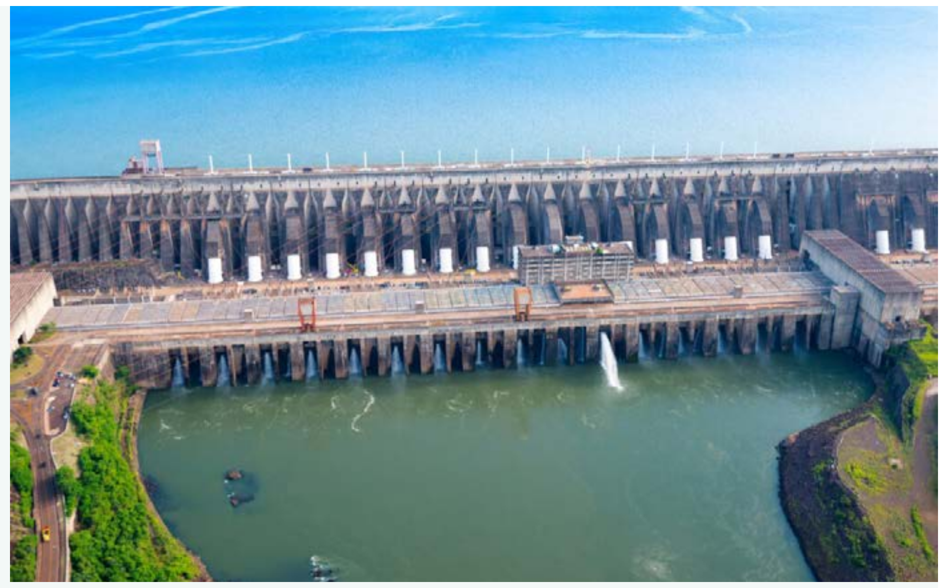


1. New Industrial Sunbelt regions include: SE Asia, India, Brazil, MENAT, LatAm. Sub-Saharan Africa and Other Asia (Pakistan, Uzbekistan, Kazakhstan) **2.** Developed Fossil Fuel Importers include EU, UK, Iceland, Ukraine, Japan and South Korea. **3.** Developed Fossil Fuel Producers include the US, Canada, Russia, Australia and Norway. **Source:** MPP Global Project Tracker

Projects that have reached FID in 2026 illustrate how local clean energy supply drives competitive advantages

Fertilisers

ATOME – Villeta[1]



Location
Villeta, Paraguay.

Project status
Reached FID,
April 2026

Capacity
0.1 Mtpa

Production route
Alkaline electrolysis

Description
In April 2026, ATOME reached final investment decision with a combination of debt and equity funding for its $650m Villeta plant in Paraguay. It is entirely commercially funded. Full operations are expected by 2029.

Clean energy supply
145MW low-cost hydroelectric power long-term supply secured

Offtake
100% secured to Yara International

Sustainable Aviation Fuels

SkyNRG – DSL-01[2]

Location
Delfzijl, Netherlands

Project status
Reached FID

Capacity
0.1 Mtpa SAF

Production route
HEFA

Description
In February 2026, SkyNRG reached financial close and started construction for its SAF production facility DSL-01 at the Delfzijl chemical park in the north of the Netherlands.

Clean energy supply
Residual fats and greases as feedstock for SAF production

Off take
KLM – Royal Dutch Airlines is the primary offtaker, for 75% of the produced volumes

Methanol

Goldwind – Green Methanol[3]

Location
Inner Mongolia, China

Project status
Reached FID for phases 1, 2 & 3)

Capacity
0.25, 0.6, 0.725 Mtpa respectively for phases 1, 2 and 3

Production route
Electrolysis + gasification (biomass)

Description
In April 2026, the groundbreaking ceremony for the Goldwind project was held in Xing'an League, Inner Mongolia. Phase 1 has been commissioned, phase 2 is under construction, and phase 3 has reached FID.

Clean energy supply
World's first large-scale wind-powered green methanol project

Offtake
long-term agreement with A.P. Moller-Maersk for 0.5Mt/yr.

1. Kleinschmidt, ATOME reaches FID for Villeta Green Fertilizer Project, World Fertilizer (2026), image source: 145MW Villeta - ATOME - The Commodities Of The Future, Today **2.** SkyNRG announces Financial Close and starts construction on its first Sustainable Aviation Fuel plant DSL-01 in Delfzijl the Netherlands, SkyNRG (2026); **3.** Goldwind Technology's Green Methanol Production Project Officially Launched, Seetao (2024). **Source:** MPP Global Project Tracker, Developer interviews

Case Study: LanzaJet Freedom Pines Fuels | the next generation of fuel

For the aviation sector, the transition to sustainable fuels is just getting started, but it is one of the areas where progress is fastest, with eight projects reaching FID in the past 18 months.

With the physics of air travel ruling out electrification as an option for all but short-haul flights, it is clear that the key to decarbonising air transport lies in sustainable aviation fuel (SAF).

This can be produced from a number of feedstocks and most first generation SAF has been produced from waste fats, oils and greases through a process known as HEFA (Hydroprocessed Esters and Fatty Acids). While this has kick-started the industry, it is widely acknowledged that there will not be enough feedstock for HEFA-based SAF to meet the needs of the industry.

And so the industry is already looking beyond oil-based feedstocks for second-generation fuels. One of the most promising – and advanced – technologies is alcohol-to-jet (AtJ), which has a number of production facilities in the pipeline, with multiple announcements since 2024. AtJ's advantage is that it uses ethanol, which can be produced using a wider range of feedstocks including municipal waste and industrial emissions, giving it flexibility to use the resources most available in different regions.

One of the leaders in SAF – across a range of technologies and in AtJ in particular – is LanzaJet, which was spun out of the carbon recycling company, LanzaTech, to enable it to focus entirely on scaling up production of second-generation SAF. "We had created a company that was scaling the biotech to make ethanol from wastes and the skills that we needed to scale alcohol to jet were different to what we had at the time, so our goal was to create a separate company to focus on that," says Freya Burton, LanzaTech, Chief Sustainability Officer.

LanzaJet has an exclusive licence to use its technology to produce AtJ, a pathway that LanzaTech started developing in 2010 and received ASTM approval for in 2018, when the first proving flight with SAF took off from Orlando to Gatwick.

LanzaTech itself is focused on capturing emissions from sources including industrial facilities, direct air captured carbon, agricultural and forestry wastes, regenerative energy crops and municipal solid waste and turning that into ethanol. Then LanzaJet takes the ethanol and converts it into drop-in SAF using a proprietary ethanol-to-SAF technology process.

This fuel has, on average, 85% lower life cycle emissions than conventional jet fuel and it can be carbon-negative depending on the feedstock.

LanzaJet has opened the world's first facility to produce SAF from ethanol, the Freedom Pines Fuels project in Georgia, USA. It believes that its first mover advantage – and the experience it is gaining in actually running a production facility – will provide valuable lessons for scaling up AtJ. →

Case Study:
LanzaJet Freedom Pines Fuels | the next generation of fuel

It is innovating not just in the production process but also in its business model. It is offering an AtJ-as-a-service tolling model. Investors secure feedstock and send it to Freedom Pines Fuels, where LanzaJet processes it to produce jet fuel and then provides it to an offtaker, who is often the investor. "It's kind of like bringing your ingredients to a bakery, paying the baker to bake the cake and then taking the cake back," says Meg Whitty, LanzaJet, VP Corporate and Government Affairs. "This reduces risks for the parties involved. It guarantees access to production capacity, you own the feedstock and you own the finished product. It creates more predictable costs and transparent margins."

It also enables LanzaJet to share the significant technology risks it is taking with its investors and gives it reassurance that it will have buyers for its SAF production. The company's partners include Shell, British Airways, Microsoft, Mitsui, Airbus, Southwest, ANA and MUFG, a roster of heavyweight investors that can support it with offtake, logistics, financing and market credibility. "It's been critical for us to pull in partners up- and downstream and across the entire value chain that really understand this market and can help us build it," says LanzaJet's Meg Whitty.

One of its most important partners is IAG, parent group to airlines including British Airways and Iberia. It was a first mover among airlines in developing SAF projects and has a target to achieve 10% SAF usage by 2030 and net zero emissions by 2050. It says that it is taking a diversified approach, spreading its risks across different geographies, technologies and suppliers.

But its offtake agreement with LanzaJet, in which it is also an investor, is a crucial vote of confidence in the company and in AtJ as a technology. "We think that advanced SAF using waste biogenic materials is a better way of doing it," IAG's Jim Davies, Programme Director – Sustainable Flight says. "And that's why we invested heavily into Freedom Pines Fuels."

Demand for SAF has been underpinned by mandates in a number of markets, particularly the EU and the UK, but also a number of Asian countries such as Singapore, Japan, India and Thailand. IAG's offtake agreement with Freedom Pines Fuels allows its British Airways subsidiary to secure a supply that will help it meet the UK's second generation SAF mandate, which prioritises waste residues (household waste, forestry residues) and AtJ technologies.

Mandates have been successful in spurring supply growth – the EU's ReFuelEU Aviation mandate requiring SAF blending to rise from 2% in 2025 to 6% by 2030 and 70% by 2050 has created predictable, binding demand and that has translated directly into project investment. The cumulative production capacity of projects past FID has more than doubled since the mandate was introduced in 2023. However, there is still some disquiet about the design of mandates and their implementation. "Mandates are helpful, but they can be quite distortive if countries have mandates but regulate in different ways," says IAG's Jim Davies.

Nonetheless, for LanzaJet, Freedom Pines Fuels is very much the starting point, with further projects under way in the UK, Australia, New Zealand, Japan and India and with LanzaTech also building integrated ethanol to SAF plants in the UK and an ATJ facility in Belgium (across from the ArcelorMittal ethanol production facility, Steelanol, that uses LanzaTech technology to make ethanol from steel mill emissions). The recent geopolitical upheaval has again surfaced the importance of domestic energy security, Meg Whitty of LanzaJet adds, "It creates a sense of urgency around the necessity of airlines and fuel producers being local."

Challenges remain in scaling up SAF production, including market risk, political and regulatory uncertainty and the need for offtake agreements to unlock capital and scale up production in a sector that works on much shorter timeframes when it comes to sourcing fuel.

And yet drivers of the sector are strengthening – in a world of increasing geopolitical volatility, home-grown SAF production using domestic feedstocks has real benefits in terms of security of energy supplies, economic resilience and protection from price shocks. LanzaTech, LanzaJet and their partners have shown what is possible, if projects like this are replicated, they will not just bring resilience but will open huge economic and industrial opportunities for communities worldwide.

Aluminium

Clean technology

A new investment frontier opens

Clean technology leadership will determine who captures the ~$4.7tn opportunity in equipment for clean industry

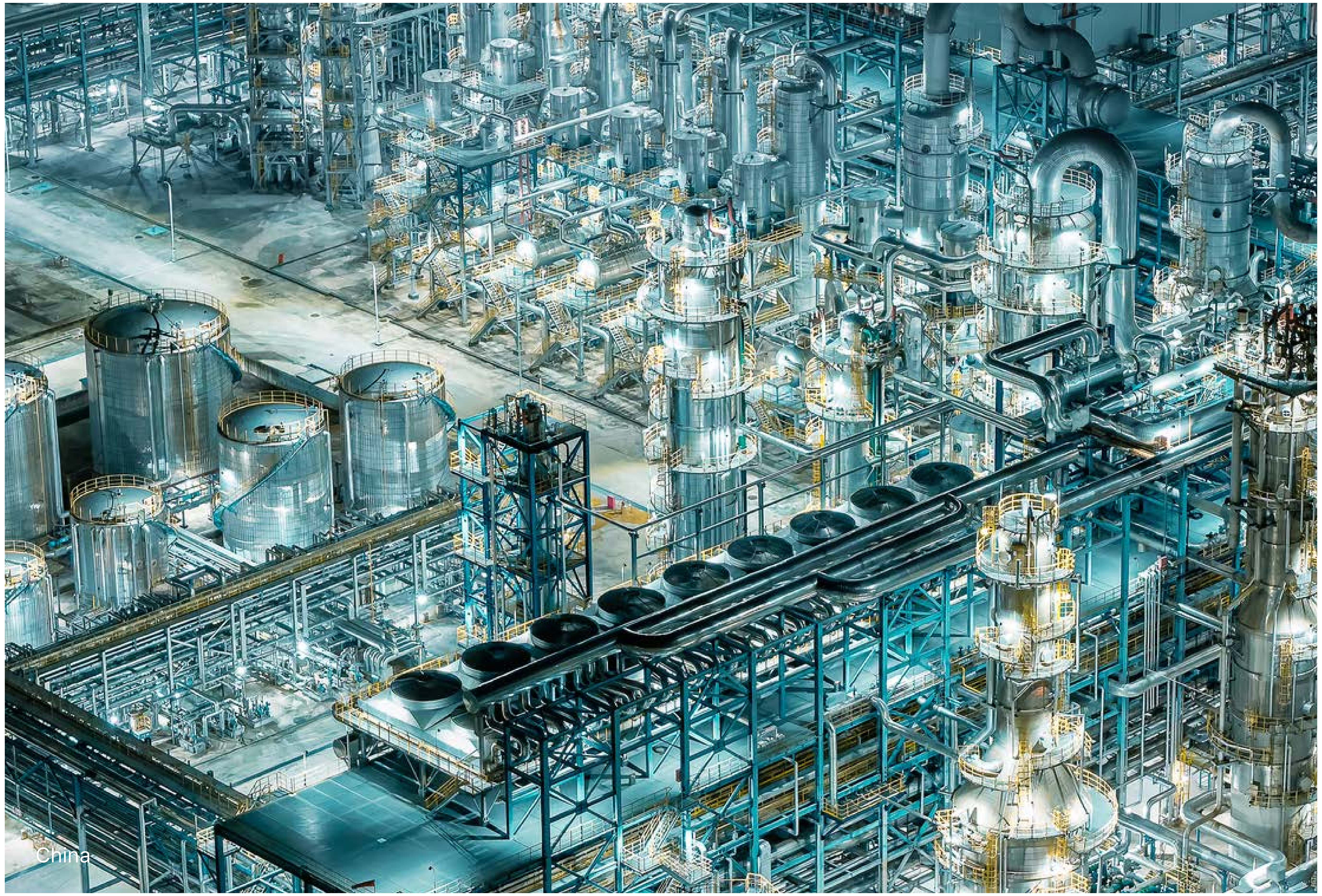
The current project pipeline offers a vast market for technology providers

The current project pipeline offers a vast market for technology providers
The global pipeline of announced projects represents an estimated $4.7 trillion[1]. This represents a significant market opportunity for developers and technology suppliers. This amount encompasses around $1.5 trillion in plant-level equipment and industrial assets and around $3.2 trillion in associated renewable energy build-out (renewables and batteries).

The opportunity spans multiple technology stacks
Renewables, batteries and electrolysers will be core enabling technologies for industry's clean transition because of hydrogen's prevalence in the global pipeline. Together, these segments represent the largest share of the opportunity for clean technology providers, with a further ~$750 billion set to be invested across complementary technologies, including carbon capture and sector-specific equipment such as ammonia loops, furnaces for direct iron reduction, or catalysts for fuel refining.

The clean industry technology race is already under way – but not decided
China has built substantial scale in mature clean tech manufacturing, accounting for more than 70% of global clean tech production across solar PV, wind, batteries and EVs. This is reflected in China's overwhelming majority share of renewable equipment provision to clean industrial projects that have already reached FID (83%).

The market for clean industry technologies remains more open and competitive: China is leading because it serves its domestic pipeline, which concentrates 45% of projects passed FID globally, followed by Europe (~30% market share) and the United States (~20%). For clean industry technology providers, acting now to commercialise these technologies at scale is key to improve performance and drive down costs, locking in lasting competitive advantages and building export-ready industries.

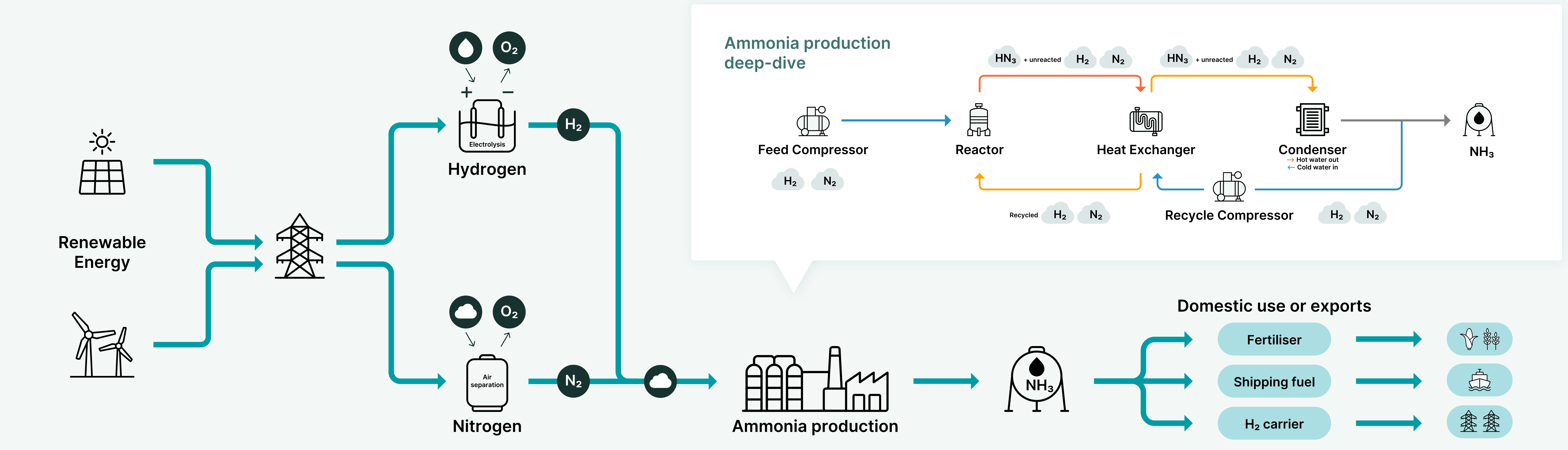

China

1. Investment figures in this section based on top down estimated capex for key tech pathways and high level regional extrapolations

Producing clean commodities requires a range of integrated technologies, creating new opportunities for energy and industrial technology developers

Clean projects involve a range of interconnected components – for example renewable generation, energy storage, electrolysers, nitrogen separation and ammonia synthesis – each with numerous sub-systems that must be deployed and integrated at scale.

Value chain example – Ammonia loop

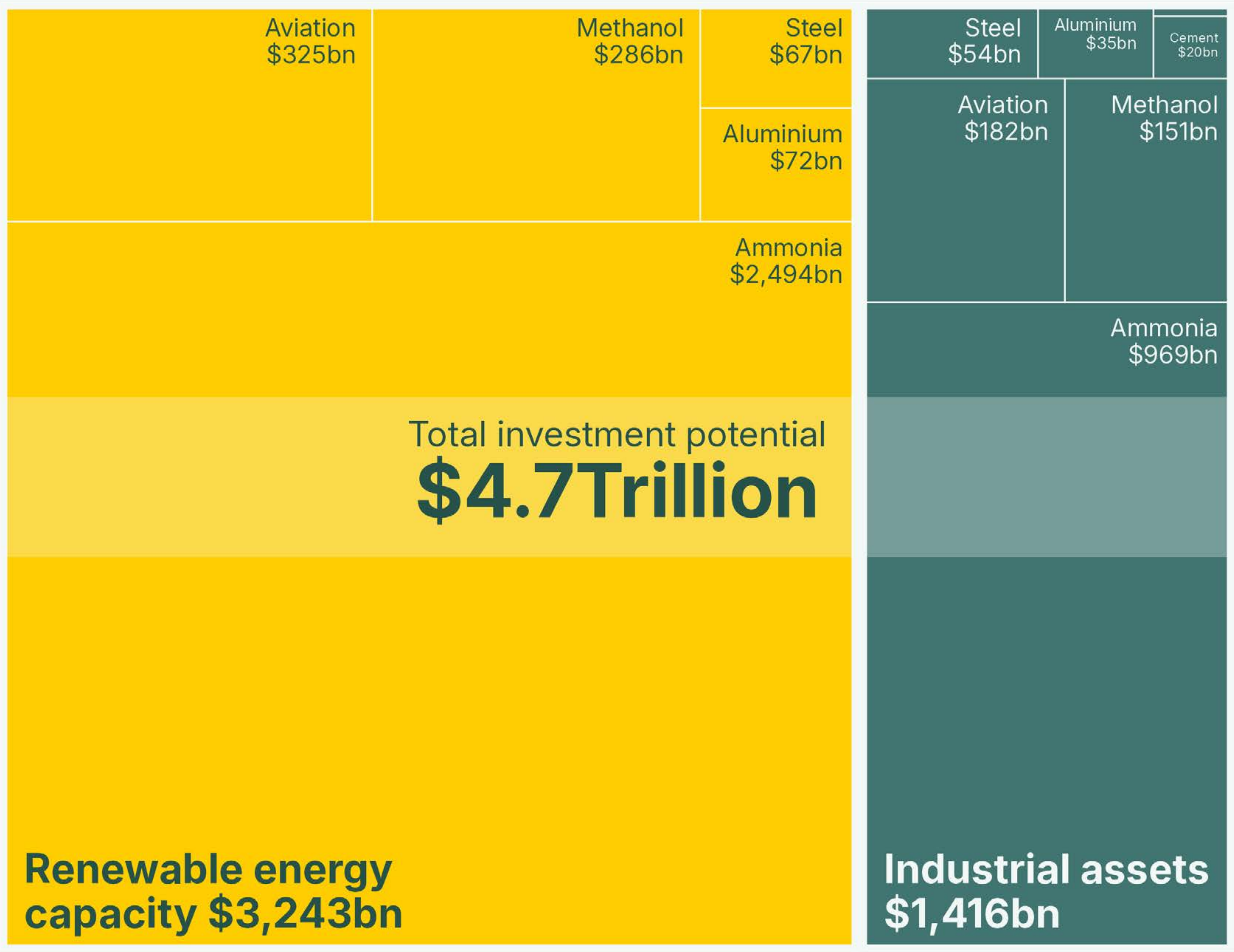


Clean commodity pipelines represent a ~$4.7 trillion under-recognised opportunity for developers and technology suppliers

~$1.5 trillion in plant investment and ~$3.2 trillion in associated renewable energy build-out.

The pipeline of projects that have not yet reached FID represents an investment potential of ~$4.7 trillion, comprising production assets and the renewable energy capacity required to supply them. Renewable energy accounts for two-thirds of this total investment opportunity.

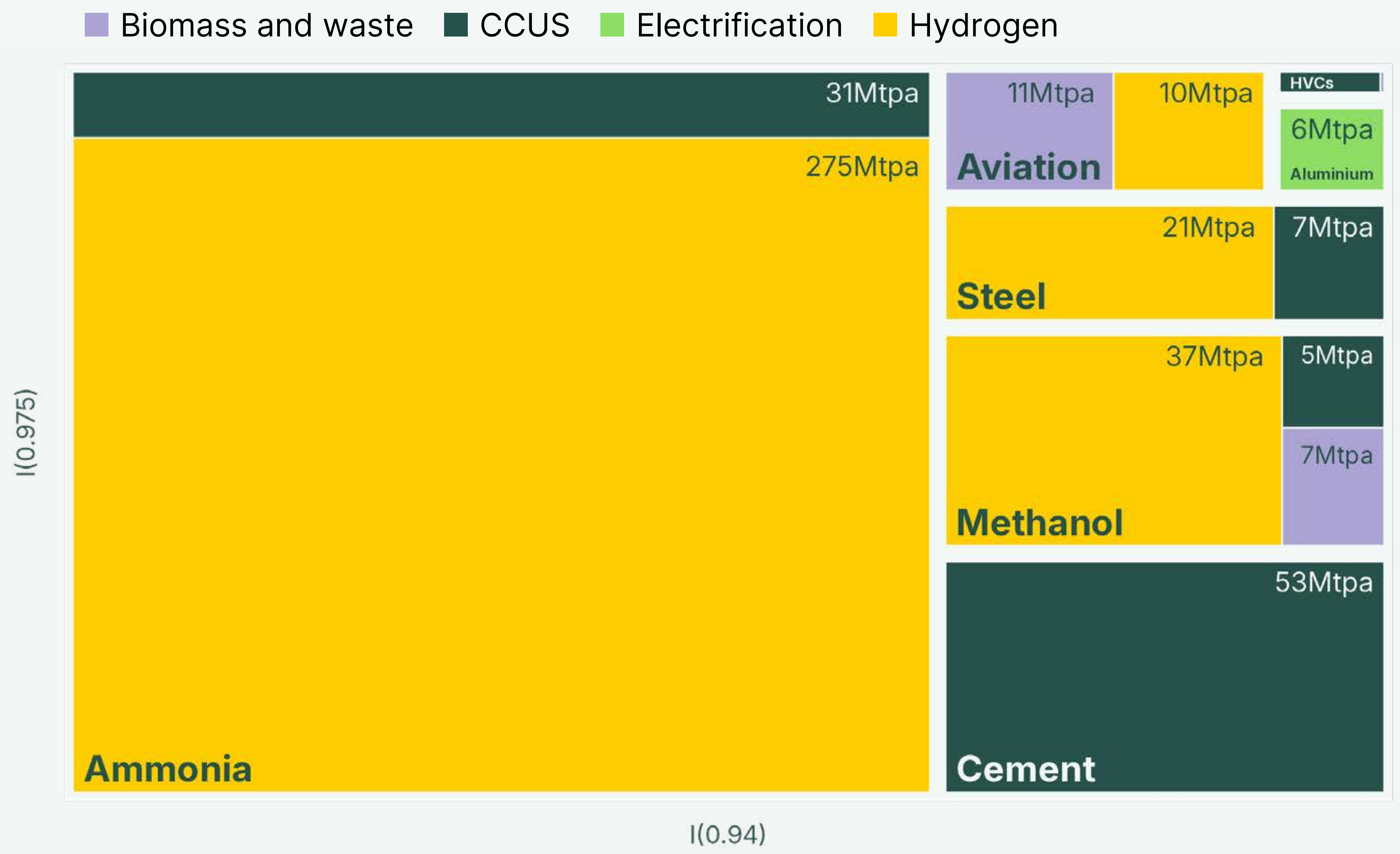
Ammonia dominates total investment potential, reflecting both the large size of the production assets and the high clean power requirements associated with them. Aviation and methanol follow - at a distance.



The dominance of announced hydrogen-based projects could create a major pull for renewable energy build-out

The scale of the future opportunity in renewable build-out associated with clean industry is explained by the dominance of hydrogen-based projects in the announced pipeline. In the ammonia sector, green ammonia projects based on electrolysis represent ~90% of the projects, while the pipeline of projects using carbon capture on gas-based ammonia production remains limited. In sectors like methanol and steel, where a variety of technology options could be considered to produce low-carbon products, hydrogen dominates, representing ~75% of the total project pipeline in both sectors.

Planned technology choices across the announced clean pipeline vary by sector
Announced pipeline capacity breakdown by sector and decarbonisation lever, Mtpa, April 2026



The current pipeline represents a significant demand for clean energy, especially clean electricity
Total potential electricity, hydrogen, biomass and carbon capture demand from announced pipeline

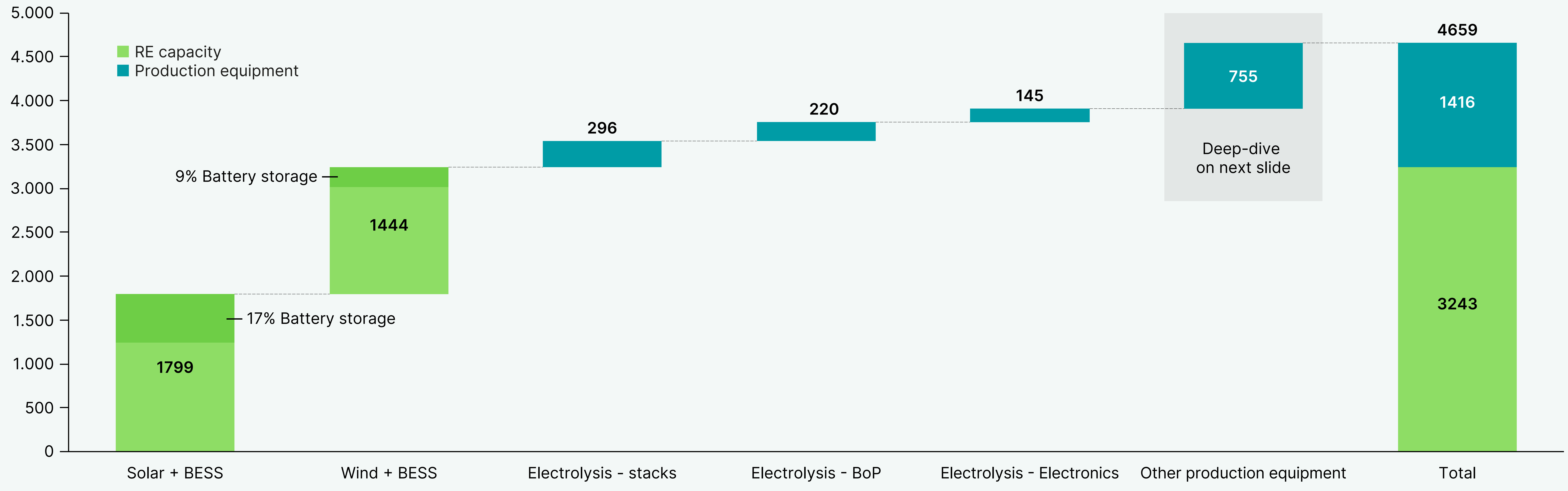
Electrification	CCUS	Hydrogen	Biomass & waste
3541 TWh	**196 Mtpa**	**63 Mtpa**	**57 Mtpa**

Hydrogen's potential dominance puts renewables, batteries and electrolysers at the top of the clean tech opportunity in industry

Other technologies represent a further ~$755 bn

Renewables, battery storage and electrolysis technology make up the majority of the investment opportunity

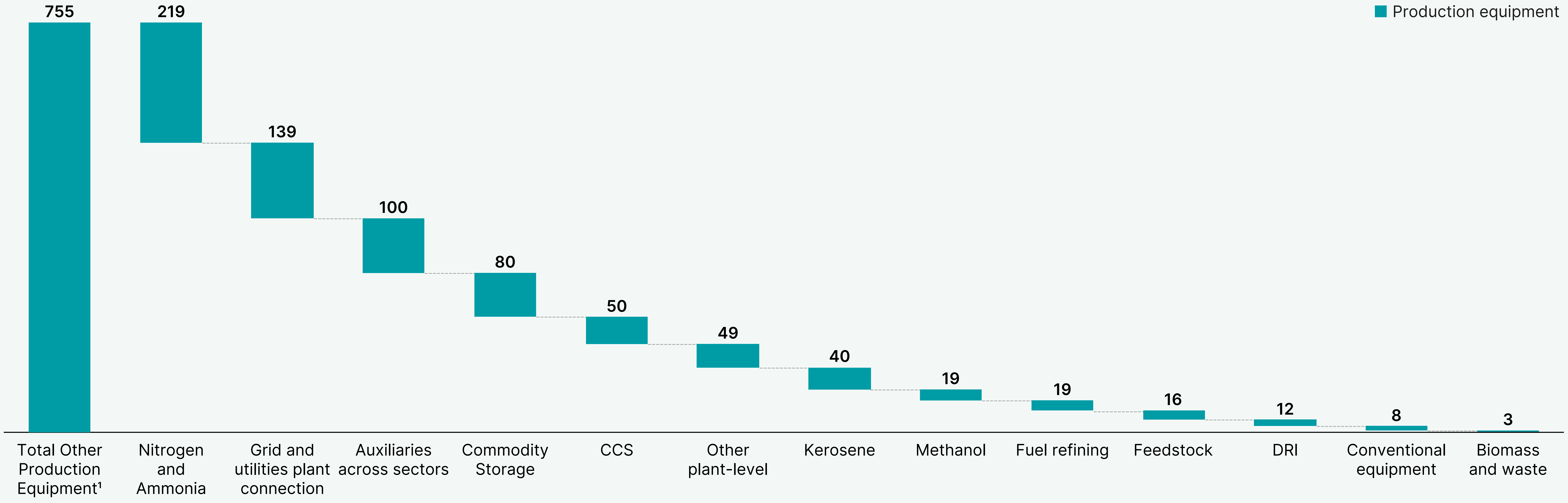
Share of equipment costs by system blocks across all sectors, $bn, April 2026



Source: MPP Global Project Tracker, MPP analysis

Beyond electricity and hydrogen related technologies, the remaining $755 bn equipment opportunity is broadly distributed across different plant-level equipment, including sector-specific equipment

Plant-level equipment, which is often sector-specific, represent a $755 bn market opportunity for technology providers
Share of equipment costs by system blocks across all sectors, $bn, April 2026

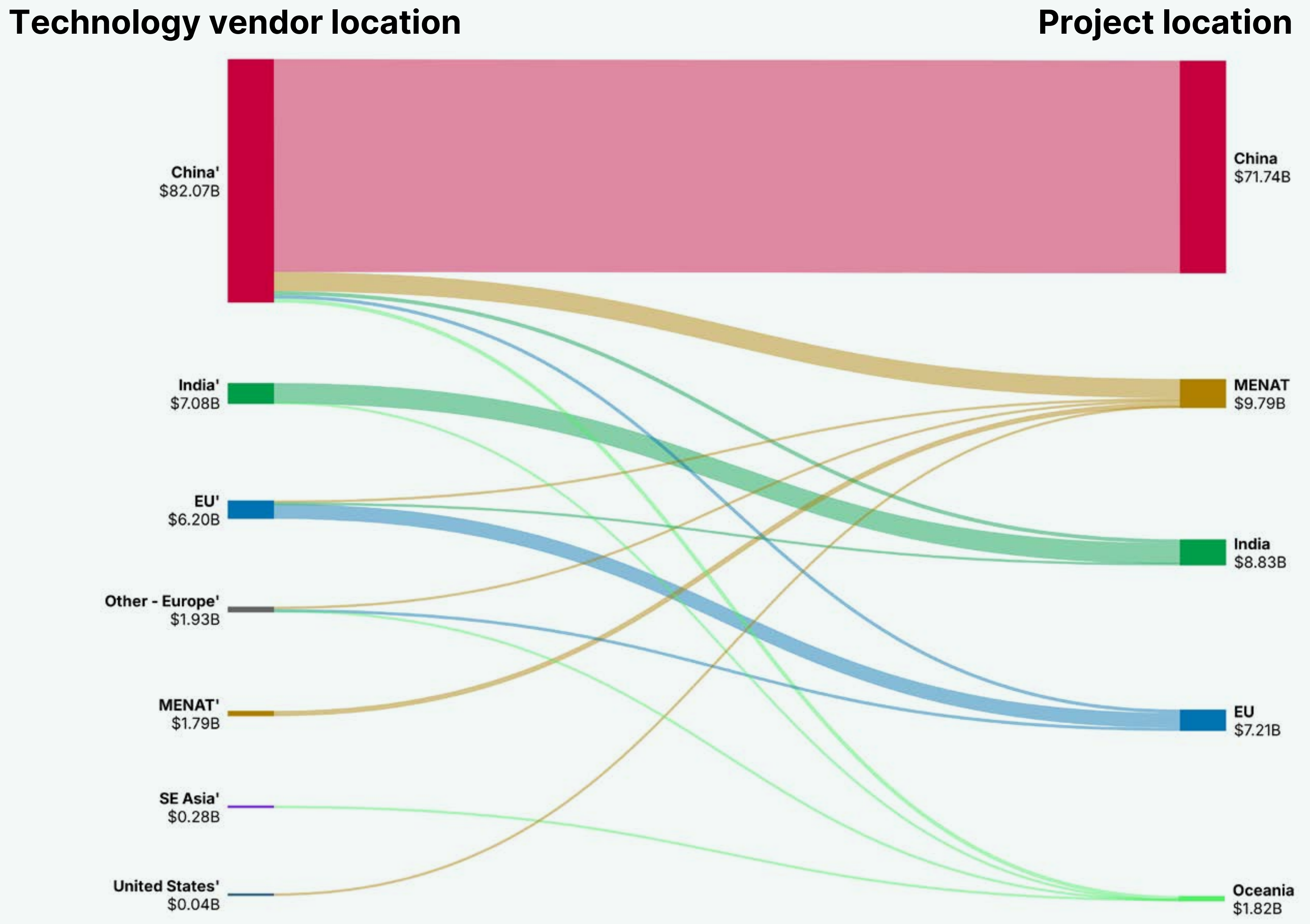


1. Besides electrolysis technology as shown on previous page. **Source:** MPP Global Project Tracker, MPP analysis

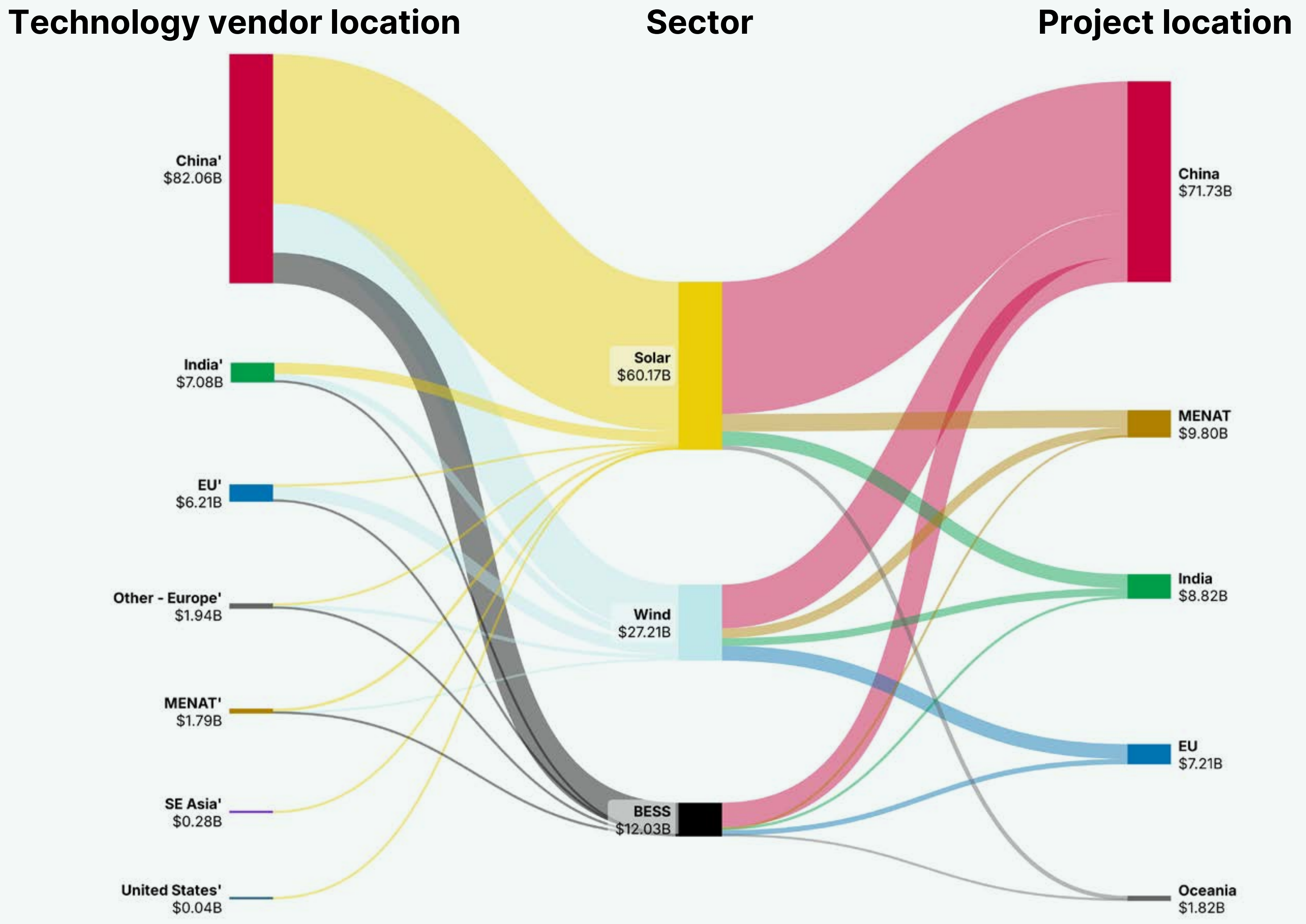
Renewable energy

China already dominates clean energy equipment for industry. Across funded projects, renewable energy technology is mainly sourced from China (83%), with a sizable gap to the next main providers: India (7%) and the EU (6%)[1]

China serves its own market and exports to the Middle East and other regions, while EU and India mainly supply their own projects.
Renewable energy equipment trade flows between markets, $bn



Chinese vendors are most represented across solar, wind and especially batteries; with the EU and India following in solar and wind
Renewable energy equipment providers by key technologies and project locations, $bn

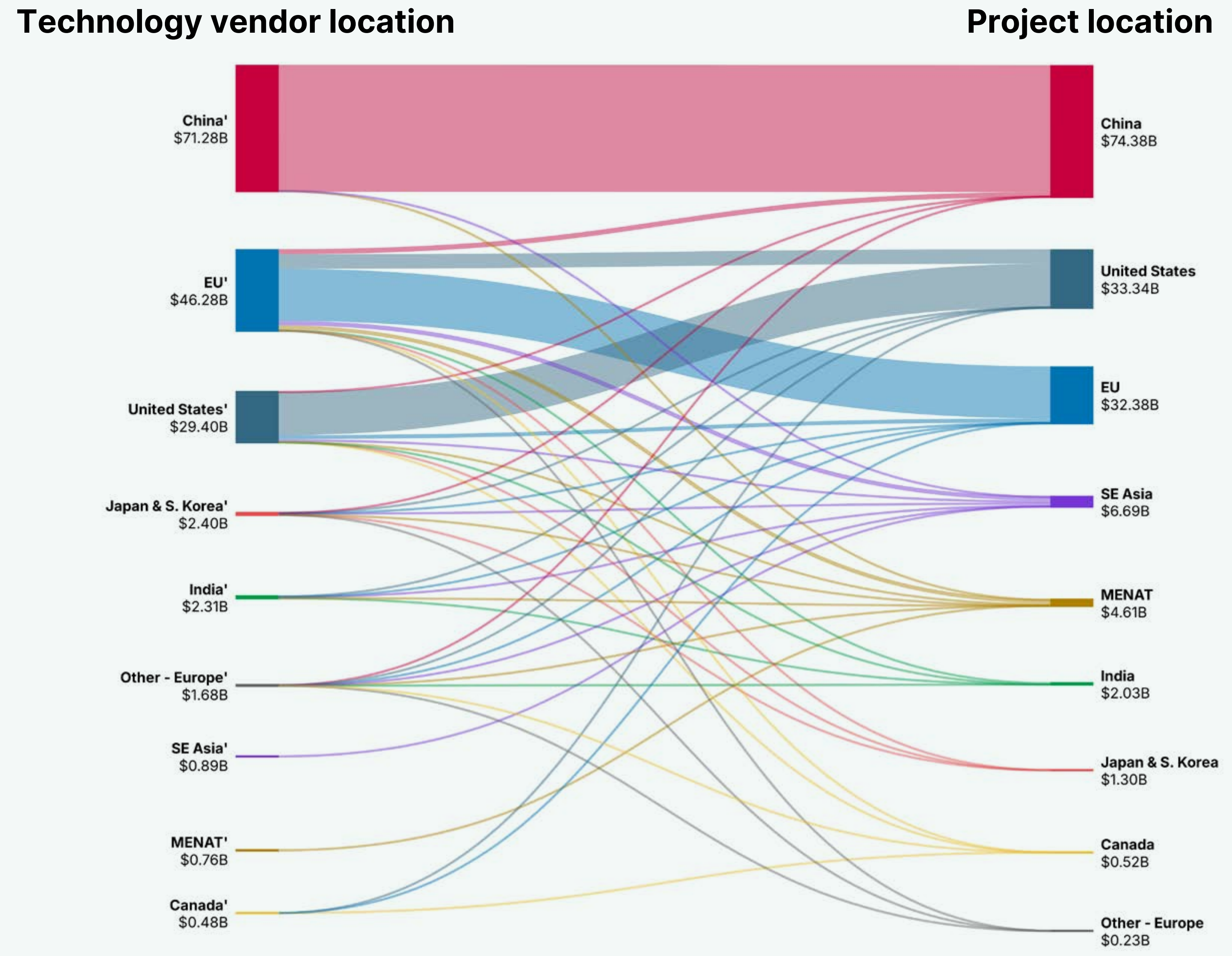


1. Methodology to calculate flows: equipment costs were aggregated across the markets. The cost of the equipment required for each individual project was estimated using techno-economic models specific to each deployed technology. Origin of the supplied equipment was identified based on available publications and public announcements. Where specific OEMs were not announced, the most likely suppliers were derived from available market information, e.g. announcements on similar projects.The required renewable energy (RE) capacity, including solar, wind and battery storage, was estimated based on renewable energy capacity factors specific to the project location/region. The cost of RE systems was estimated using the Annual Technology Baseline 2024, which was developed by the National Laboratory of the Rockies.

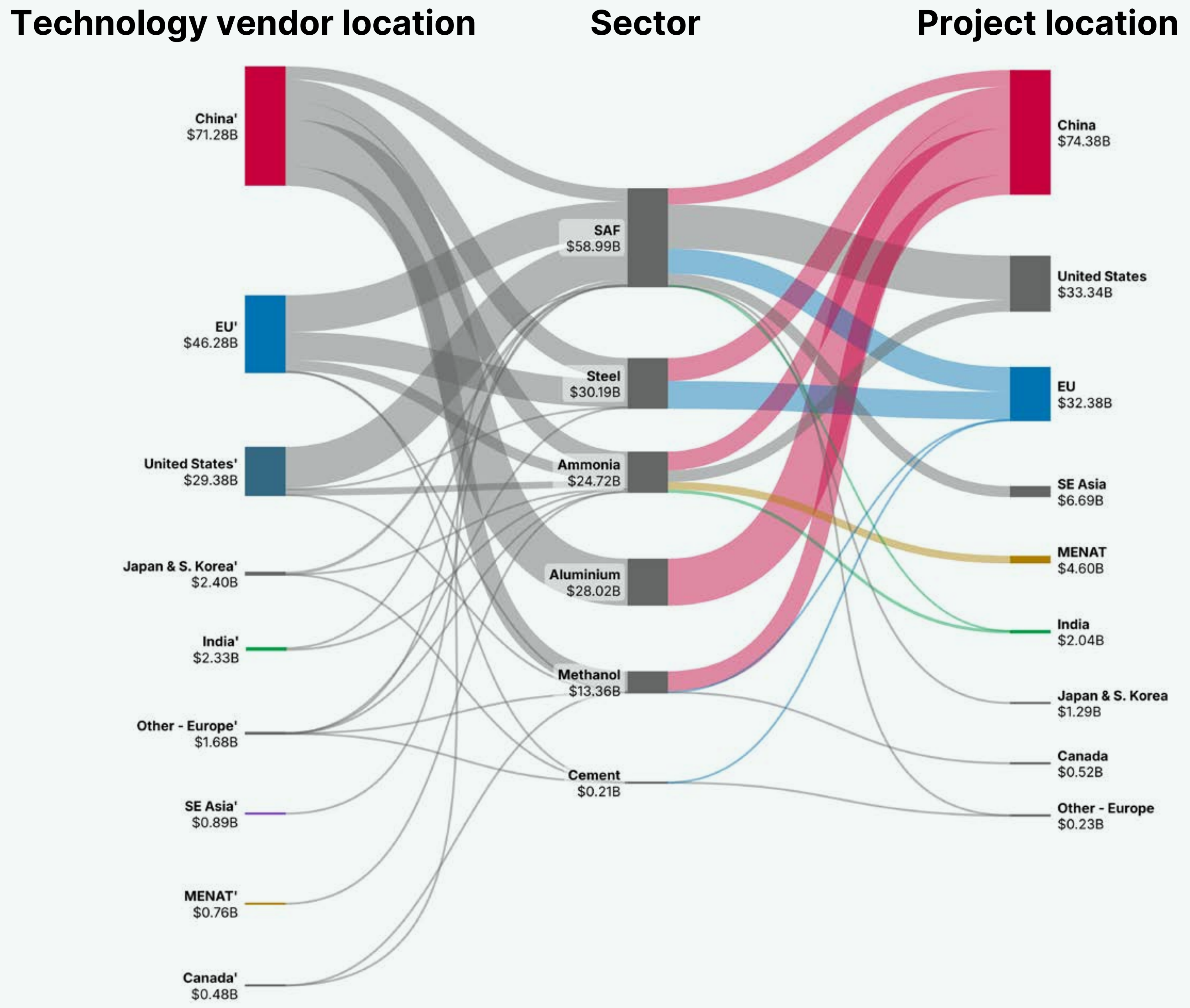
Production equipment

Across funded projects, plant equipment has mainly been sourced from China (46%), EU (30%) and US (19%) to date[1]

China and the US provide equipment mainly to their own domestic projects; while Europe serves both its own projects and projects abroad, including in China and in the US.
Plant equipment trade flows between markets, $bn



Chinese vendors are well-represented across sectors, while Europe mainly in SAF, steel and ammonia and the US almost exclusively in SAF
Plant equipment providers by sectors and project locations, $bn



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Case Study:
CISRI Linyi | Pioneering pure-hydrogen metallurgy

The China Iron & Steel Research Institute Group (CISRI) is a national research institute and state-owned enterprise in China, overseen by the central State-owned Assets Supervision and Administration Commission (SASAC). It has been conducting research on pure hydrogen metallurgy for more than 20 years. CISRI's Linyi project in Shandong Province represents one of the most significant breakthroughs in global iron and steel decarbonisation. As an industrial-scale pure hydrogen direct reduced iron (DRI) facility, the project demonstrates China's ambition to advance to near-zero carbon metallurgy by combining long-term research, abundant renewable energy resources and state-backed industrial innovation.

As the second most industrialised province in China, the pure hydrogen DRI demonstration plant was strategically commissioned in Linyi, Shandong. It provides an ideal location to showcase its technology to downstream users, regulators and future investors.

The Linyi plant is fully optimised for 100% hydrogen reduction with no syngas or natural gas blending possible. The pilot tests have demonstrated some unique technical features including electric heating of the process gas using clean electricity, the ability to process virtually all iron ore grades, achieving a ~5% higher metallisation rate than conventional DRI and a design that incorporates a recycling loop that prevents any hydrogen losses. The facility operations are also 100% automated and incorporate advanced AI-assisted safety controls, heating optimisation and support digital twin development.

Although the Linyi facility has a nominal capacity of 50 ktpa, it is not used commercially. Instead, it functions as an R&D and validation platform. Test results are now feeding directly into a wave of commercial scale projects, four of which already under construction:

- One 300 ktpa plant in Songyuan (wind-powered).
- Two lines of 600 ktpa each in Baotou, Inner Mongolia.
- Two plants in Xinjiang, one of 300 ktpa and one of 1,200 ktpa.

With four more under development, all using 100% green hydrogen. →

Case Study:
CISRI Linyi | Pioneering pure-hydrogen metallurgy

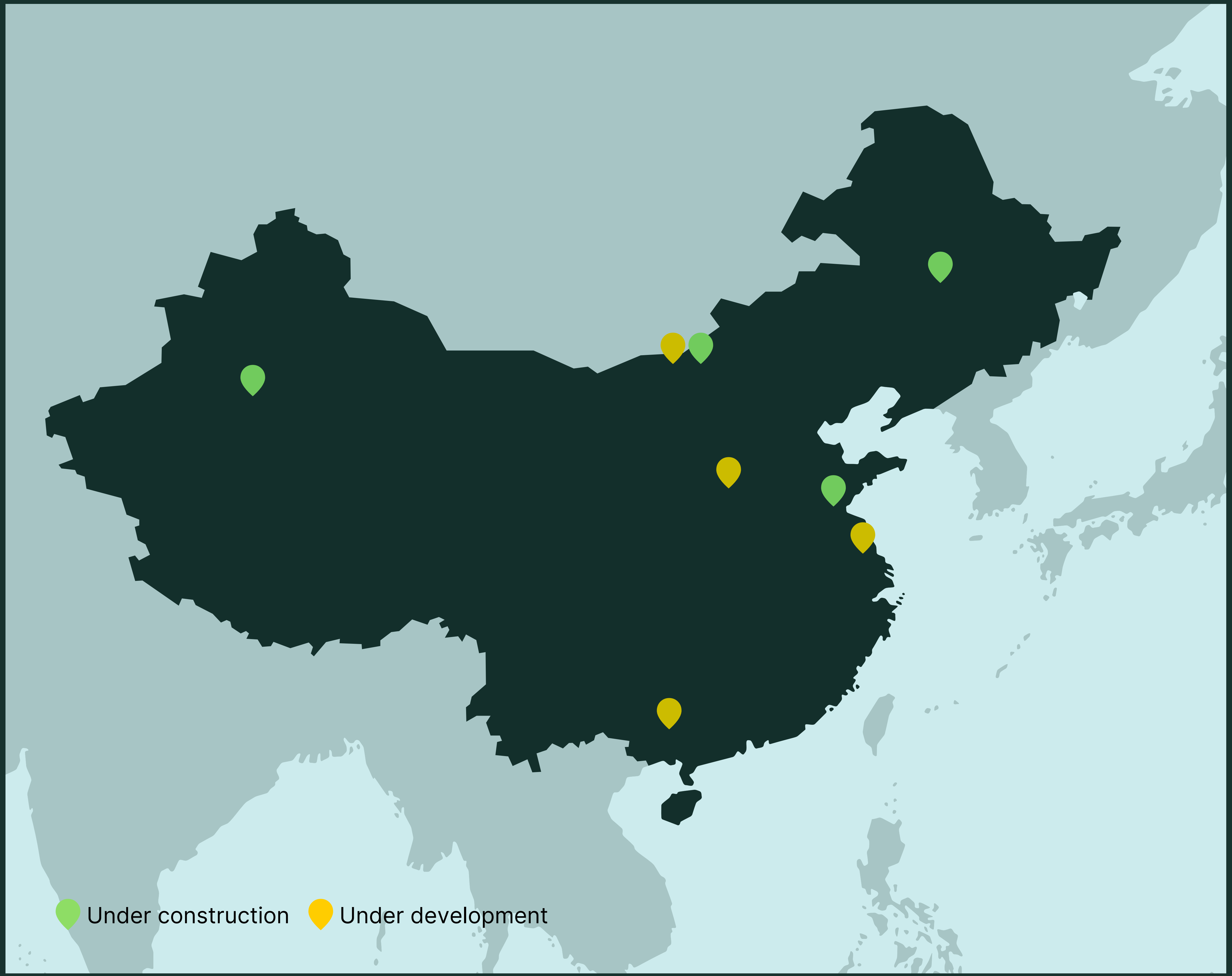
Delivering the Linyi project required deep collaboration across China's industrial system:

- National and local state grid authorities to guarantee renewable electricity supply.
- Hydrogen producers to ensure consistent hydrogen availability.
- EPC subsidiaries of CISRI to deliver engineering, construction and commissioning.
- Downstream steel users to secure product offtake, especially with high-end manufacturers.
- Local & national governments for permitting, policy support and renewable energy access.

Because China's steel sector faces overcapacity, offtakers are generally reluctant to co-invest. However, for high-end steel grades enabled by pure hydrogen metallurgy, CISRI is engaging select customers. Carbon-free DRI produced via hydrogen metallurgy offers additional intrinsic advantages, particularly for the manufacture of higher-end and special products such as automotive steel, tool and die steels, superalloys, stainless steel and electromagnetic materials.

Pure hydrogen metallurgy is becoming cost competitive in China, due to the very low-cost of clean electricity, which has reached average costs as low as 0.1 RMB/kWh (i.e. ~15 $/MWh). Other driving factors include increasing scale in renewable hydrogen, in-house engineering and fabrication capacities and strong policy alignment with national decarbonisation targets.

The Linyi project represents a turning point for both China's and the world's steel industry. CISRI is demonstrating that pure hydrogen metallurgy can be technically viable, cost competitive under China's renewable energy conditions and scalable with more than 4 Mtpa of capacity already under development. By combining abundant renewables, state backed innovation, strong engineering, procurement and construction capabilities and a fast-growing domestic technology base, China is gearing up to position itself as the centre of near zero carbon iron-making.



Case Study:
European Energy Kassø | Building the world's first e-methanol plant

European Energy is a private renewable energy developer spanning origination, construction and asset management. Recognising that direct electrification cannot reach every energy-intensive sector, it set out to convert its renewable power into low-carbon molecules, turning electrons into fuels and feedstocks for shipping, chemicals and consumer goods.

Kassø, in southern Denmark, is now home to one of the world's first operational e-methanol facilities, producing 42,000 tonnes per year from a 304 MW solar park, a 52 MW electrolyser and biogenic CO_2 captured from a local biogas facility. It reached FID in January 2022 without operating subsidies and started operations in 2025.

Offtake as the foundation

Bankability was key to unlocking the project. In 2021, Maersk signed the anchor offtake agreement, contributing to minimize the first-mover risk and demonstrating that shipping could shift from spot contracts to long term commitments. LEGO and Novo Nordisk followed in 2023, using e-methanol to replace fossil methanol in their plastics supply chains. These three distinct markets provided revenue certainty, reducing financial risk and validating the product.

Owning the value chain

The Kassø site was built largely from scratch, with European Energy retaining control wherever possible. It supplies its own renewable power, developed its methanol synthesis technology and secured CO_2 →

Case Study: European Energy Kassø | Building the world's first e-methanol plant

supply from one of the biggest biogas plants in Denmark and secured the CO_2 technology through the acquisition of Ammongas, a biogas upgrading and CO_2 capture specialized company. Siemens supplied electrolysers, Schneider Electric integrated the system and Mitsui & Co., which holds a 49% stake, added methanol market expertise and commercial confidence.

This integration proved decisive: For a first-of-a-kind project with multiple technologies, technical issues could be resolved across desks rather than across contracts - accelerating problem-solving and strengthening investors and offtaker confidence.

"When you own the value chain, that's very powerful, especially being a first mover. You can put the engineers together and solve a common problem. This is now being applied in the next suite of projects such as in Brazil, Spain, Australia and Denmark"
Jaime Casasus-Bribian, Head of PtX Projects (Americas, Iberia, Australia), European Energy, CEO Ammongas

Learnings
Permitting was a significant challenge with around 30 approvals needed rather than the anticipated five to seven, reflecting the plant's novel hybrid nature. Operationally, power costs are the core challenge. Electricity accounts for more than half of production costs and managing production against volatile wholesale prices adds complexity. Grid connection delays also pushed back commissioning by a number of months. These lessons are now informing plans for a ~100 ktpa expansion at Kassø, where existing infrastructure, permits and operational data provide a material head start.

The business case for going first
"We are first movers and risk takers, but with a measured approach. Our expansion plan is three times the size of Kassø - big enough to be relevant, yet still manageable."
Jaime Casasus-Bribian, Head of PtX Projects (Americas, Iberia, Australia), European Energy, CEO Ammongas.

Kassø now serves as a blueprint being tested in Denmark, Brazil, Spain and Australia By moving early and operating at scale, European Energy has secured advantages later movers cannot buy: proven performance, real cost data and offtaker relationships.

What is e-methanol?
Produced by synthesising green hydrogen - made via electrolysis using renewable electricity - with biogenic or captured CO_2. The result is chemically identical to fossil methanol but with a much lower carbon footprint.

Because methanol is already widely used in shipping and the chemicals sector, e-methanol can act as a near-drop-in replacement - making it one of the most practical early solutions for decarbonising energy-intensive sectors.

China

Clean markets

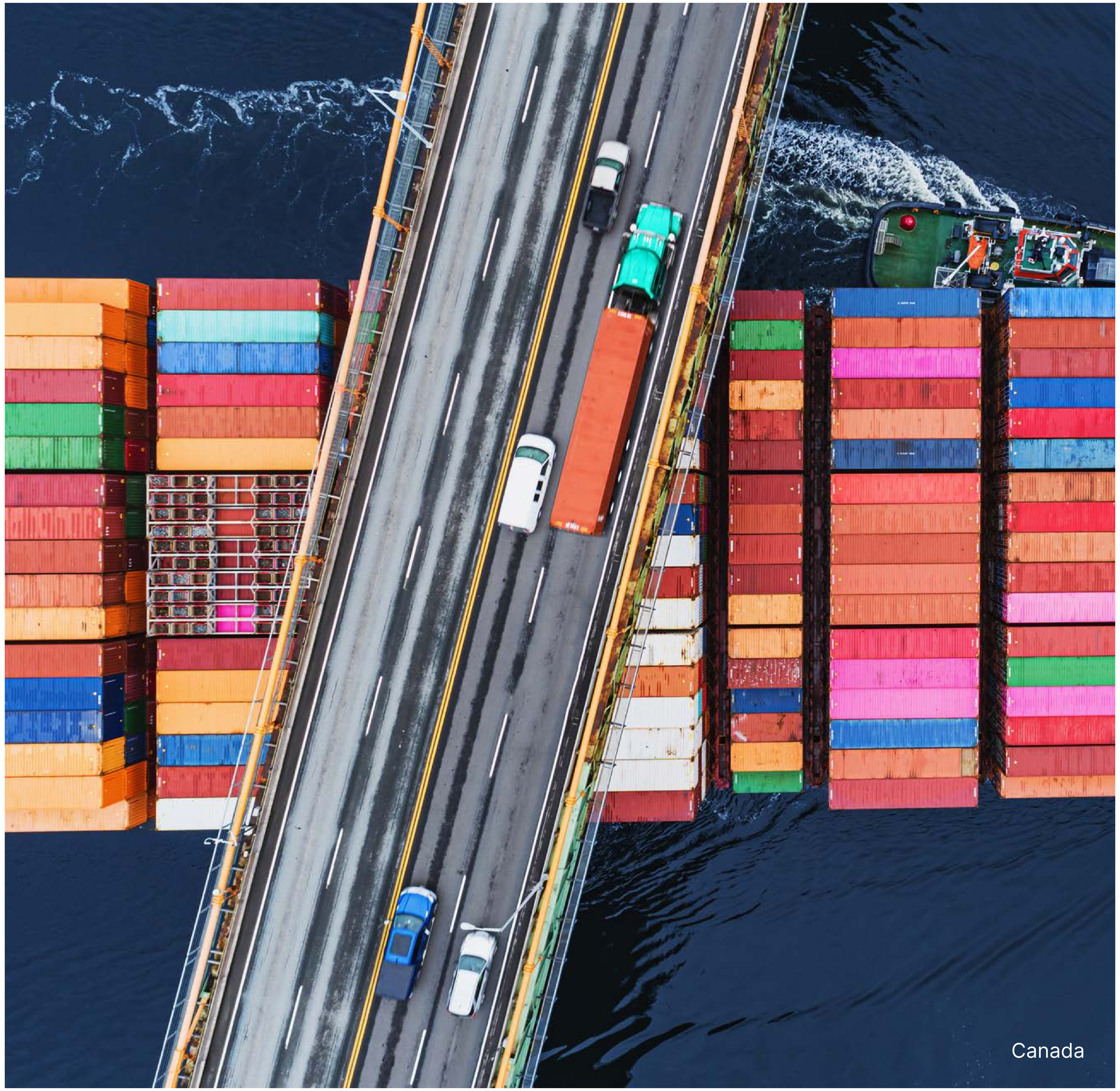
Engineering new industrial supply chains

The biggest markets are powerful and can gain strategic advantage shaping their supply chains

Buyers choose what they buy and from where
The largest consumers of materials like steel, chemicals such as ammonia and fuels such as sustainable aviation fuels, sit at the top of global supply chains. In a world of growing trade fragmentation, they can decide through their market and trade policies what is produced domestically versus what is imported and from where. China, India, Europe and the US are the most prominent markets for industrial commodities today; they shape current markets and can configure the new supply chains of clean commodities. They can build resilience into their economies – making strategic choices that balance near-term cost, long-term competitiveness, jobs and resilience to geopolitical and climate shocks.

Demand-stimulation policies: the key to shaping new markets
Demand only shapes supply when it is credible and investable. Policies stimulating demand for low-carbon commodities are critical to unlock investment in supply and shape that supply in line with national strategic interests. Project data shows that where demand-stimulation policies are weak or absent, pipelines stall; where they exist, investment follows. Aviation – supported by blending mandates – now has the highest number of clean-industry projects past FID (46) (excluding legacy aluminium). The next sector is methanol – with 24 projects passed FID – boosted by mandates in China. The pioneering EU aviation mandate demonstrates the power of buyers: the sustainability criteria imposed by the EU are influencing which projects move forward across the globe, forcing SAF project developers to prioritise feedstocks that will be compliant with EU regulations.

Scale is the catalyst to unlock exponential growth
The deployment of new technologies usually follows a S-curve, with slow progress until a tipping point is reached, reinforcing feedback loops – such as cost declines, market uptake, policy support and infrastructure build out – kick in and deployment becomes exponential and selfsustaining. If they start scaling their domestic market for low-carbon commodities simultaneously, a small group of major economies could together precipitate clean commodity tipping points, unleashing the clean industrial revolution.

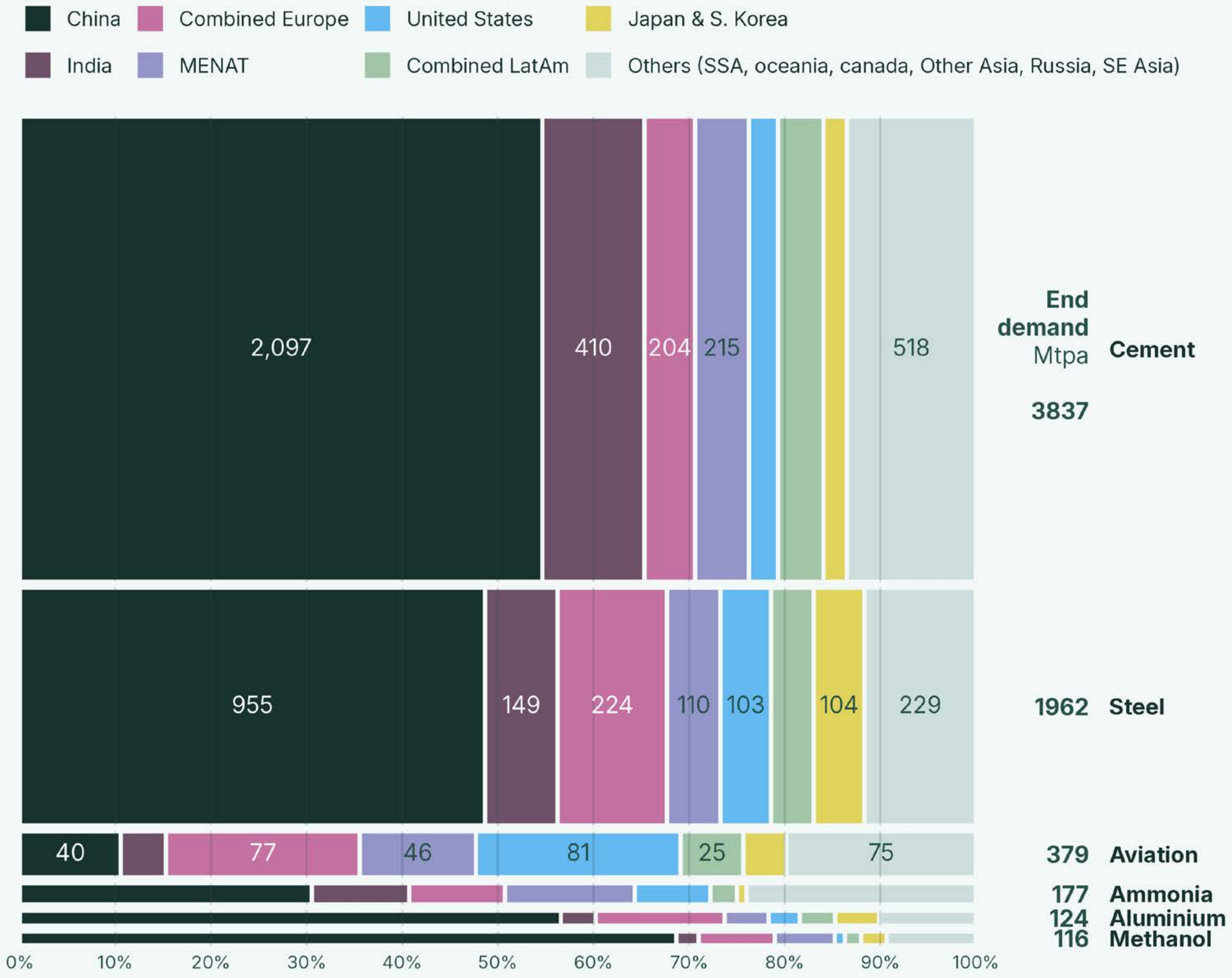

Canada

Commodity demand is concentrated in a handful of countries – giving them the influence to shape new global supply chains

Countries with the biggest demand pull for materials, chemicals and fuels today have the power to influence how the clean industry transformation unfolds in these value chains. Through their market and trade policies, they can influence the location of clean production, which clean technologies are used, which technology suppliers serve these new markets and where value accrues.

Today, demand power sits with a small number of large markets. China, Europe, the United States, India and a handful of other major economies currently account for the majority of industrial commodity demand. Major importers of manufactured goods, such as Europe and the United States, can also influence the decisions of consumer goods companies in countries like China that supply their markets.

That balance will shift as emerging markets grow. Fast-growing economies in South-East Asia and parts of Africa are expected to account for an increasing share of demand over the next decade, expanding their ability to shape their own supply chains.



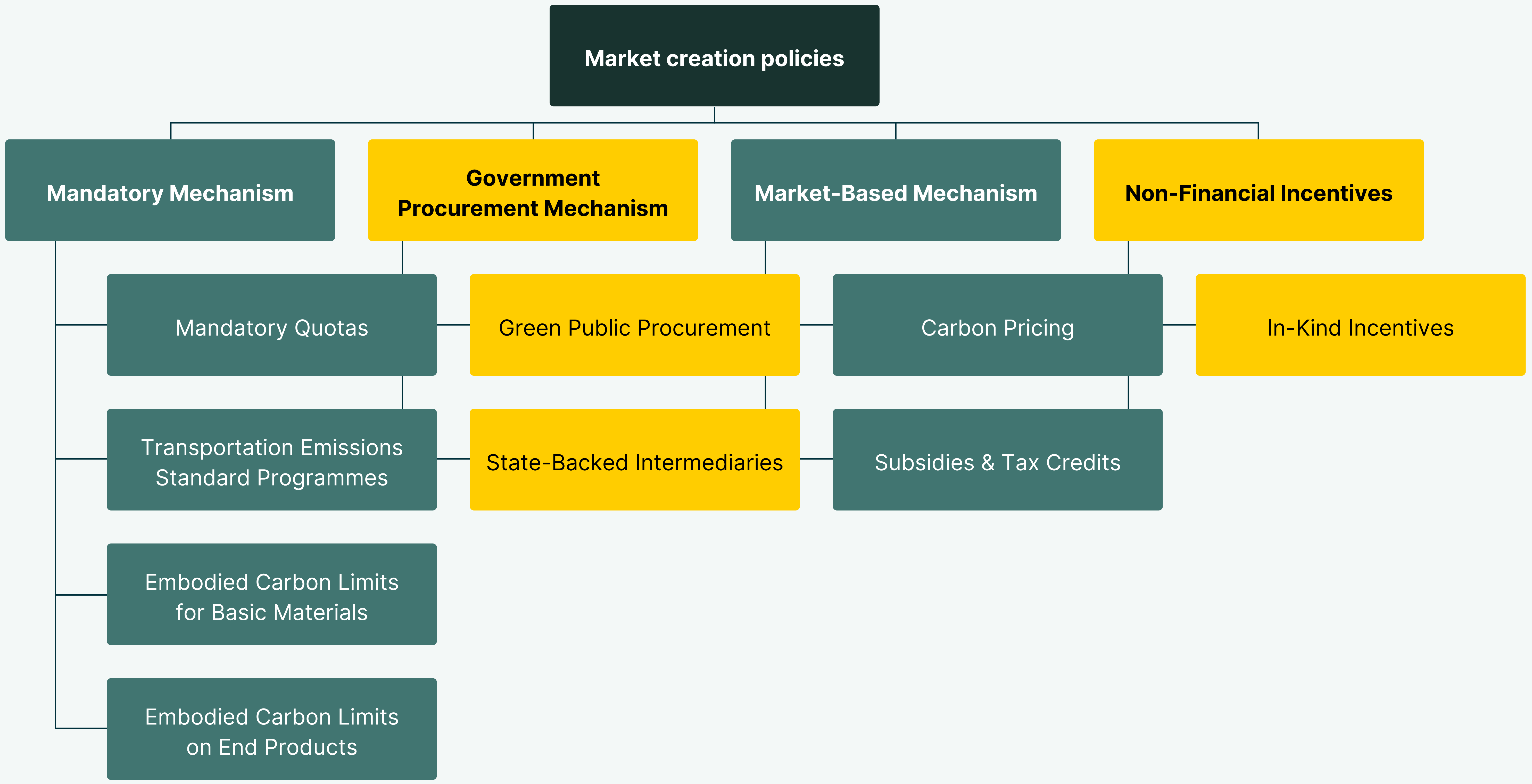
Scaling clean markets: the evidence shows that the main barrier to reaching FID is not technology, but lack of bankable demand as a necessary first step in redesigning supply chains

Investment is unlocked when revenues become more certain. Across sectors, project evidence shows the necessary first step to secure finance is predictable offtake agreements at a price affordable to both the developers and offtakers. Today's clean commodity markets remain too small and uncertain to unlock the pipeline at scale.

If they want to shape new global supply chains, countries with the biggest markets for fuels, chemicals and materials need to first create demand for clean commodities. Market creation policies – such as green public procurement, mandates on private procurement and carbon pricing mechanisms – are essential to create investable revenue streams.

Evidence from the project pipeline shows that where predictable signals exist, most clearly in sustainable aviation fuels and in methanol and where they are expected, in ammonia and methanol as zero-carbon shipping fuels, the pipeline grows and investors respond. In materials production, where the pipeline lags behind, the metals and cement sectors stand to benefit from strengthened market-stimulation policies. Mandates, quotas, clean procurement rules and pricing mechanisms are not peripheral instruments, but the precondition for unlocking investment at pace.

Overview of the suite of market creation policies available to governments



A proof point of the effectiveness of demand-creation policies: mandates precipitating investment in SAF plants

Mandates are translating demand certainty into FIDs
Sustainable aviation fuel mandates have emerged as the most effective lever for scaling SAF production. The EU's ReFuelEU Aviation mandate – requiring SAF blending to rise from 2% in 2025 to 6% by 2030 and 70% by 2050 – has created predictable, binding demand that has translated directly into project investment in Europe and across the globe in countries with favourable natural endowments for biofuels production.

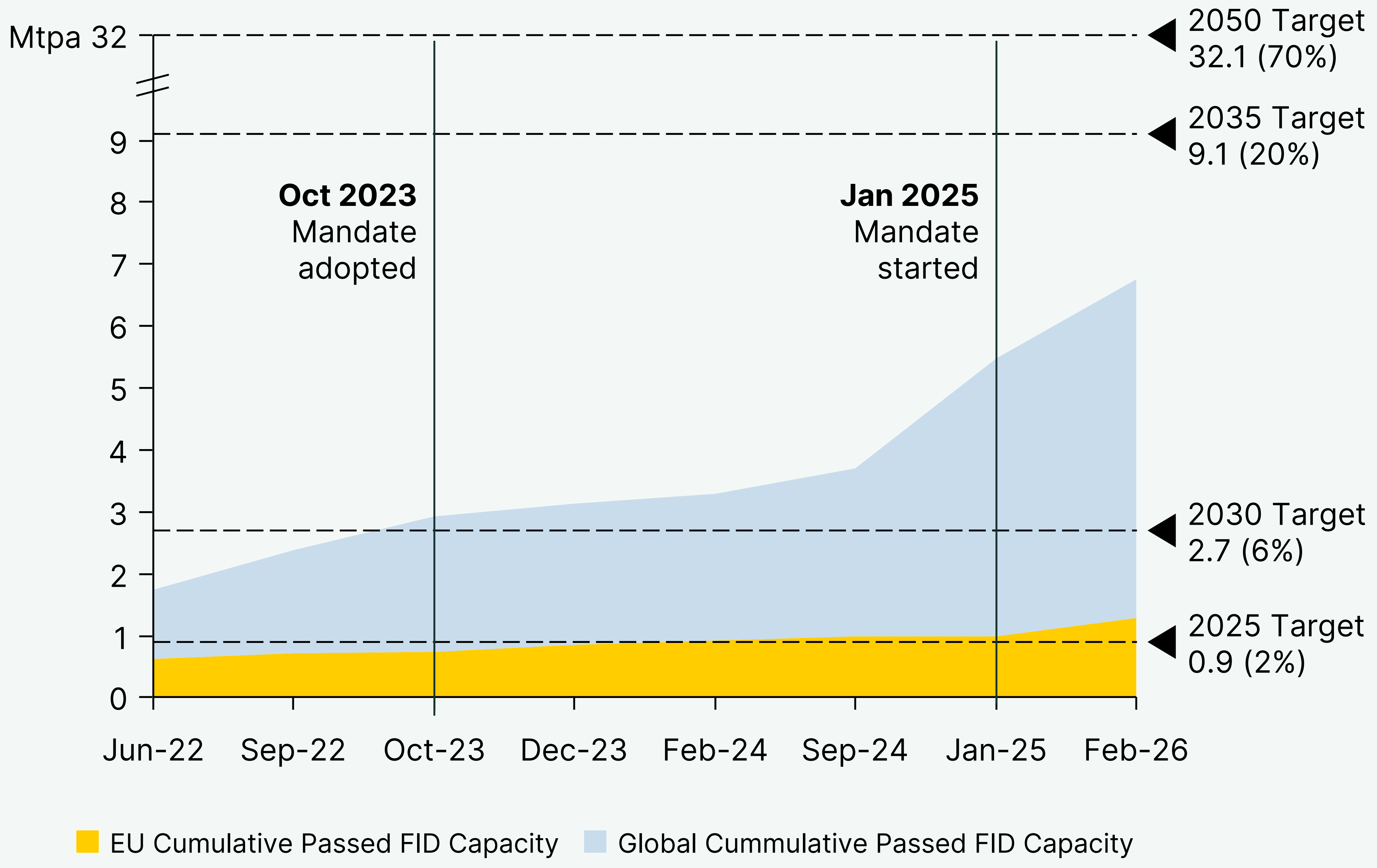
Since the mandate's adoption in October 2023, projects reaching FID have increased sharply, with cumulative past-FID capacity more than doubling, demonstrating a clear supply-side response to regulated demand, tracking the timeline set out by the EU and enabling targets to be met.

Aviation shows how policy design can unlock investment at scale
Sustainable aviation fuel mandates are now spreading in application from Europe to Asia. As a result, over the past two years, aviation accounted for 35% of all clean-industry projects reaching FID and overall the sector has the most projects at investment globally (excluding legacy aluminium projects) with 46 passed FID, including 22 that are operational. A further 55 SAF projects excluded from the Global Project Tracker's deep decarbonisation projects have generation 1 (or unclearly defined) feedstocks[1]. This concentration underscores how binding, long-term mandates reduce demand risk, enabling revenue certainty through offtake agreements, an often-decisive factor in reaching investment.

What's happening in aviation highlights the power of mandates to provide clarity of a phased, predictable ramp up, enforcement and a clear rulebook. Where these elements are present, clean commodity markets can scale and are particularly effective where technology-push or voluntary approaches alone fail to underpin more than first or second-of-a-kind investments.

First buyers shape global markets
The pioneering EU aviation mandate also demonstrates the power of buyers to shape the technical qualifications of new supply chains: the criteria imposed by the EU are influencing which projects move forward across the globe, forcing SAF project developers to prioritise feedstocks that will be compliant with EU regulations.

Clear supply side response to mandated volumes: global SAF supply (passed FID) exceeds both 2025 and 2030 EU targets[2]
Global vs EU cumulative passed FID capacity, Mtpa, April 2026



1. These projects with generation 1 or unclearly defined feedstocks no longer have the *Critical decarbonisation technologies* categorisation, but are still separately counted and included in the *First big steps technologies* category. See slide in appendix titled *Category Definitions* for further reference. **2.** MPP Global Project Tracker (June 2026); RMI, Global SAF Demand (Oct 2024)

Demand-stimulation policies are propelling project delivery in sectors and markets where they exist

Aviation

LanzaJet Freedom Pines

Location
Soperton, Georgia, USA

Capacity
~0.03 Mtpa

Production route
Ethanol-to-Kerosene (AtJ)-BtL

Latest status
Operational

Policy framework
The project is geared to serve European markets created by the EU and UK SAF mandates. In addition, US policy support includes supply-side support – with the Inflation Reduction Act SAF tax credit and federal grants – and state-level programmes driving demand (e.g. California's Low Carbon Fuel Standard). Demand-side policies are critical to reduce offtake risk, while supply-side measures improve SAF economics. Combined, they enable commercial SAF investment and deployment.

Key takeaway
Demand certainty driven by regulations and targeted subsidies can unlock FOAK projects, even in high-cost, early-stage value chains like SAF.

Methanol

Lishu Green Methanol

Location
Lishu County, Jilin Province, China

Capacity
~0.20 Mtpa

Production route
Electrolysis + Gasification (Biomass)

Latest status
Reached FID

Policy framework
The recognition of green methanol as a strategic industry in the 14th and 15th Five-Year Plans means the sector benefits from co-ordinated industrial policy, including CAPEX subsidies, city and provincial incentives, partnerships with and offtakes from State-Owned-Enterprises. Demand for green methanol is driven by a combination of domestic demand for methanol in road transport, strongly encouraged by the government and offtake in the shipping sector from major shipping companies anticipating likely international regulations.

Key takeaway
State co-ordination across producers, offtakers and infrastructure can de-risk entire value chains, while combining domestic and international demand de-risks projects.

Steel

Stegra Boden

Location
Boden, Sweden

Capacity
~5 Mtpa

Production route
Green Hydrogen Direct Reduction of Iron

Latest status
Reached FID

Policy framework
While developing 100% green steel presents a challenging business case, Stegra has benefitted from voluntary offtakes from first movers aiming to anticipate future regulations and establish foundational commercial partnerships in an emerging supply chain ahead of competitors. In addition, the combination of carbon pricing (EU Emissions Trading System), carbon border measures (Carbon Border Adjustment Mechanism CBAM) provided greater longer-term market visibility beyond initial offtake agreements, while public support facilitate project financing.

Key takeaway
Voluntary offtake can underpin first-of-a-kind projects, but market-shaping policies are critical to scale capital-intensive clean industry.

Demand centres face strategic choices in designing their new supply chains, balancing competitiveness, value creation and resilience

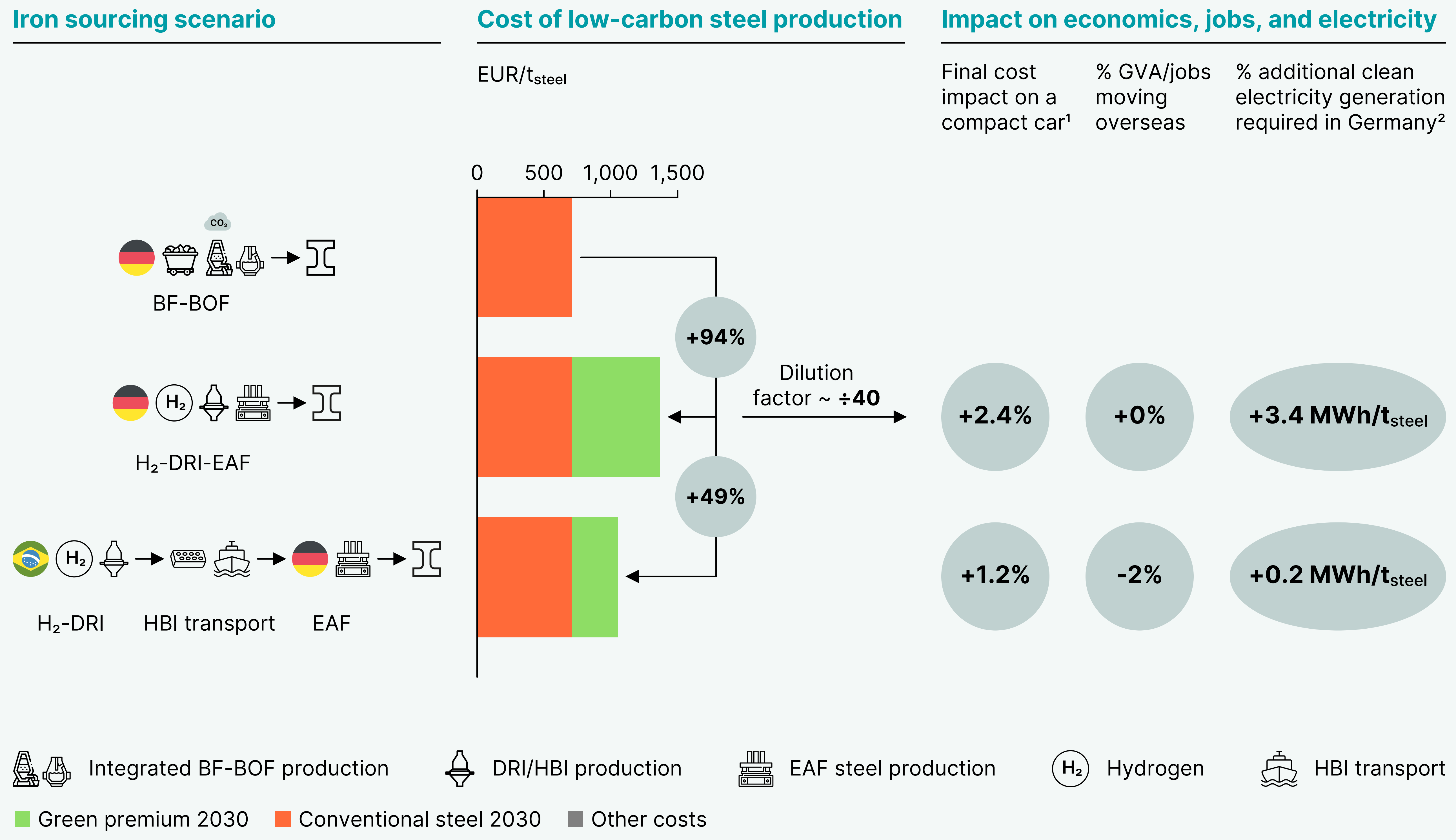
In a world of geopolitical, economic and climate crises, each country must balance short-term cost with long-term competitiveness, jobs and value creation, supply chain resilience, climate imperatives and security concerns.

The strategic choices facing the German steel industry illustrate this difficult balancing act. German fossil-based steel production, vulnerable to peaks in gas prices that set electricity prices, currently struggles to compete in a global market suffering from overcapacity. The shift to clean steel, incentivised by the EU's carbon pricing mechanism, will modernise and future-proof the sector, but represents upfront investments and an ongoing green premium for industrial players. Importantly, two different value chain configurations could be considered:

- Maintaining integrated iron and steel making in Germany may be considered as a matter of industrial sovereignty and as a security imperative in a context of geopolitical tensions. However, production costs will likely be relatively high penalising the competitiveness of the German steel industry – which may then require protection against more cost-competitive, low-carbon steel from abroad – and of downstream steel-using sectors such as the German automotive and white goods sectors. It would also require significant additional clean electricity generation – or equivalent hydrogen imports.
- Importing green iron to be used alongside scrap in electric arc furnaces from various trusted partner countries with favourable endowments, such as Sweden and Spain in Europe, or Brazil and Australia outside Europe, would reduce production costs, limit pressure on the German electricity system, bolster German industrial competitiveness and lower impact on European consumers. But this would require transitioning a small share of jobs in the German steel industry, a loss of technology leadership on ironmaking and a lower level of industrial sovereignty.

The choices made by the EU and Germany today in their carbon pricing, industry and trade policies will strongly influence the balance between these two paths going forward, the shape of the future European steel industry and the scale of the opportunity for aspiring green iron producers around the world.

In Europe, importing green iron for local steel manufacturing can halve cost to consumers and drastically reduce clean electricity requirements, with very limited negative impacts in terms of jobs and GDP.



Sources: MPP analysis based on J.C. Kelly et al. (2020), S. Xiong et al. (2019), RMIS (2025), R&D GREET 2 Series Vehicle-Cycle, ADEME (2024), BCG (2023), ICCT (2025), IEAGHG (2013), TradeMap, Steelonthenet (2025), N. Müllet et al. (2021), K. Benavides et al. (2024), X. Fang et al. (2024), P. Cavaliere et al. (2022), A. Bhaskar et al. (2020), L. Hooey et al. (2014), W. Hall et al. (2021), P. Duarte & J. Martinez (2021), BNEF (2025), Eurostat (2025), Eurostat (2026), World Steel (2025) and other publicly available sources.
1. Selected vehicle is an average compact ICE. Anaylsis with other vehicle types lead to similar conclusions. **2.** Assumes net power demand (i.e. minus self-generation from process gases) of 380 kWh/tsteel for the BF-BOF route, 2,900 kWh/tDRI for H2-DRI, 600 kWh/tsteel for the EAF and 3,800 kWh/tsteel for the integrated H2-DRI-EAF route.

Strategically re-engineering supply chains: key policy design choices for market shapers

Leverage supply, demand and trade policies to optimise for cost, speed and resilience

No single instrument can simultaneously deliver rapid decarbonisation, low costs, resilience and jobs creation all at once. In practise, a three-pronged approach is logical:

- Focus supply-side support where it matters most – target subsidies and industrial support towards segments that you want to anchor domestically, especially where jobs and value are concentrated and where capability delivers resilience or strategic advantage (e.g. high value processing, finishing, specialised production);
- Design demand-side policies to scale markets and source as you see fit, using procurement rules and content requirements to direct buying power toward the suppliers and geographies that serve your resilience and industrial goals; and
- Develop trade partnerships in service of affordability and resilience, where domestic supply is neither cost-competitive nor strategically essential, securing reliable, low-cost inputs through diversified supply chains.

Target local content rules where they matter most and can build advantage

When designing demand-stimulation policies, governments should be clear on what they want to produce domestically, what they want to import and from whom, to shape the markets in line with their strategic needs:

- If cost is paramount, in the absence of any other strategic consideration, free trade remains the most evident and easily applicable option, ensuring cost to downstream sectors and to consumers are as low as possible.
- If there is a risk of overly concentrated supply and a strategic imperative to diversify supply from trusted partners, a country could grant preferential access to its domestic market to a subset of trade partners based on considerations such as effective implementation of carbon pricing and reciprocity of market access – this is an option currently considered in the EU's Industrial Accelerator Act.
- In sectors where a country has already established an undisputable clean industrial leadership, opening access to its domestic market can open the doors of international trade to national leaders.
- When economic or geopolitical priorities justify a level of domestic production despite higher costs, governments can use targeted local content rules (e.g. "Made in Europe") to build a domestic value chain. Over time, this can become cost competitive or help protect strategically important parts of the chain

Embed other strategic goals in industrial policy design

Countries can also leverage their industrial policy frameworks to pursue distinctive strategic goals, for instance:

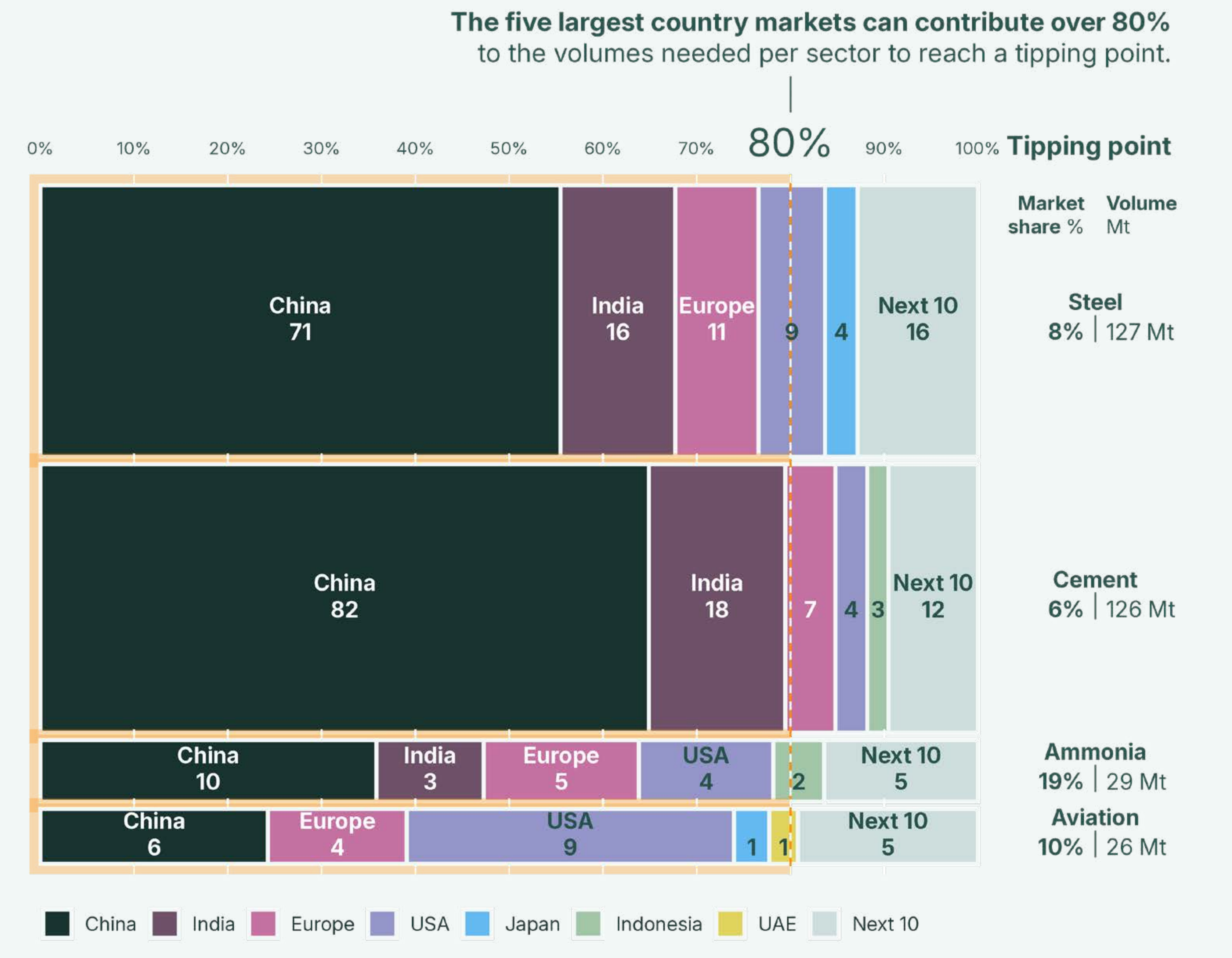
- Expanding global markets for clean commodities to level the playing field and open new market opportunities for national champions - e.g., there is growing evidence that the EU's CBAM, which allows domestic carbon costs to be deducted from the border charge, is encouraging the proliferation of carbon pricing systems, particularly in countries with significant exports to the EU;
- Incentivising the use of domestic technologies and co-investment in projects located abroad - e.g., Germany's export credit agency, Euler Hermes, provided investment into project NEOM, the world's largest green ammonia project, supporting the deployment of Thyssenkrupp Nucera's electrolysis technology;
- Enabling technology transfer to national companies - e.g., China has long conditioned market access in strategic sectors to co-investment with Chinese firms through joint ventures;
- Shaping the technical specifications of key commodities - e.g., sustainability requirements in the ReFuelEU regulations are shaping feedstock sourcing for sustainable fuels across the globe.

Simultaneous demand commitments by major economies could rapidly scale clean commodity markets to tipping points

At an individual country level, smart demand stimulation can shape supply chains in line with national interests. Multiple major countries doing it simultaneously could catalyse global tipping points.

A tipping point is the moment when reinforcing feedback loops, such as cost declines, market uptake, policy support and infrastructure buildout, combine to make a technology's widespread adoption rapid and selfsustaining. It usually occurs when clean technologies reach 5–10% of market penetration.

If the 15 biggest buyers of fuels, chemicals and materials globally were to simultaneously stimulate demand for low-carbon commodities (whether or not in a coordinated way), they could together scale global clean markets to sufficient volumes to unlock tipping points. The top five biggest buyers alone, which generally encompass China, Europe, US and India, could generate 80-90% of the necessary volumes. Depending on the sector, each country would need to transition between 5- 20% of its market to clean products to precipitate a global tipping point. If certain regions like China or the EU were to scale their clean demand faster, they could trigger tipping points even in the absence of progress in other geographies.



1. Tipping point volumes are defined as 5% of projected 2050 production per sector, used as an indicative threshold at which market tipping points become plausible. The top 15 markets selected for each sector are ranked based on projected 2030 consumption, filtered by a weighted feasibility score. The contribution of each country to the estimated volume required to reach a tipping point is calculated by (i) dividing its 2030 demand by the combined 2030 demand of all 15 markets to determine its share proportionally and (ii) applying this share to the estimated volume required to reach a tipping point. **2.** Europe excludes Russia and Türkiye. **Source:** Adapted from MPP, Unleashing market forces to scale green industry The role of Green Market Makers, (Sep, 2024).

Singapore

Clean trade

Forging alliances for resilient, competitive value chains

Trade to win: diverse cross-border alliances can boost competitiveness and resilience

With the global industrial map being redrawn by geopolitics and comparative advantages in clean industrial value chains, projects are actively pursuing cross-border commercial partnerships. Governments can now start exploring which alliances will serve their strategic objectives.

Competitive value chains combine strengths across borders
The strongest, most cost-competitive clean industrial supply chains will combine best-in-class technology and engineering expertise with abundant, cheap, clean energy and natural resources, alongside access to large and growing end markets that provide revenue certainty. These elements are rarely co-located in a single country and so cross-border commercial partnerships are set to minimise production costs for the low-carbon commodities that are the backbone of the global economy and of people's standards of living.

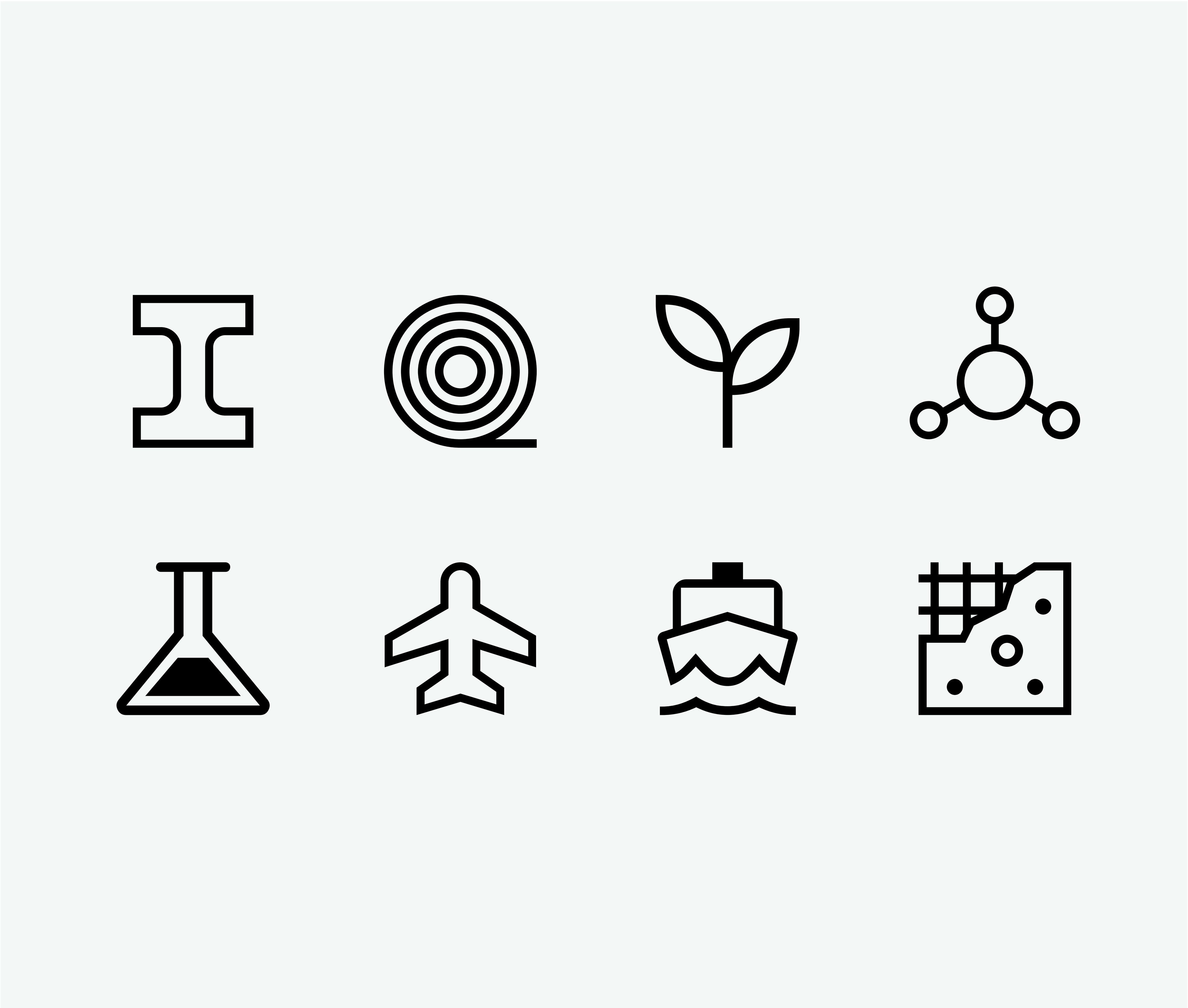
Emerging global clean value chains stumble on barriers at the borders
Three structural barriers prevent clean industrial value chains from reaching their full potential:

- **First-mover risk:** no country, region, or company will transition its segment of an inherently international value chain unilaterally
- **Fragmented markets:** individual lead markets remain insufficient in scale to underpin commercial-scale investment
- **Standards incompatibility:** divergent carbon accounting and certification frameworks create friction for cross-border trade in low-carbon commodities

Proactive trade partnerships accelerate win-win outcomes
In a world of fragmented trade, governments increasingly shape trade flows purposefully to serve their national interests. In emerging clean industrial value chains, depending on each country's singular competitive advantages and strategic objectives, trade can be leveraged to improve affordability, to grow domestic industrial value creation, to boost industry champions on international markets, or to diversify supply chains and increase resilience.

New clean industrial value chains will scale through win-win trade partnerships anchored in complementary national interests. Leading governments have started looking for and nurturing these win-win opportunities. The EU-South Africa partnership is an early example and the first of the EU's Clean Trade and Investment Partnerships (CTIPs) aiming to give the EU access to South Africa's critical raw materials and clean energy while supporting the country's Just Energy Transition. Further afield, the commercial case for an Australia–Korea green iron corridor, making use of Australian renewables and iron ore feeding state-of-the-art Korean steel manufacturing to export to the EU is compelling, but the policy architecture to unlock it remains incomplete.

Market forces will structure trade relationships based on inherent competitive advantages. Waiting for this to happen will affect who captures the value and how resilient resulting supply chains are. For governments, being proactive is the surest way to make clean industry a foundation of their national economic strength and resilience.



Case Study:
AM Green | pioneering new cross boarder trading relationships

India's AM Green is a pioneer in the production of green ammonia and aims to develop a portfolio of plants in India that will eventually be able to produce 4 million tonnes per year of renewable ammonia.

The company's first facility, known as AMGA-K1, is under construction in Kakinada Andhra Pradesh and will have a capacity of 1.5 million tonnes per year. It aims to start producing ammonia commercially in 2028 and is expected to avoid around 2 million tonnes of CO_2 emissions a year once it is fully operational.

The flagship project demonstrates a pathway for building green ammonia facilities, with its repurposed brownfield site, access to round-the-clock green power and a lower cost of capital because of its location in India. It also shows the importance of thinking about the entire value chain when looking at the viability of clean industry projects – not just end customers but suppliers as well.

As a counterpoint to the EU's Made in Europe agenda, it highlights how Europe can benefit economically from clean energy projects outside Europe because European technology suppliers provide key equipment and engineering and European offtakers buy the product cheaper than if it had been produced in Europe. →

Case Study:
AM Green | pioneering new cross boarder trading relationships

“There’s lot of European partnerships here,” says the company’s CEO, Gautam Reddy. The electrolysers for the project are being provided by Belgium-based John Cockerill, Air Liquide is providing a nitrogen generation unit, Swiss company Casale is providing the ammonia licence and a joint venture between Technip Energies and John Cockerill, called Rely, is an integrated technology and Engineering, Procurement and Construction Management (EPCM) delivery contractor. Japan’s Toyo is building the ammonia storage facility.

The demand from European offtakers was key to attracting investment to the project, although India’s high dependence on imports of energy and other inputs for fertiliser means there are also domestic demand drivers for the green ammonia.

AMGA-K1 is one of the first large-scale renewable ammonia plants to be built globally that is compliant with the EU’s RFNBO (renewable fuel of a non-biological origin) requirements.

Its economics are helped by the fact that the project is converting an existing facility that previously produced ammonia and urea using gas as a feedstock.

AM Green is a sister company to Greenko, one of India’s largest clean energy companies and it allows the founders to branch out from clean power, which cannot be exported from India, to green molecules, which are globally tradable and can provide a source of export revenue.

Green hydrogen is an expensive molecule today, says Damien Eyries, CEO at Rely and it needs to become affordable without support because subsidies will disappear at some point. “It’s very important for us to work on the competitiveness of this molecule. And the best way to do that was to combine the technology development with the project execution. Having this combination between technology and project execution is the only way to remove the cost barriers and to decrease the price of the hydrogen.”

Combining EPCM and technology development helps to reduce capital costs by up to 20%, with savings also available on operational costs, Eyries adds. And there is further room for improvement thanks to an accelerated feedback loop between project operations and technological improvements. Having one single point of contact gives financiers confidence in a nascent technology, he adds, while Rely also hopes to benefit from its first mover advantage.

The initial markets for green hydrogen and green ammonia, he believes, are refining and fertiliser, where green can replace existing grey hydrogen with minimal investment in new infrastructure required. Green ammonia or hydrogen will allow these sectors to reduce their carbon intensity but also to manage the gas price volatility that has had such a disruptive effect in recent years. The value of this has been demonstrated by the huge instability in prices seen recently due to the geopolitical upheaval in the Middle East.

Sectors such as shipping will take longer to develop. Although it will be an important market in the long term, it needs a completely new ecosystem for maritime fuel, with ships adapted to run on methanol or ammonia, as well as changes to port infrastructure.

The crucial factor in building scale by bringing more large projects online is a full order book, Eyries adds. “We need offtake. Europe is encouraging that thanks to regulations such as CBAM (Carbon Border Adjustment Mechanism) and the Renewable Energy Directive (RED III). We need certainty, simplification and acceleration of the deployment of this regulation. If the rules of the game are not set in stone, it’s quite difficult to develop the large projects, the whole supply chain and the industry to improve our technology, improve our execution and then lower the price.”

For this project, the key offtaker is the German energy company Uniper, which has agreed to offtake up to 500,000 tonnes of AM Green’s ammonia production from 2028. This has, in turn, unlocked interest in offtake by a number of others. The company sees itself as a market catalyst, using its pioneering experience in trading LNG, biomass and other global energy commodities to link global supplies of low-carbon fuels with European demand. Green ammonia is the ideal place to start because it already benefits from existing infrastructure, end-use versatility and its cost gap to its grey equivalent is lower than some other low-carbon alternatives. “We decided to focus on the not-so-hard-to-abate sectors first. The willingness to pay is higher and the need for subsidies therefore lower,” says Benedikt Messner, Uniper’s SVP New Energies.

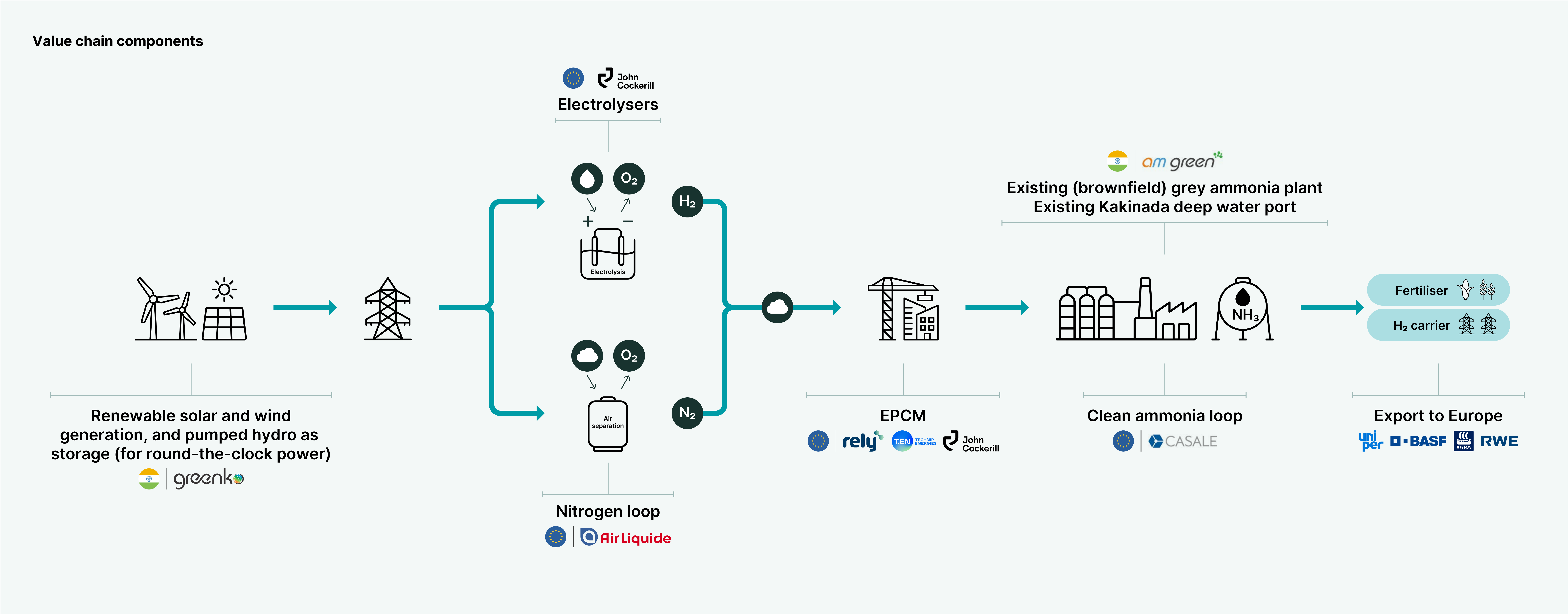
Clean fuels suffer from a “chicken-and-egg” problem. Projects cannot secure financing without long-term offtake agreements, but customers are reluctant to commit to such agreements because of uncertainty and high costs.

Having Uniper as an offtaker gave investors in AM Green confidence that large-scale trade in green ammonia is possible. Uniper’s experience across the full value chain of shipping, ports, storage and ammonia cracking back to hydrogen, as well as its experience in finding customers for commodities – in this case in the refining, chemicals and fertiliser sectors – also helped to reassure the market.

Uniper highlighted, though, that signing the contract is not the end of it. For the industry to develop, appropriate certification must be in place to ensure that the product complies with RFNBO standards and further sources of green ammonia will be needed to compensate for any unexpected production disruption in a project.

Looking ahead, Uniper expects Europe to rely on imports for hydrogen and ammonia because high electricity prices will limit local electrolysis outside renewables-rich regions such as Spain or the Nordics. The company advocates a pragmatic transition, prioritising “low-hanging fruit” sectors where emissions can be reduced in a more cost efficient and timely manner, while accepting that full transformation will take time and require a mix of technologies rather than a single solution.

Deep-dive: AM Green consciously sourced all its major technology components from European suppliers to help it build credibility for its target export market of European offtakers



The way forward: how governments can leverage trade to build resilience and competitiveness

Global trade will be shaped by market forces and underlying competitive advantages. But how value chains take shape, who captures value and how resilient those chains become is not predetermined. Governments that engage proactively will help shape the markets of tomorrow. Acting now and acting deliberately is the surest way to make clean industry a foundation of long-term economic strength, competitiveness and resilience.

Five ways governments can act

1. **Prioritise critical value chain positions**
   Governments should make explicit choices about which segments of which clean industrial value chains matter strategically. Rather than self-sufficiency as the goal, deliberate choices should be made about what to build domestically and how to secure advantaged positions within globally integrated systems.
2. **Use demand to build leadership, resilience and security**
   Domestic demand-stimulation policies - including public procurement and mandates on private procurement - are among the most effective tools governments have to build leadership through scale and/or protect strategic activities.
3. **Forge win-win trade partnerships to strengthen resilience**
   No country will lead across every segment of every clean value chain. Strategic trade partnerships allow countries to combine complementary strengths - improving affordability, access to clean inputs and resilience. Bilateral cooperation and interestaligned coalitions ("minilaterals") offer an effective way forward.
4. **Establish the building blocks of successful trade corridors**
   Together, partner countries can:
   - **Coordinate industrial strategies** to allow partners to scale complementary parts of clean value chains at a coherent pace;
   - **Scale low-carbon markets faster,** as several countries act together to stimulate demand and open markets to trusted partners;
   - **Align standards for tradable clean products,** including product definitions, carbon accounting, certification and MRV systems;
   - **Co-invest in industrial assets and infrastructure** through joint corridor infrastructure planning and shared derisking instruments to unlock first projects and crowd private capital into crossborder value chains.
5. **Act early to shape tomorrow's markets**
   Clean markets are being defined now by those willing to make choices, scale demand, partner and invest. Countries that establish their role early will help shape rules, standards and value distribution. Those that wait will find markets already structured around others' priorities.

Nineteen new final investment decisions were recorded in the last six months, double the equivalent period a year earlier

The time is now

We live in a time in which it is increasingly clear that dependence on fossil fuels – not just for energy but also for materials such as steel and cement and chemicals such as fertilisers – is a serious risk for countries and companies alike.

Relying on imported oil and gas makes nations, businesses and citizens vulnerable to higher and more volatile energy costs. In turn increasing the risks of energy insecurity and the associated knock-on impacts that hold back economic growth, weaken supply chains and food security, ultimately undermining industrial competitiveness.

Clean industrial development offers a way to reduce that dependence and vulnerability. It lessens shock rises in the price of food, fuel and raw materials in the face of geopolitical upheavals while making a major contribution to the fight against climate change.

The sector needs trillions in investment to scale up, but that investment will drive growth while making economies more resilient and competitive. And that investment is starting to flow – more than 800 projects are in development, with 161 already financed or built. Fuels and chemicals have dominated recent investments, particularly in methanol and SAF, showing an emerging fuel supply infrastructure that can help the aviation and shipping sectors to decarbonise. Materials remain slower to progress, but aluminium already has a head start on low-carbon production while even the modest additions to clean steel and cement volumes can provide significant learning and cost reductions to accelerate future projects.

Clean industry projects offer countries with strong renewable resources across the New Industrial Sunbelt the opportunity to reduce their reliance on volatile fossil fuel imports, boost their energy security and build new, future-facing industrial capacity.

While China is powering ahead in clean industry, it is not yet as dominant as it is in clean energy and transport. Nations that act now to commercialise clean technologies can still lock in durable advantages, improve performance, drive down costs and build export-ready industries.

But growing clean industries is not just about who has the supply side advantages – demand from the largest industrial consumers plays a huge role in how global clean supply chains develop. Because bankable demand and low-cost clean inputs, particularly renewables, rarely happen in the same place, cross-border partnerships are crucial to build scale, create jobs and cut costs.

Attracting capital into clean industrial assets can create a virtuous cycle of cost reduction and adoption. What is needed to make clean industry bankable and attract this capital is first and foremost markets for low-carbon commodities at scale. The time is now. Those that wait risk repeating past mistakes and ceding manufacturing, market share and long-term strategic control as the industry consolidates.

Ammonia | fertiliser

Appendix

Category definitions

Tighter parameters have been set to identify clean industrial projects as near-zero production, while new categories recognise complementary approaches driving broader moves towards clean industry across sectors.

1 Deep decarbonisation technologies
Core focus

Major technology routes without which the sector cannot reach near net zero (>70–80% emissions reductions across production processes). Required for the bulk of the journey to net zero.

- Green H2-DRI
- CCS
- Electrolysis-based NH3
- (e)SAF production

2 Circular technologies
Needed for full sector decarbonisation

Technologies that reduce emissions through recycling and reuse.
Projects are not always additional.

- Scrap-based steel
- Scrap-based aluminium
- Plastics / chemicals recycling

3 Last-mile technologies
Required for full sector decarbonisation

Technologies that stack onto critical decarbonisation technologies to deliver the final emissions reduction to reach net zero.

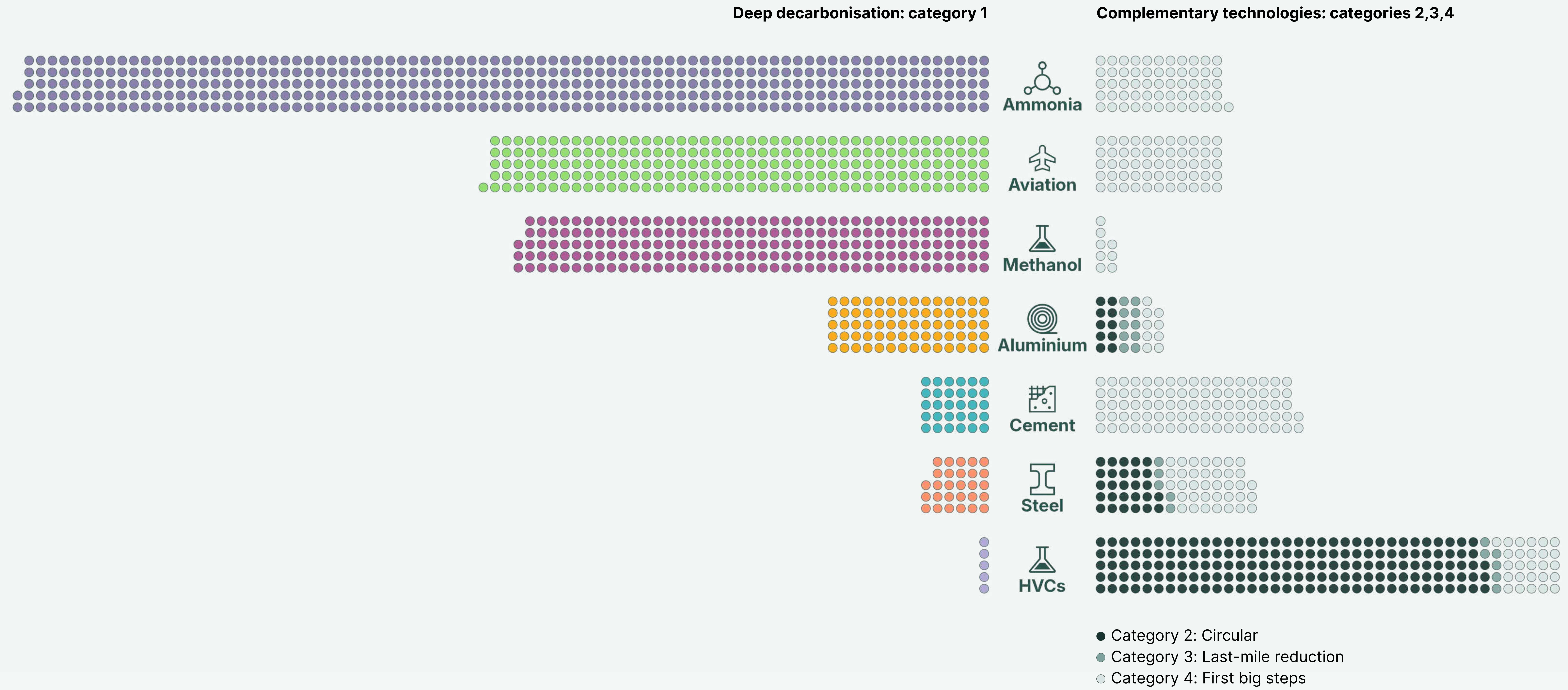
- Inert anodes
- Low-carbon alumina
- Ancillary EAF electricity

4 First big step technologies
Important for clean industry transformation

Technologies that yield significant emissions reductions but are insufficient by themselves to reach near-zero. Important particularly in the short term, provided they do not lock projects into suboptimal assets such as fossil fuel infrastructure.

- Partial H2-DRI
- Calcined clay (SCMs)
- NH3 process emissions capture
- BF + bio-energy

Total number of projects in core pipeline and for complementary technologies



Final Investment Decision | Ammonia

AM Green | Kakinada | India

Sector
Green ammonia

Status
Under construction - targeting 2027 production

Project investment
$200 m site acquisition; undisclosed full project capex

End markets
Binding offtake secured with multiple European companies from fertilisers to energy to chemical manufacturers

Production volume
500 ktpa phase one; 1 mtpa cumulative phase two; 1.5 mtpa at full build out

Emissions
Up to 3.3 $MtCO_2e$ abatement annually at full 1.5 mtpa capacity

Infrastructure
1 km from Kakinada Deep Water Port. Approx 1.3 GW of electrolyser capacity at full phase 1 build out; power from Greenko pumped hydro storage

AM Green's Kakinada facility is India's first RFNBO-certified green ammonia project, converting a brownfield fertiliser plant into a 1.5 mtpa site. It secured Europe's first binding long-term green ammonia offtake from Uniper SE with offtake already exceeding twice Phase 1 capacity. Rely (Technip Energies–John Cockerill JV) provides integrated electrolyser technology and EPCM services.

Power drives 75% of costs in clean ammonia production. Sister company Greenko provides renewable power with high efficiency pumped hydro storage, for highly cost-competitive round-the-clock (RTC) power, enabling a sub-$800/tonne target price without extensive subsidies. Beyond the direct ammonia output, Kakinada opens a new India–Europe trade corridor in clean commodities, with contractual precedents (e.g., no fossil-fuel indexation, RFNBO compliance) now shaping the broader market.

Project Insights

Read Full Case Study ▶

Technology: AM Green knew it would be targeting European offtakers, so consciously chose established European tech suppliers. The RTC power allowed for decades-proven alkaline electrolysers (John Cockerill). Rely supplies the modular Clear100+ platform, Casale the ammonia synthesis loop and Air Liquide the air separation unit.

Market: Uniper's 500 ktpa contract is among the world's first binding long-term green ammonia offtakes. It required precedent-setting pricing and RFNBO compliance architecture.

Economic: The brownfield acquisition compressed timelines costs and demonstrated operational credibility - e.g., existing ammonia loops, permits and operators. Additionally, Rely estimates a ~20% cost reduction from integrated procurement of technology development and project execution.

Partnerships: Key across technology, energy, delivery and offtake. Rely and AM Green operate as an integrated team, enabling rapid issue resolution. AM Green's in-house engineering team owns the technical architecture and interface integration.

- **2022:** Brownfield site acquired: $200 mn acquisition of Nagarjuna Fertilisers & Chemicals at Kakinada (Andhra Pradesh)
- **2024:** RFNBO certification: First company in India certified under the EU Renewable Fuels of Non-Biological Origin standard
- **2024:** First binding offtake: Uniper SE signs 500,000 tpa contract
- **2025:** 1.1 MTPA contracted: Yara (500 kt), RWE (250 kt), and BASF (100 kt)
- **2025:** Construction underway: electrolyser assembly facility being established in India under PLI scheme
- **2027:** Phase 1 first production: targeted; phase 2 second train planned to launch within 6–9 months of initial commissioning

Operational | E-methanol

European Energy | Kassø | Denmark

Sector
E-methanol

End markets
Shipping (A.P. Moller – Maersk), toy manufacturing (Lego group), pharmaceuticals (Novo Nordisk)

Production volume
42 ktpa

Capacity
304 MW solar park connected to the grid, 52 MW of electrolysis capacity, biogenic CO_2 sourced from a nearby biogas facility

Other metric
2 production lines, first commercial e-methanol facility

The Kassø project is the world's first commercial-scale e-methanol facility. It integrates renewable electricity from a co-located solar park, a 52 MW electrolyser and a local biogenic CO_2 source to produce low-carbon methanol for shipping, chemicals and healthcare offtakers. While the first facility is relatively small, European funding will unlock a co-located 100ktpa facility – with offtakers already interested – and global scaling is being explored, for example in Brazil (with Petrobras).

The initial smaller scale allowed European Energy to test and de-risk their own and others' technology and they have made several technology acquisitions across the value chain. Another key first mover advantage is building trust with offtakers and other stakeholders for subsequent projects. Kassø shows how renewable electricity can be converted into versatile clean fuels for hard-to-abate sectors.

Project Insights

Read Full Case Study ▶

Technology: The facility integrates European Energy's own proven renewable power technology, hydrogen production, carbon capture and methanol synthesis., They used Siemens electrolysers, acquired a Danish start-up for the synthesis (which they subsequently scaled) and CO_2 from a nearby biogas plant as well as acquiring Ammongas CO_2 processing. Schneider Electric did the technology integration.

Market: Offtake agreements from Maersk, LEGO and Novo Nordisk secure demand across shipping, plastics and healthcare, demonstrating cross-sector appetite for e-methanol.

Innovation: Besides Kassø and the related technology acquisitions, European Energy operates a 12 MW electrolyser test facility to trial different electrolyser brands and configurations. Together, these assets enable continuous learning on performance, system integration and cost optimisation, to directly inform future project development.

Financing: Kassø was developed without operating subsidies, through equity and project debt. Ownership is split between European Energy (51%) and Mitsui & Co. (49%), with long-term offtake contracts underpinning bankability and investor confidence.

- **August 2021:** Sign offtake agreement with Maersk for e-mthanol to be used in the world's first dual fuel container ship
- **January 2022:** Reaches final investment decision
- **June 2022:** a 304 MW solar park is connected to the grid and will supply the future e-methanol facility
- **August 2022:** Contracted with Tønder Biogas for a 60 ktpa supply of biogenic CO_2 required for e-methanol production
- **April 2023:** Novo Nordisk and Lego sign offtake agreements
- **May 2023:** Inauguration of the Kassø solar park and groundbreaking for the plant
- **May 2025:** official opening of the e-methanol facility

Operational | Aviation

LanzaJet
Freedom Pines Fuels | United States

Sector
SAF

End customers
IAG, Shell (SAF) and Microsoft (renewable diesel)

Production volume
31 ktpa of SAF (90%) and renewable diesel (10%)

Jobs
250 jobs during construction, 30 direct and 50 indirect jobs during operation

Freedom Pines Fuels is the world's first commercial-scale Alcohol-to-Jet (AtJ) facility, proving reliability at commercial scale beyond existing HEFA pathways. It converts ethanol into drop-in jet fuel by combining established technologies within a new AtJ pathway. It has introduced a novel 'AtJ as-a-service tolling model': feedstock providers supply the feedstock, LanzaJet does the AtJ conversion and gets paid a fixed fee with the offtakers receiving the fuel. It is flexible on feedstock but plans to use waste slurry as this is locally available in the US and meets EU requirements.

Beyond fuel production, the facility strengthens energy security, supports local economic development and demonstrates that emerging SAF technologies can scale, providing a replicable model for global SAF expansion.

Project Insights

Read Full Case Study ▶

Markets: Demand-side policy is critical in getting projects like Freedom Pines Fuels financed to enable technology improvement and cost reductions. Offtakers, currently, are mainly EU and UK markets due to the existing mandates there.

Innovation: For offtakers, the tolling structure guarantees access to production capacity and avoids dependence on other parties' feedstock choices. For LanzaJet, it ensures predictable revenues and clearer risk allocation, enabling investment in a first-of-a-kind facility where traditional financing models would be challenging.

Delivery: A vertically integrated model enabled rapid iteration and reduced complexity. A deliberate "small-scale commercial" design allows for a faster deployment of future facilities.

Partnerships: Freedom Pines was enabled by a wide ecosystem of strategic partners across energy (Mitsui, Shell, Breakthrough Energy), aviation (BA, IAG, Southwest, ANA, Airbus, Groupe ADP), corporates (Microsoft), finance (MUFG) and US and UK governments.

2010: LanzaTech and the Department of Energy's Pacific Northwest National Lab initiated research and proof of concept efforts

2015: LanzaTech constructed first pilot and demo SAF facilities

2018: the first SAF proving flight from Orlando to Gatwick. LanzaTech receives ASTM approval resulting in the first approved alcohol-to-jet pathway for SAF production.

2020: Together with Suncor, Mitsui, U.S. Department of Energy and All Nippon Airways LanzaTech establishes LanzaJet ito scale SAF production.

2023: LanzaJet receives EPA Fuel Pathway Approval to use sugarcane ethanol at Freedom Pines

2024: Freedom Pines, the first commercial AtJ SAF facility, is commissioned

The Global Project Tracker: methodology and updates

Recent updates reflect a continued effort to improve data accuracy, consistency and regional coverage across the global pipeline of commercial-scale decarbonisation projects. This cycle focused on deeper data validation, stricter inclusion criteria and expanded regional research to better capture real-world deployment trends.

Enhanced duplicate verification and data integrity refinement	A comprehensive duplicate review was conducted in collaboration with data partners, resulting in the identification and removal of overlapping entries. This was particularly relevant in regions such as China, where multiple sources and naming conventions had previously led to double counting.
Refined treatment of defunct projects	Projects with no public evidence of progress since 2023 have been systematically reclassified as defunct. This ensures the tracker reflects a more realistic view of the active pipeline and avoids overstating near-term deployment potential.
Stricter feedstock eligibility criteria	A more stringent approach to feedstock classification has been applied to Category 1 projects. Projects relying on first-generation (Gen 1) feedstocks (food-grade fats and oils) have been downgraded to the First Big Steps category. Feedstock choice is a key driver of lifecycle emissions and projects using similar technological pathways can have materially different decarbonisation outcomes depending on input sources.
Expanded regional coverage	Data coverage has been further strengthened through expanding regional expertise across APAC markets and continued deep-dive research in China. Work across Brazil, MENAT, India and Australia has also continued, further improving visibility into emerging project pipelines and better reflecting regional deployment dynamics.

1. For additional information on key data sources, methodologies and set thresholds for each sector, please refer to the Global Project Tracker at tracker. missionpossiblepartnership.org
2. We reserve the right to make data adjustments within 30 days of the publication.

Detailed methodology and definitions

The data for this edition of the Global Project Tracker follows updated methodology across all projects and sectors, with the following criteria in the scope of Category 1: Deep Decarbonisation projects:

Sector	Data sources	In-scope products	In-scope Category 1 technologies[1]	Threshold[2]
Ammonia	AEA, Primary Research	Ammonia	Electrolysis (ALK/PEM/SOEC), Grey H2 + CCS (ATR/Gasification/SMR)	0.1 Mtpa
Methanol	Methanol Institute, Primary Research	Methanol	CCS (Natural Gas), Electrolysis + CO_2, Electrolysis + Gasification (Biomass/Residual waste), Gasification	0.1 Mtpa
High Value Chemicals	Systemiq, IEA, Global Partners for Plastics Circularity	Ethylene, Propylene, Olefins	Green MTX (biogenic), Cracker + CCS	0.1 Mtpa
Aviation[3]	Atoma Research, Primary research	SAF	Fischer-Tropsch (BtL/PtL), Methanol-to-Kerosene, Ethanol-to-Kerosene (AtJ), HEFA-BtL, Pyrolysis-BtL	0.01 Mtpa
Aluminium	Primary research, IAI historic data	Primary Aluminium	100% clean electricity[4]	0.1 Mtpa
Cement	Primary Research, LeadIT historic data	Cement	Traditional production + CCS	0.1 Mtpa
Steel	LeadIT, Atoma Research, Primary Research	Primary Steel, Iron	Green H2 Direct Reduction, NG/COG-DR (transitioning to H2), DRI + CCS	0.1 Mtpa

1. Includes Category 1 technologies for each sector for which commercial scale projects have attained in-scope pipeline status definitions.
2. For each sector, only projects above the set capacity threshold were included. Commercial-scale plants and demo projects with noted commercial ambition were included on a case-by-case basis; pilot and R&D level projects are excluded where identified.
3. Aviation technology categories adjusted to broadly align with ASTM pathways as well as Power to Liquid (PtL), Biomass-to-Liquid (BtL) and Power Biomass to Liquid (PBtL) categorisation.
4. Assumes fully decarbonised smelting of primary aluminium; does not include projects without ties to specific smelters.

Back-up: tech routes per category

Ammonia	• Deep: Electrolysis (ALK, PEM, SOEC, Pressurized Alkaline, Other); Grey H2 + CCS (ATR, Gasification, SMR flue gas + process emissions capture, Partial Oxidation, Other) • First big steps: Grey H2 + CCS (SMR/gasification only process emissions capture); Grey H2 + CCU; Gas reforming (Biomethane + Natural gas)
Aluminium	• Deep: 100% clean electricity[1] • Last-mile: Inert anodes; Low-carbon alumina • Circular: Scrap-based secondary production • First big steps: Partial clean electricity; Bioenergy for anode production
Steel	• Deep: Green H2 DRI; NG/COG-DR (with concrete plans to transition to H2) • Circular: Scrap-based secondary production • First big steps: BF + Bio; BF + CCUS (<80% capture); H2 Production; NG/COG-DR (no concrete plans to transition to H2); Traditional production + CCUS; Biocovers; DRI + CCU
Cement	• Deep: Traditional production + CCS • First big steps: Alternative Binder Chemistries; Alternative Fuels; Conventional SCMs; SCM: Calcined clay; Traditional production + CCUS[2]
Methanol	• Deep: CCS (Natural Gas); Electrolysis + CO_2 (biogenic/non-biogenic); Electrolysis + Gasification (Biomass/Residual waste); Gasification (Biomass/Residual waste); Gas reforming (Biomethane) • First big steps: CCUS (Natural Gas); Gas reforming (Biomethane + Natural gas); CCU + H2 (non-renewable)/ETL
High Value Chemicals	• Deep: Green MTO (biogenic); E-cracker • Circular: Chemical recycling; Mechanical recycling; Pyrolysis; Depolymerisation; Gasification; Biological Treatment; Landfill gas upgrading; Landfill gas to power; WtE + CCS • First big steps: Ethane cracking + CCUS (byproduct); Methane pyrolysis (carbon black byproduct); Partial biomass; H2-fuelled cracker; CCU (EOR); CCS
Aviation	• Deep: Fischer-Tropsch Synthesis-PtL, Fischer-Tropsch Synthesis-BtL, Fischer-Tropsch Synthesis-PtL/BtL; Methanol-to-Kerosene (PtL, BtL, PtL/BtL); Ethanol-to-Kerosene (AtJ) (BtL, PtL, PtL/BtL); Hydrothermal Liquefaction-PtL/BtL; Novel-BtL; HEFA-BtL • First big steps: HEFA-BtL (Coconut oil feedstock); Ethanol-to-Kerosene (AtJ)-BtL (Gen 1 feedstock); Fischer-Tropsch Synthesis-PtL/BtL (Gen 1 feedstock); Bio-ethanol dehydration; Plastic pyrolysis

1. Refers to the Rio Tinto Arvida AP60 extension and legacy projects. **2.** Usually cases are CCU or unclear how the captured carbon will be utilised.

Join us in driving the new industrial revolution and fast-tracking clean industry this decade.

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