Business Breakthrough Barometer 2024

Chemicals

World Business Council *for Sustainable Development*

BAIN & COMPANY

29 October, 2024

Key messages *1/2*

- The majority of businesses are not confident that the chemical sector is on track for net-zero, as 50% of business expect chemical GHG emissions to peak after 2030
  - 56% thought the sector was “not on track” for a Paris aligned transition
  - Only half of businesses expect that Chemical GHG emissions will peak before 2030
- Business leaders believe the heterogeneity and complexity of the chemical industry have led to inaction from policymakers
  - The industry emphasizes that no single solution exists for all chemical products, with action required on multiple fronts, including alternative feedstocks, carbon capture and sequestration, and process energy abatement
  - However, most business leaders believe the biggest impact can be achieved through process energy decarbonization
  - Despite these potential pathways, companies report slow progress. The general sentiment is that voluntary demand is low, and regulatory pressure is insufficient to drive change
  - Without economic drivers, businesses remain hesitant to allocate significant capital expenditures for low-carbon technologies
- Electrification remains a focal point for reducing process emissions, but only 7% of the industry’s process energy is currently electrified, with no progress over the past decade
  - Only 7% of the industry’s process energy is currently electrified, with stagnant progress over the past decade
  - The sector views tackling process emissions as a top priority, but energy intensity makes electrification challenging
  - No material progress on electrification has been made past 12 years, companies like BASF and SABIC investing in early-stage efforts to electrify energy-intensive core processes, such as electric steam crackers, which accounts for ~10% of the sector’s primary energy use
  - However, extensive process redesigns are required, involving significant CapEx, and businesses are concerned about the availability of renewable energy
- Alternative feedstock use currently driven by other sustainability trends but will in the future increasingly support decarbonization
  - Some companies are increasingly exploring the use of bio-based and recycled feedstocks, largely driven by demand for circular products
  - Currently the use bio-feedstocks often results in higher lifecycle emissions due to the higher energy intensity of processes; and scaled adoption of recycling constrained by high costs and the scarce supply of high-quality waste required for mechanical recycling
  - Business leaders are more optimistic on the prospects for chemical recycling to increase viability of alternative feedstock use for some production processes but do not expect material progress until after 2030, with only ~150ktpa pilot capacity deployed
  - Companies also anticipate the adoption of green hydrogen and ammonia production, but progress is slow with operational capacity only accounting for 2% of global hydrogen production

Key messages *2/2*

- Business leaders consider incentives vital to accelerate carbon capture and storage deployment in a high-volume, low-margin industry like chemicals
  - Carbon capture is currently in place for less than 1% of global primary chemical production emissions, though the pipeline is more promising at around 15%
  - Much of the capture capacity is geared towards chemical feedstock for fuel industries, like ammonia for shipping or power, rather than reducing emissions from existing use cases as producers view the added costs as prohibitive in an already low-margin and globally competitive commodity industry
  - However, U.S. tax credits have significantly increased the viability of CCS for chemical production. Ammonia producers highlight that these credits make it feasible to capture two-thirds of direct GHG emissions, leading to a sixfold increase in FIDs for U.S. chemical point capture projects from 2021 to 2024
  - Full emissions capture would require higher subsidy levels, with ammonia producers citing significantly higher credits required to enable complete capture and sequestration
- On the current trajectory, business leaders predict chemical sector emissions will peak well after what is required for a net-zero scenario
  - Companies are sceptical about the industry's ability to reduce emission intensity, and with new net-zero use cases expected to drive significant demand growth, few believe the sector is on track for net-zero by 2050
  - Sectors leaders are concerned that limited policy attention is causing the chemicals sector to lag behind: over 60% of surveyed chemical companies have low confidence in current policy support
  - Some sector leaders suggest other sustainability interventions – such as the UN Plastic Treaty - could drive greater international action on waste, and thus indirectly address GHG emissions tied to plastic production
  - But the scope and nature of implementation is yet to be defined and there is little else on the horizon other than the EU ETS and CBAM which is likely to incentivise investment
- Companies cite unattractive business case and technological immaturity as top barriers holding back decarbonization of chemical production
- Policy within pricing support, mandates, financing, global collaboration & standards, is cited as top asks from government by chemical producers

Businesses’ confidence in the chemical sector's transition is among the lowest across all sectors

56%

56% thought the sector was “not on track” for a Paris aligned transition

50%

Only half of businesses expect that Chemical GHG emissions will peak before 2030

Source: Business Breakthrough Barometer Sector Survey (N=250); Business interviews; Bain analysis

Business leaders believe the heterogeneity and complexity of the chemical industry have led to inaction from policymakers

Highest — **Abatement impact:** Business leaders view decarbonizing process energy as the top priority for abating chemical emissions — Lowest

	PROCESS ENERGY DECARBONIZATION		ALTERNATIVE FEEDSTOCK			CARBON CAPTURE
	Decarbonize energy	Energy efficiency	Bio-feedstocks	Hydrogen / Captured Carbon	Recycled feedstocks	Capture and storage of CO_2
Petroleum refining products	Shift to low-and zero-carbon H_2 and/or electrification possible	Some remaining potential (e.g., optimizing use of residual heat)	Partial replacement of crude oil by bio feedstocks to create biofuels (limited by feedstock availability)	Partial decarbonization of hydrotreating and hydrocracking process steps by use of green H_2	Partial replacement of crude oil by recycled plastic feedstock (e.g., by companies like Renasci)	Combination of pre-combustion capture (SMR) and post-combustion capture (furnaces, FCC regenerators possible
Olefins and aromatics (cracking)	Low-and zero-carbon H_2 and electrification possible	Some remaining potential (e.g., optimizing use of residual heat)	Bio-based pathways are viable yet currently net-negative given increased energy demands	Existing technologies available but hindered by challenges related to water formation and separation	Mature chemical recycling technologies available but limited feedstock availability	Post-combustion capture (e.g., flue gas)
Organic intermediates	Low-and zero-carbon H_2 and electrification possible	Some remaining potential	Bio-based pathways are viable yet currently net-negative given increased energy demands	Existing use cases (e.g., ethylene glycol from CO_2) but challenged by high energy requirement	Chemical recycling of plastic allows for the pure recovery of the carbon building blocks (e.g., PET recycling to EG and PTA)	CO_2 emissions are not concentrated and come from both process and energy so difficult to capture
Ammonia	Low-and zero-carbon H_2 and electrification possible	Sizeable potential as efficiencies are ~55% today	n/a given no need for a carbon feedstock	Majority of emissions from SMR to produce grey H_2 which can be substituted by green H_2	n/a given no recycled feedstock available	Combination of pre-combustion capture (SMR) and post-combustion capture (furnaces, FCC regenerators possible
Polymers	Low-and zero-carbon H_2 and electrification possible	Some remaining potential (e.g., optimizing use of residual heat) Further efficiency gains are possible in LDPE production	Existing use cases (e.g., Polylactic acid) but challenged by high energy demand	Existing use cases (e.g., PP produced from green H_2 and CO_2) but challenged by expensive and low supply feedstock	Chemical recycling (early stage today) allows for the recovery and use of carbon building blocks	Post-combustion capture (e.g., flue gas)
Inorganic intermediates	n/a production is already electrified	Sizeable potential as efficiencies are ~75% today	n/a given no need for a carbon feedstock	CO_2 is a reactant during the production of Sodium carbonate	n/a given no recycled feedstock available	Given limited process emissions

Most chemical customers, despite making significant decarbonization commitments, are not moving fast to reduce chemicals [emissions] despite having identified this area as a main contribution to their footprint

CO-CEO, SUSTAINABLE CHEMICALS PRODUCER

We are targeting high-value sectors like fragrances and food packaging where sustainability narratives are strong, but the industry moves slowly because it's so complex

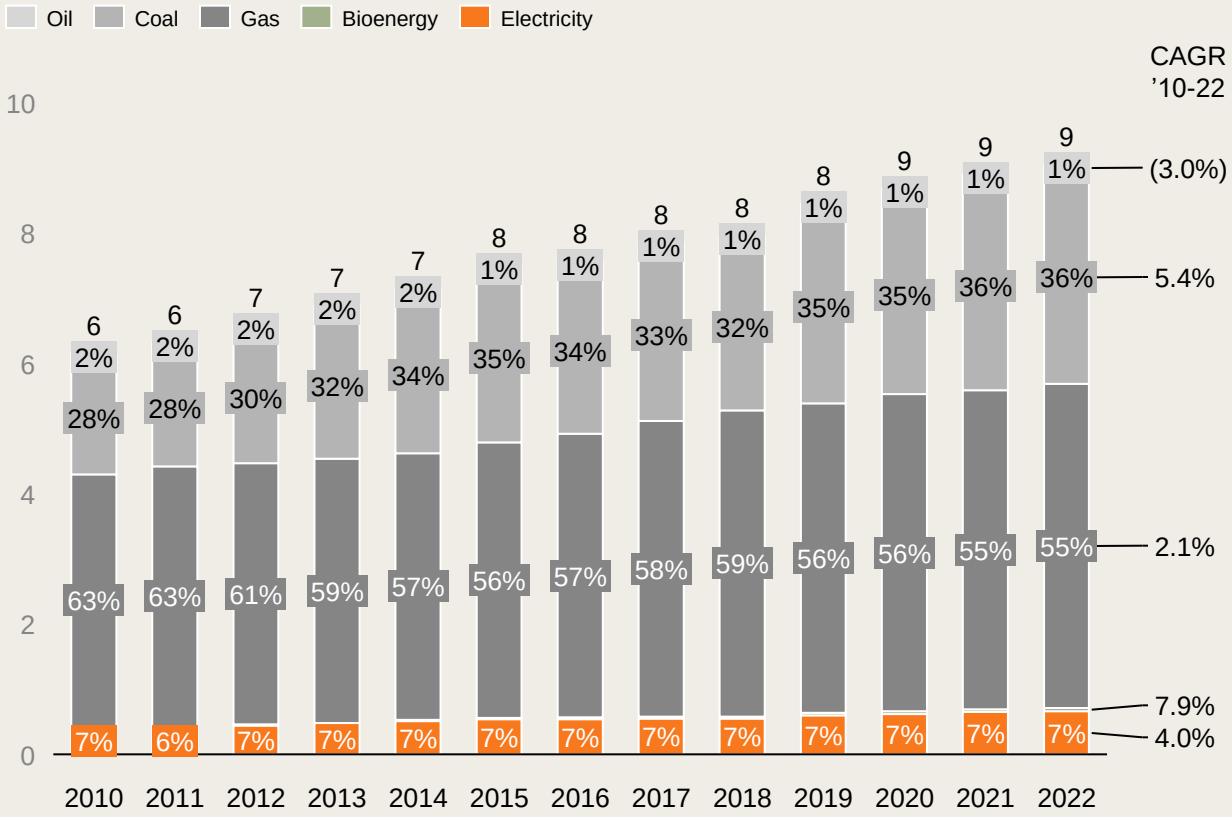
CO-CEO, SUSTAINABLE CHEMICALS PRODUCER

Decarbonization potential[1] Low → High

Note: 1) Bain assessment
Source: Business Breakthrough Barometer Sector Survey (N=250); Business interviews; Bain analysis

Electrification remains the focal point for reducing process emissions, but only 7% of energy use is electrified, with no progress the past decade

Process energy for primary chemical production (EJ, ’10-22)



- The sector views tackling process emissions as a top priority, but energy intensity makes electrification challenging
- No material progress on electrification has been made past 12 years, companies like BASF and SABIC investing in early-stage efforts to electrify energy-intensive core processes, such as electric steam crackers, which accounts for ~10% of the sector’s primary energy use
- However, extensive process redesigns are required, involving significant CapEx, and businesses are concerned about the availability of renewable energy

> Our production require around-the-clock supply of power, heat, and steam. We cannot have power interruptions when the sun isn’t shining or the wind isn’t blowing. In addition, while renewables generate enough electricity to run some of our processes, they cannot deliver the high temperatures and high-pressure heat and steam many of our processes require.
>
> COMPANY STATEMENT, CHEMICALS PRODUCER

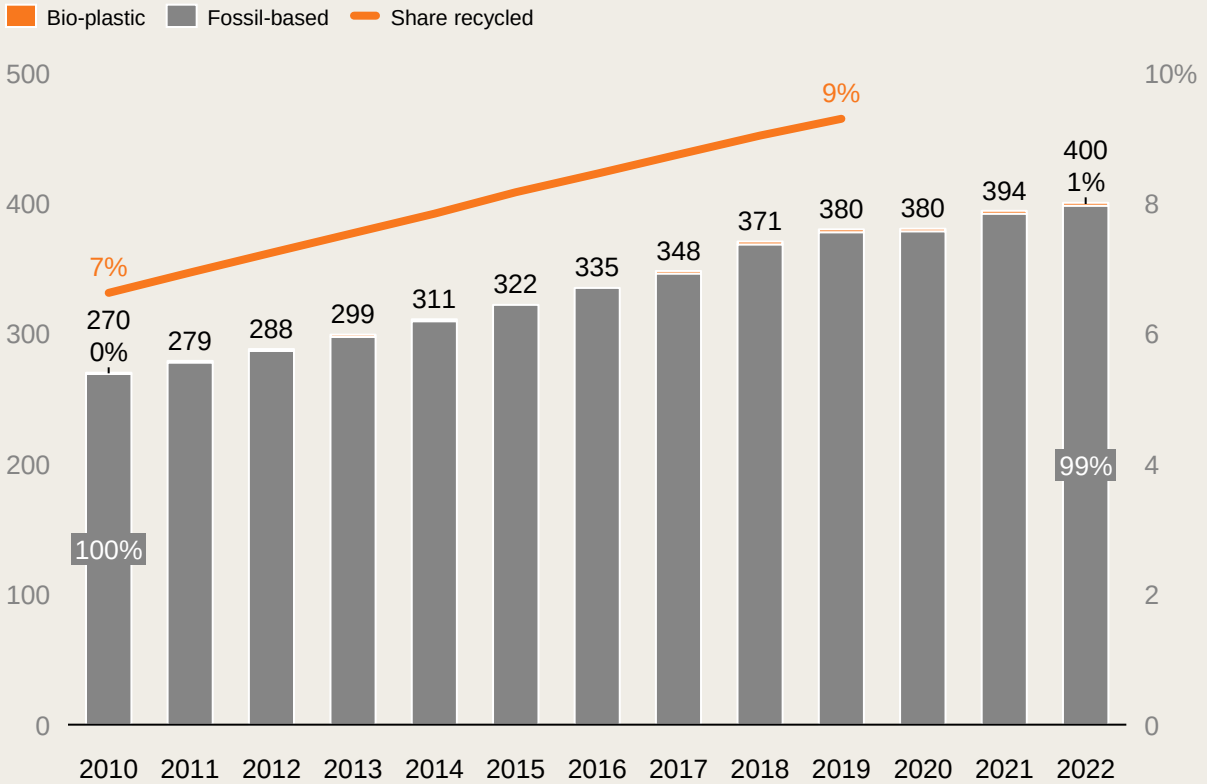
> We can restructure our internal energy supply to enable us to use renewable electricity natural gas, but the volumes of electricity the site will need are not yet available in the region and cannot yet be transported to through the existing power networks.
>
> HEAD OF ENERGY AT FACTORY #1, CHEMICALS PRODUCER

Source: IEA; Business Breakthrough Barometer Sector Survey (N=250); Business interviews; Bain analysis

Alternative feedstock use currently driven by other sustainability trends but will in the future increasingly support decarbonization

Global plastic production (Mt, Bar)

Global share of plastic waste recycled, (%, Line)



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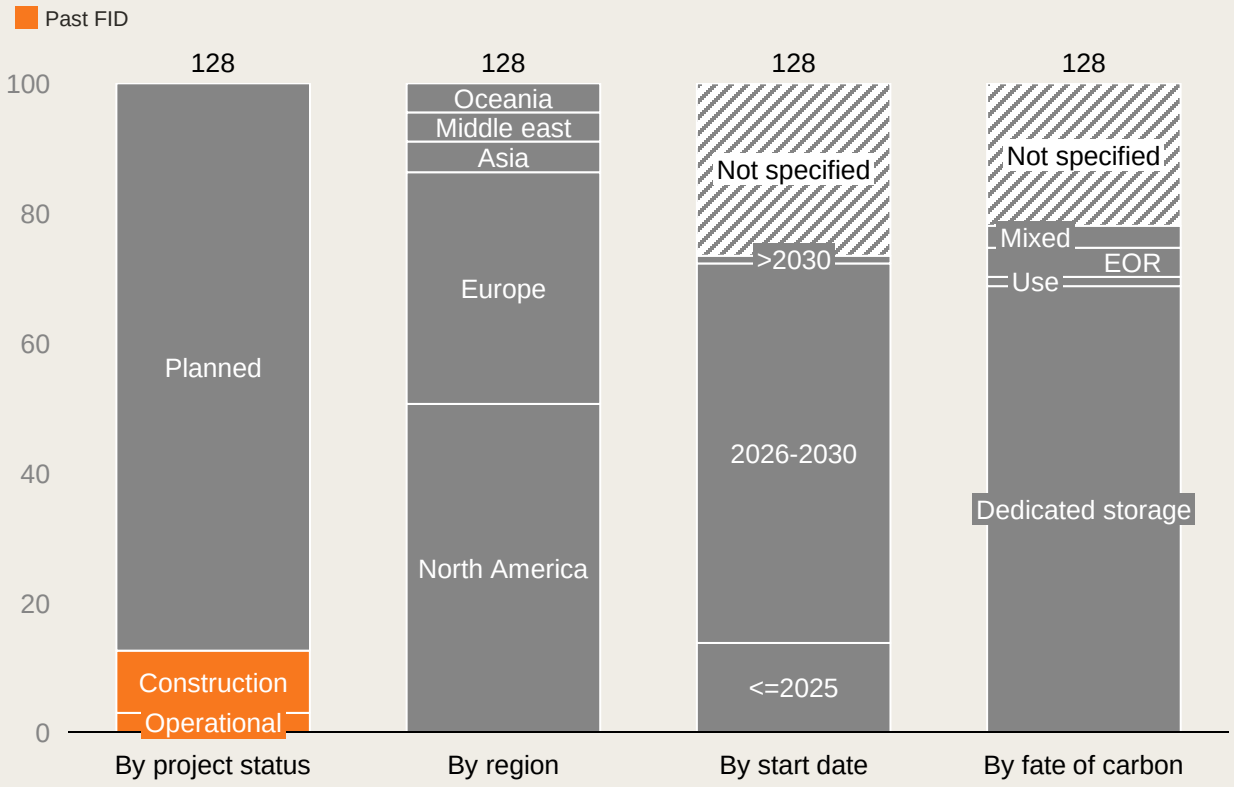
> The customer won't take it [alternative feedstocks] if it's more expensive or compromises quality. Right now, sustainability alone isn't enough to sell
>
> CO-CEO, SUSTAINABLE CHEMICALS PRODUCER

Source: OECD; Ecoinvent; European Environment Agency; GlobalData Hydrogen Plant database (August 2024 update); IRENA; HEIPA; PlasticsEurope; Company websites; Business Breakthrough Barometer Sector Survey (N=250); Business interviews; Bain analysis

Business leaders consider incentives vital to accelerate carbon capture & storage deployment in a high-volume, low-margin industry like chemicals

Pipeline of CCUS for chemical production (capacity, in Mtpa CO_2)



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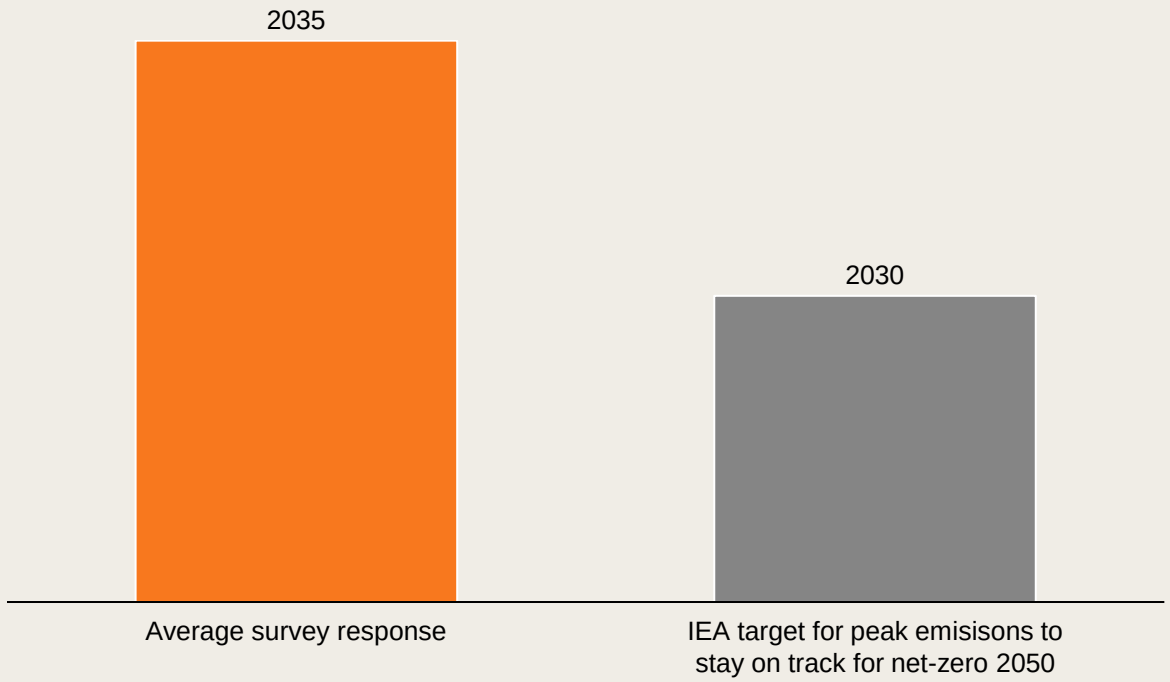
- Full emissions capture would require higher subsidy levels, with ammonia producers citing significantly higher credits required to enable complete capture and sequestration

> In the ammonia and hydrogen sector, we have seen a significant amount of projects decarbonizing existing production passing FID due to the 45Q, providing clear tax credits for carbon sequestration, bridging the gap to willingness to pay for what are essentially globally traded commodities
>
> VP PUBLIC AFFAIRS, CHEMICAL PRODUCER

Source: IEA; IEA CCUS database (February 2024 update); Business Breakthrough Barometer Sector Survey (N=250); Business interviews; Bain analysis

On the current trajectory, business leaders predict chemical sector emissions will peak well after what is required for a net-zero scenario

What year do you expect the chemical sector's GHG emissions to peak?



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- But the scope and nature of implementation is yet to be defined and there is little else on the horizon other than the EU ETS and CBAM which is likely to incentivise investment

> There is no pressure or incentives to drive low carbon emission [chemical] products
>
> CO-CEO, SUSTAINABLE CHEMICALS PRODUCER

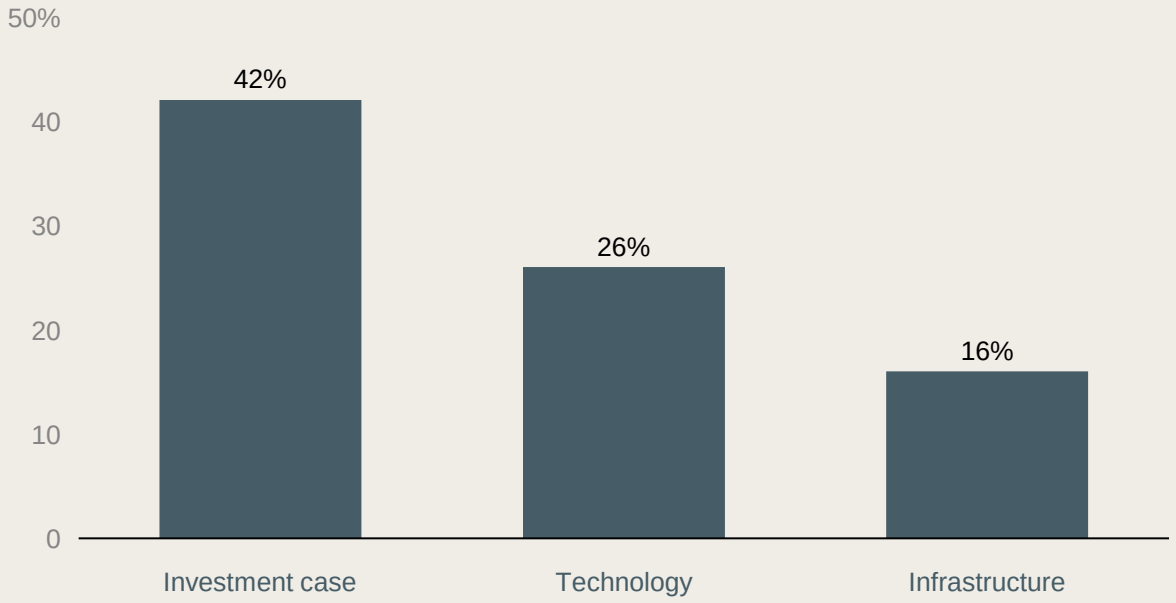
Source: Planet Positive Chemicals (2022); GlobalData; IEA; Business Breakthrough Barometer Sector Survey (N=250); Business interviews; Bain analysis

Companies cite unattractive business case and tech immaturity as top barriers holding back decarbonization of chemical production

Which of the following do you view as the sector's largest barriers for accelerating investment in the development and deployment of net-zero chemical production?

Please select the top 3 most impactful barriers

Share of survey responding barrier in the top 3 (%)



INVESTMENT CASE

- Chemicals is regarded as largely a commodity business with slim margins leading to focus on process efficiency and scale, resulting in significant CapEx required to pivot to low GHG emissions processes
- Companies currently see little voluntary or regulated demand on the horizon, and so few financial incentives to invest in lower emissions technologies

TECHNOLOGY

- Core processes are highlighted energy intense and difficult to electrify
- Expanded use of alternative feedstocks requires developments in novel feedstocks, like low carbon hydrogen and captured carbon, but also enabling technology like chemical recycling, to reach cost parity and meet required quality standards

INFRASTRUCTURE

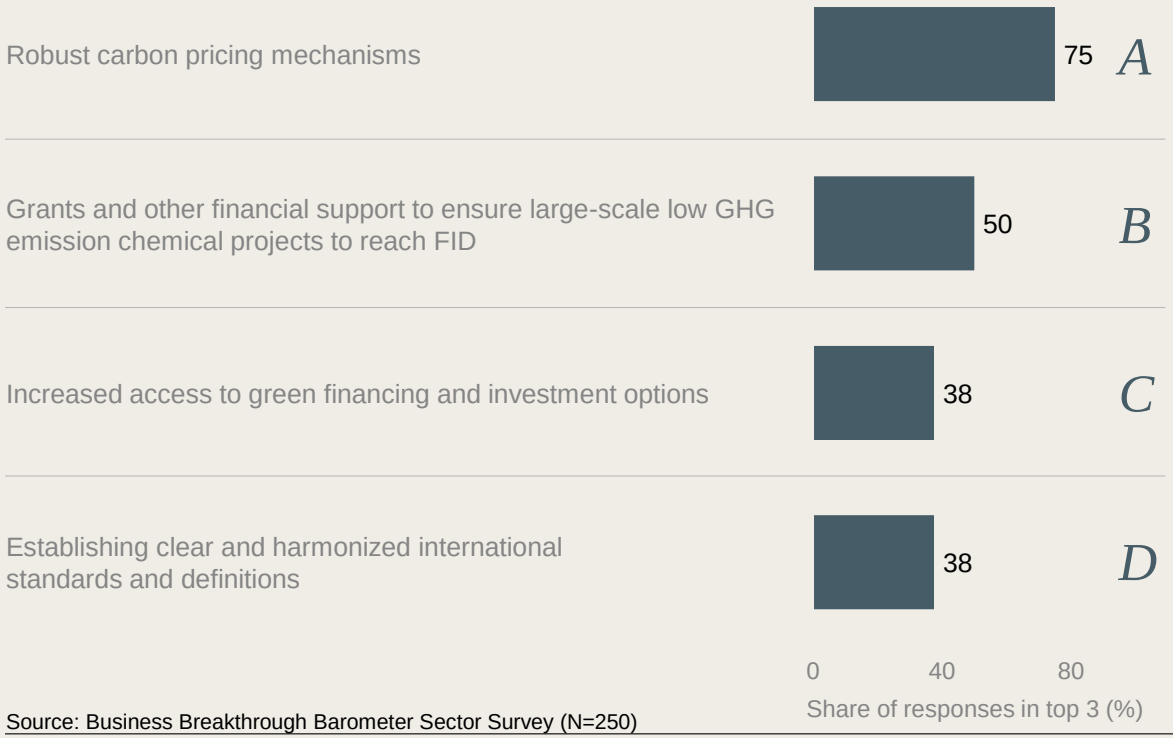
- Business point to the lack infrastructure for transport and storage to enable alternative feedstock use (e.g., biomass, low carbon hydrogen and captured carbon), increasing the logistical cost of securing feedstock

Note: Survey results for alternative feedstock and process energy decarbonization is aggregated to show overarching top barriers
Source: Business Breakthrough Barometer Sector Survey (N=250); Business interviews; Bain analysis

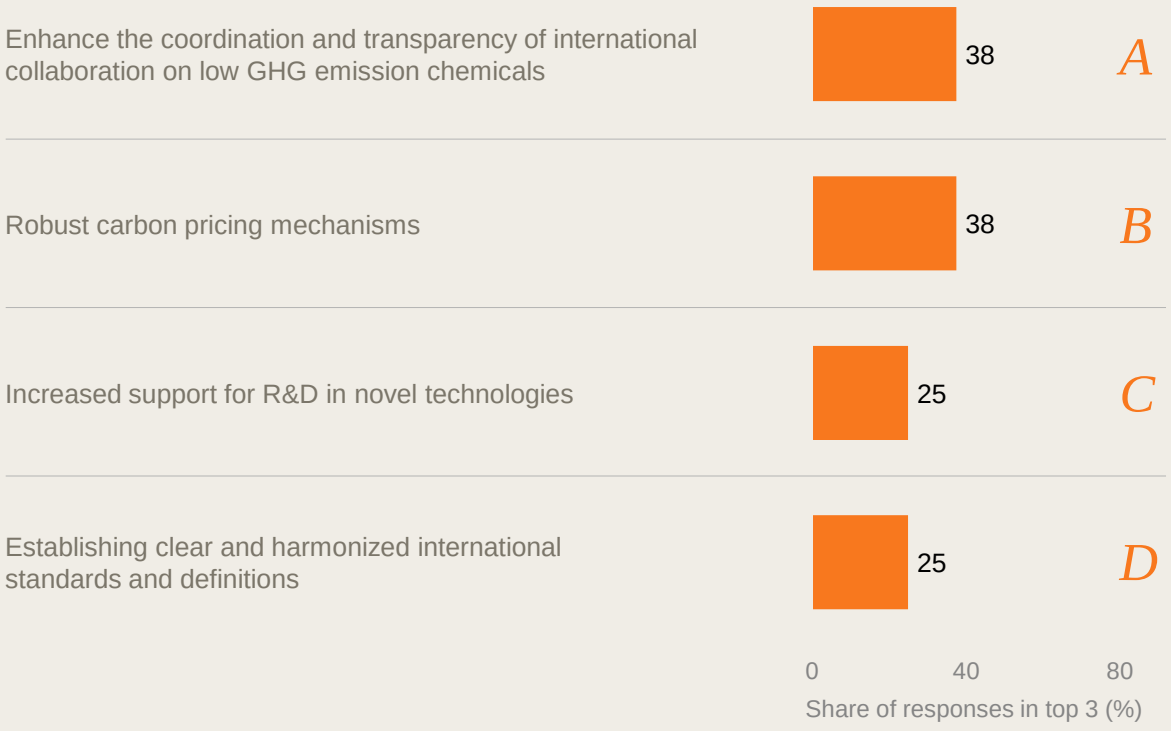
Sector sees key policy focus for chemical decarbonization in carbon pricing, standard collaboration and financial support

WHAT ARE THE TOP THINGS REGULATORS SHOULD FOCUS ON IN THE NEXT 12 MONTHS TO ACCELERATE INVESTMENT IN THE DEVELOPMENT AND DEPLOYMENT OF KEY TECHNOLOGIES AND SOLUTIONS TO ENABLE THE NET ZERO TRANSITION WITHIN THE CHEMICAL SECTOR?

NATIONAL



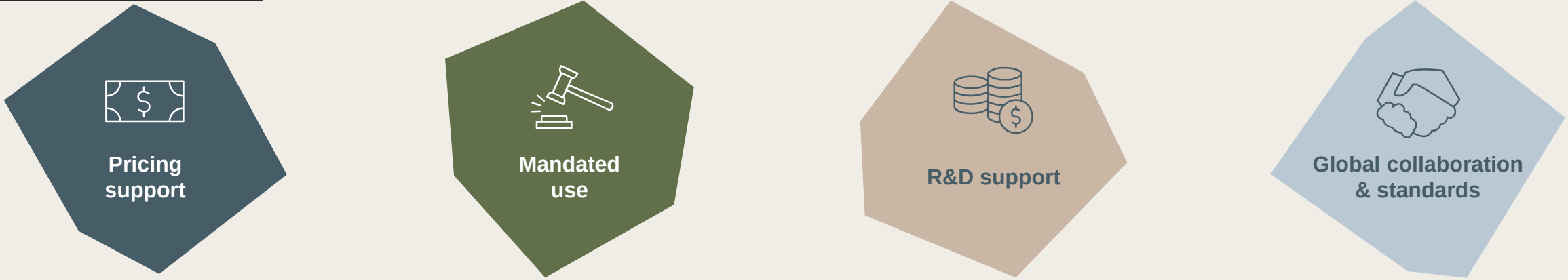
INTERNATIONAL



Source: Business Breakthrough Barometer Sector Survey (N=250)

Policy within pricing support, mandates, financing, global collaboration & standards, is cited as top asks from government by chemical producers

Policy focus
National International



Carbon pricing comes as a clear priority for business leaders, for example through carbon border measures, but this would only be possible with significant international coordination to ensure a level playing field

Mandates for green production targets for producers of primary chemicals would be game changing to incentivise investment into low GHG emission chemicals. However, these mandates must be applied in regional contexts, which could lead to the risk of disjointed approaches

Increased R&D funding for advanced technologies in the forms of CapEx support would help accelerate early-stage production investments into low GHG emission chemicals

Simplified and mutually recognized standards and definitions for low-GHG chemicals is critical to enable international trade of low GHG emissions chemicals

Thank *You*

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