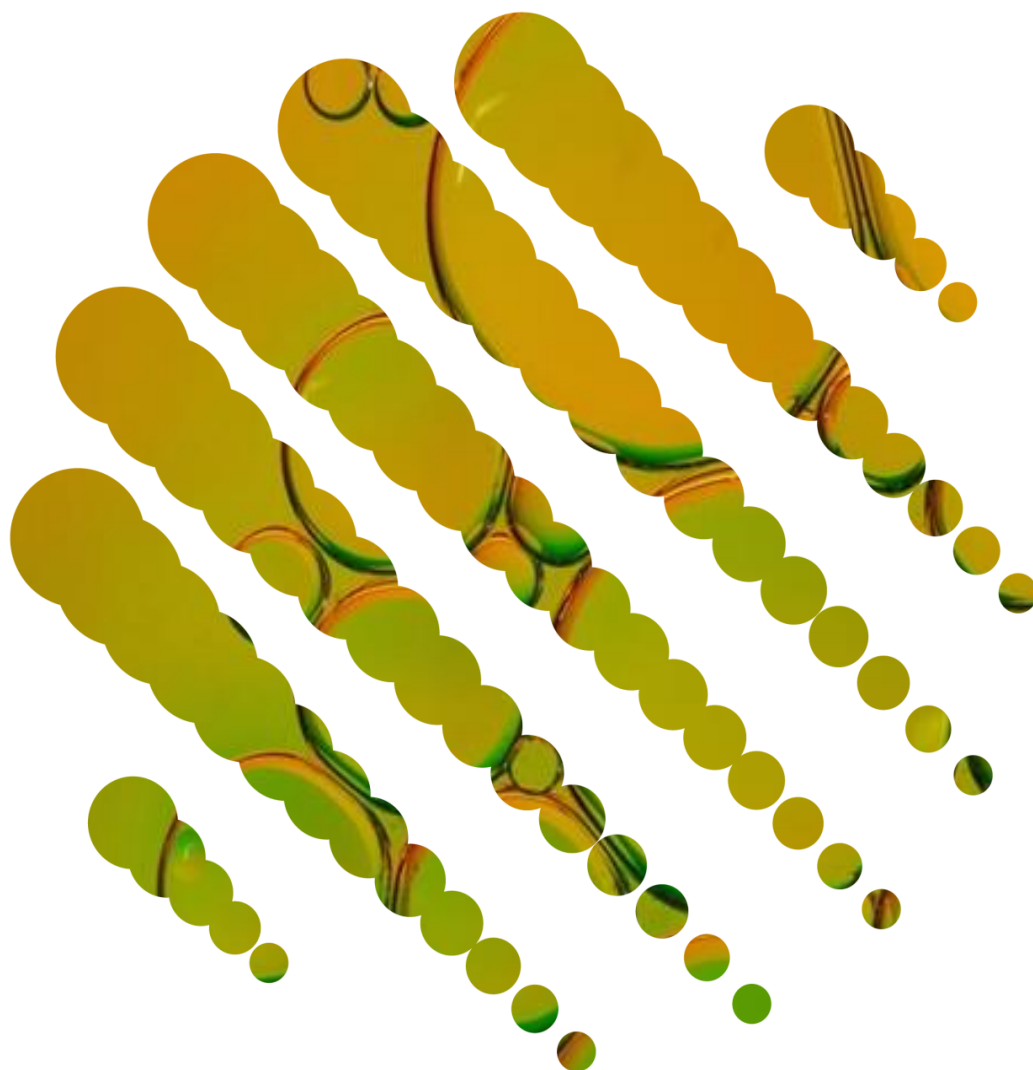


Carbon Performance assessment of chemical producers: discussion paper

September 2025



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About the TPI Global Climate Transition Centre at LSE

The TPI Global Climate Transition Centre (TPI Centre) is an independent, authoritative source of research and data on the progress of corporate and sovereign entities in transitioning to a low-carbon economy. It is part of the Global School of Sustainability at the London School of Economics and Political Science (LSE). The TPI Centre is the academic partner of the Transition Pathway Initiative (TPI), a global initiative led by asset owners and supported by asset managers, aimed at helping investors and other stakeholders assess company, bank and sovereign preparedness for the transition to a low-carbon economy and supporting efforts to address climate change. As of September 2025, 156 investors globally, representing approximately US\$87 trillion¹ combined Assets Under Management and Advice, have pledged support for TPI. The TPI Centre provides data on publicly listed equities, corporate bond issuers, banks and sovereign bond issuers. The TPI Centre's company data:

- Assess the quality of companies' governance and management of their carbon emissions and of risks and opportunities related to the low-carbon transition
- Evaluate whether companies' current and planned future emissions are aligned with international climate targets and national climate pledges, including those made as part of the Paris Agreement
- Form the basis for the Climate Action 100+ Net Zero Company Benchmark Disclosure Framework assessments
- Are published alongside the methods online. They are public and free to use for non-commercial purposes and available at www.transitionpathwayinitiative.org.

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¹ This figure is subject to market-price and foreign-exchange fluctuations and, as the sum of self-reported data by TPI supporters, may double-count some assets.

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Executive summary

This discussion paper proposes a new methodology to assess the Carbon Performance of chemical producers. We are publishing it now to solicit feedback with the aim of improving the methodology. The chemicals methodology adds to the TPI Centre's bank of methodologies to assess corporate Carbon Performance which it has previously produced for 12 other high-emitting sectors, including electricity utilities, oil and gas producers, and high-carbon industrial and transport sectors.

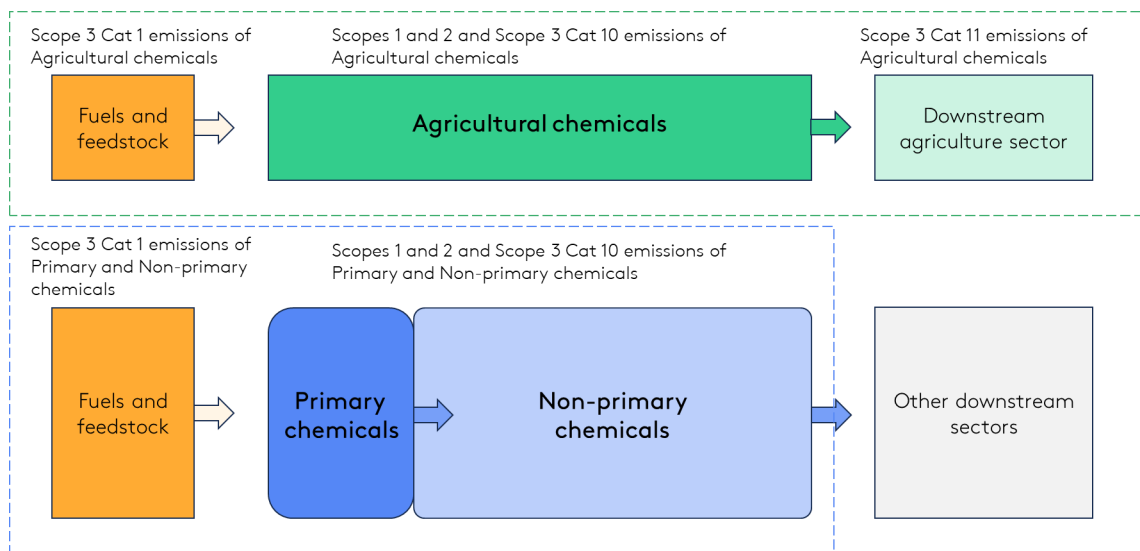
The chemicals sector is significant both to investors and the climate. It is one of the largest global manufacturing industries by market capitalisation, with publicly listed companies representing 1.7% of equity markets. As the largest industrial consumer of fossil fuels, the sector plays a major role in global emissions, accounting for 1.3 gigatonnes of direct carbon dioxide (CO₂) emissions annually – approximately 3.6% of the global total. The sector and its value chain are also significant sources of non-CO₂ greenhouse gases. This combination of broad economic influence and high emissions exposes the sector to transition risk and makes it a priority for credible decarbonisation pathways.

In developing a methodology for assessing the Carbon Performance of chemical producers, we have had to overcome unique challenges. The sector encompasses hundreds of thousands of distinct products, each associated with different production processes, greenhouse gas profiles and end-use applications. Adding to this complexity is the diversity of company portfolios. Some companies specialise in producing high-emitting primary chemicals; others focus on fertilisers, which have significant use-phase emissions; some concentrate on customer-facing speciality chemicals; and many operate integrated businesses spanning multiple parts of the value chain.

Recognising the significant heterogeneity of the chemicals sector, we divide it for the purposes of analysis into **three distinct subsectors: agricultural chemicals, primary chemicals, and non-primary chemicals**. This classification enables more accurate benchmarking and target assessment.

For each subsector, we define specific emissions boundaries and derive emissions trajectories under different climate scenarios. Scope 1 and 2 emissions are included in all three subsectors. However, the treatment of Scope 3 emissions varies. For primary and non-primary chemicals, Scope 3 is limited to upstream supply chain emissions (Category 1) and processing of sold products (Category 10), in line with the emissions characteristics of these subsectors. In the case of agricultural chemicals, we additionally include use-phase emissions (Scope 3, Category 11) to account for significant nitrous oxide (N₂O) emissions from fertiliser use. Figure ES1 provides a summary of the emissions boundaries adopted for each subsector.

Figure ES1. Overview of the TPI Centre's defined chemicals subsectors, with allocated emission scopes and key emission sources



To enable the assessment of integrated companies that operate across the three subsectors, we introduce a novel **subsector-weighted benchmarking approach**. This methodology assigns each company a weighted average benchmark based on its exposure to the three defined subsectors, using the revenue share of each business segment as the weighting factor. This enables a more accurate and representative comparison of a company’s emissions trajectory against relevant benchmarks, while capturing the distinct transition risks associated with its specific product mix.

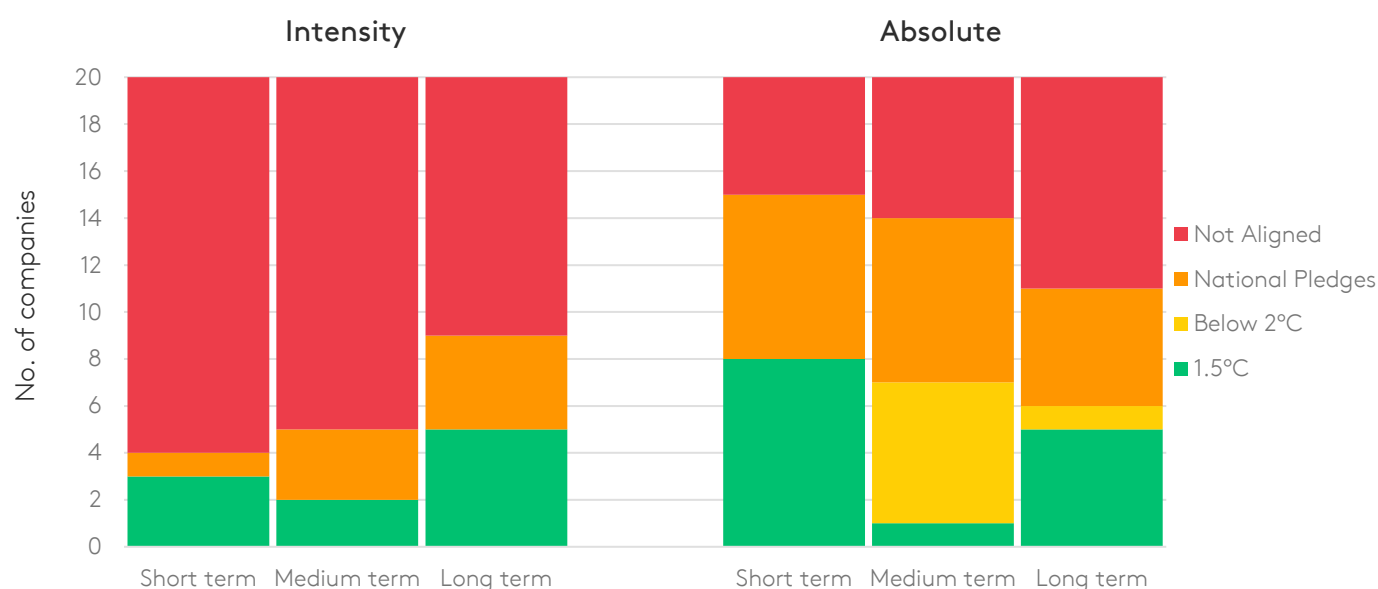
The choice between absolute emissions and emissions intensity is always important. The TPI Centre has historically used emissions intensity — that is, the volume of emissions per unit of activity/production — as it enables comparisons of companies’ current Carbon Performance, and by requiring greater reductions in emissions intensity from companies with higher emissions it likely promotes economic efficiency. However, absolute emissions are used in coal mining, since its transition pathway involves winding down coal production, something an intensity approach cannot capture. Given the heterogeneity of the chemicals sector and our consequent inability to compare all companies on the same emissions metric, the choice between absolute emissions and emissions intensity is more finely balanced, *a priori*.

We test both approaches in this paper. For the intensity approach, we use sales revenue as the measure of activity, acknowledging the sector’s product heterogeneity. An analysis of 83 large chemical companies reveals an average emissions intensity of 1.2 tonnes of carbon dioxide equivalent (tCO₂e) per US\$1,000 of sales revenue, with values ranging from 0.03 to 9.8 tCO₂e per US\$1,000. This highlights the significant variation in emissions performance across the sector.

For the absolute emissions approach, company performance is evaluated based on total emissions relative to a fixed baseline. To account for year-on-year fluctuations in reported emissions — due to factors such as economic cycles, acquisitions or divestments — both company and benchmark emissions trajectories are indexed to the average of emissions reported during the 2020–22 period.

To test the two approaches, we assess 20 companies with high emissions intensity and diverse subsector exposure. The two approaches yield markedly different results. Perhaps contrary to expectations, the intensity approach is stricter, particularly in the short and medium terms. The vast majority of the 20 companies are not aligned with any of our low-carbon benchmark scenarios in the short or medium terms. In the long term (2050), still only five companies are aligned with 1.5°C. By contrast, according to the absolute emissions approach, alignment with the benchmarks is much higher in the short and medium terms. For example, in the short term, eight companies are aligned with 1.5°C and a further seven companies are aligned with National Pledges. In the long term, the two approaches produce results that are more similar. The contrast between the results of the Carbon Performance assessments under the two approaches is illustrated in Figure ES2.

Figure ES2. Comparison of alignment scores for 20 assessed companies using intensity-based and absolute emissions approaches



Based on both theoretical considerations and these empirical results, **we prefer the intensity approach for the chemicals sector**. Under the absolute approach, more companies appear aligned in the short and medium terms, but this reflects the way the baseline is set rather than real transition readiness. The intensity approach, by contrast, incorporates companies' starting performance and places greater responsibility on higher-intensity polluters. While revenue-based intensity metrics are not without drawbacks, they provide a consistent basis for comparison in a heterogeneous sector. Absolute emissions remain essential for assessing global progress, but the Sectoral Decarbonization Approach (SDA) we employ ensures that intensity pathways are rooted in an absolute carbon budget. We therefore regard the intensity approach as the more meaningful benchmark for assessing chemical companies' transition readiness.

1. TPI's Carbon Performance assessment

This discussion paper develops a new Carbon Performance methodology for chemical producers. This is one of the most complex of the emissions-intensive sectors to assess on Carbon Performance due to the heterogeneity of products, emissions sources and use cases. Developing a methodology strongly raises the question of whether chemical producers should be assessed based on their emissions intensities or their absolute emissions, and this paper pays particular attention to the issue.

The TPI Centre has historically assessed companies' emissions pathways on an intensity basis — that is, the volume of emissions per unit of activity/production. Coal mining has been the only sector assessed using absolute emissions, reflecting its unique decarbonisation challenge (i.e. wind down). The TPI Centre's intensity approach corresponds to the Sectoral Decarbonisation Approach (SDA),² while the absolute emissions approach aligns with the Emissions Contraction Approach (ECA); both methodologies are described in further detail below.

The choice between an absolute and an intensity approach depends on several factors, such as the goal of the analysis and the characteristics of the sector. Absolute and intensity approaches can be used in combination to evaluate companies' transition efforts. For example, diversified mining companies involved in coal mining can be assessed using the SDA for their overall portfolio, while the ECA can be employed for a specific assessment of their coal business.

In the chemicals sector, however, the aforementioned features of the sector create technical challenges for establishing a common intensity benchmark based on the SDA. The choice of sales revenue as the only viable option to reflect product diversity requires assumptions about sector growth and makes the metric sensitive to market fluctuations. Alternatively, the use of an absolute ECA requires companies of all sizes and carbon footprints to reduce their absolute emissions in line with the same benchmark, regardless of whether it would be better to increase the output of lower emissions-intensity products.

In this discussion paper, we compare both approaches. Below, we introduce the general characteristics of the two approaches. Section 2 sets the assessment boundaries for the chemicals sector. Section 3 outlines the formulation of benchmarks under each metric. Section 4 compares the results of applying the two approaches to a set of 20 chemical producers. Finally, Section 5 discusses the implications of applying each method to the chemicals sector. Based on this analysis, we propose the intensity metric as the preferred approach, as it better reflects companies' transition risks and is more accurate when translating disclosed targets into comparable benchmarks.

1.1. The Sectoral Decarbonisation Approach

To date, the TPI Centre's Carbon Performance assessments have been predominantly based on the SDA. The SDA translates emissions reduction targets made at the international level (e.g. under the 2015 UN Paris Agreement) into benchmarks, against which the performance of individual companies can be compared [1].

The SDA recognises that different sectors of the economy (e.g. oil and gas production, electricity generation and automobile manufacturing) face different challenges arising from the low-carbon transition, including where emissions are concentrated in the value chain and how costly they are to reduce. Other approaches to translating international emissions targets into company benchmarks have

² The Sectoral Decarbonisation Approach (SDA) was created by CDP, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF) in 2015. See: <https://sciencebasedtargets.org/resources/files/Sectoral-Decarbonization-Approach-Report.pdf>.

applied the same decarbonisation pathway to all sectors, regardless of these differences [2]. Such approaches would likely make climate action expensive, as not all sectors have the same emissions profiles or face the same challenges: some sectors may be capable of faster decarbonisation, while others require more time and resources.

Therefore, the SDA takes a sector-by-sector approach, comparing companies within the same sector against each other and against sector-specific benchmarks, which establish the performance of an average company aligned with international emissions targets. The SDA can be applied by taking the following steps:

- A global carbon budget is established, which is consistent with international emissions targets, for example, keeping global warming below 2°C. To do this rigorously, some input from a climate model is required.
- The global carbon budget is allocated across time and to different regions and industrial sectors. This typically requires an Integrated Assessment Model (IAM), and these models usually allocate emissions reductions by region and by sector according to where it is cheapest to reduce emissions and when. Cost-effectiveness is, however, subject to some constraints, such as political and societal preferences, and the availability of capital. This step is therefore driven primarily by economic and engineering considerations, but with some awareness of political and social factors.
- In order to compare companies of different sizes, sectoral emissions are normalised by a relevant measure of sectoral activity (e.g. physical production or economic activity). This results in a benchmark path for emissions intensity in each sector:

$$\text{Emissions intensity} = \frac{\text{Emissions}}{\text{Activity}}$$

- Assumptions about sectoral activity need to be consistent with the emissions modelled and therefore should be taken from the same economy–energy modelling where possible.
- Companies' recent and current emissions intensity is calculated, and their future emissions intensity is based on emissions targets they have set (this assumes companies meet their targets).³ Together, these establish emissions intensity pathways for companies.
- Companies' emissions intensity pathways are compared with each other and with the relevant sectoral benchmark pathway.

1.2. The Emission Contraction Approach

The TPI Centre introduced the ECA for Carbon Performance assessments in the coal mining sector [3]. In this approach, a company's Carbon Performance is based on absolute emissions as opposed to emissions intensity.

Like the SDA, the ECA is based on sectoral carbon budgets that are derived from an IAM. However, instead of dividing the sectoral carbon budget by a sector-specific activity metric, the benchmark pathways represent the relative (percentage) change in absolute emissions. The relative change in companies' absolute emissions is then compared with the absolute emissions reduction rate in low-carbon benchmark scenarios.

The ECA is not the first method to assess companies' transition efforts on the basis of absolute emissions. The Science-Based Targets initiative (SBTi) uses a similar method, the Absolute Contraction Approach (ACA), to assess absolute Scope 1 and 2 (and in certain cases also Scope 3) targets [4]. The key difference is that the ACA applies an economy-wide emissions reduction rate to all sectors, while the ECA is based on a sector-specific carbon budget.

³ Alternatively, companies' future emissions intensity could be calculated based on other data companies provide on their business strategy and capital expenditure plans.

2. Assessing the chemicals sector

2.1. Introduction to the chemicals sector

The chemicals sector is a major pillar of the global economy. It is the fifth-largest manufacturing sector globally, contributing 1.3% to global gross domestic product (GDP) directly, and 7% including indirect contributions [5]. Companies operating in this sector are correspondingly of significant interest to investors. The total market capitalisation of publicly listed chemical companies stood at US\$2.05 trillion as of January 2025, representing 1.7% of total global market capitalisation and 10.2% of global industrials and basic materials market capitalisation.⁴

The chemicals sector is also a significant source of carbon dioxide (CO₂) emissions, accounting for 1.3 gigatonnes of direct CO₂ emissions annually or 3.6% of global CO₂ emissions [6]. The use of fossil fuels is the main contributor to the sector's emissions. When both energy-related fuel use and non-energy feedstock consumption are taken into account, the chemicals sector emerges as the largest industrial consumer of fossil fuels overall [7].

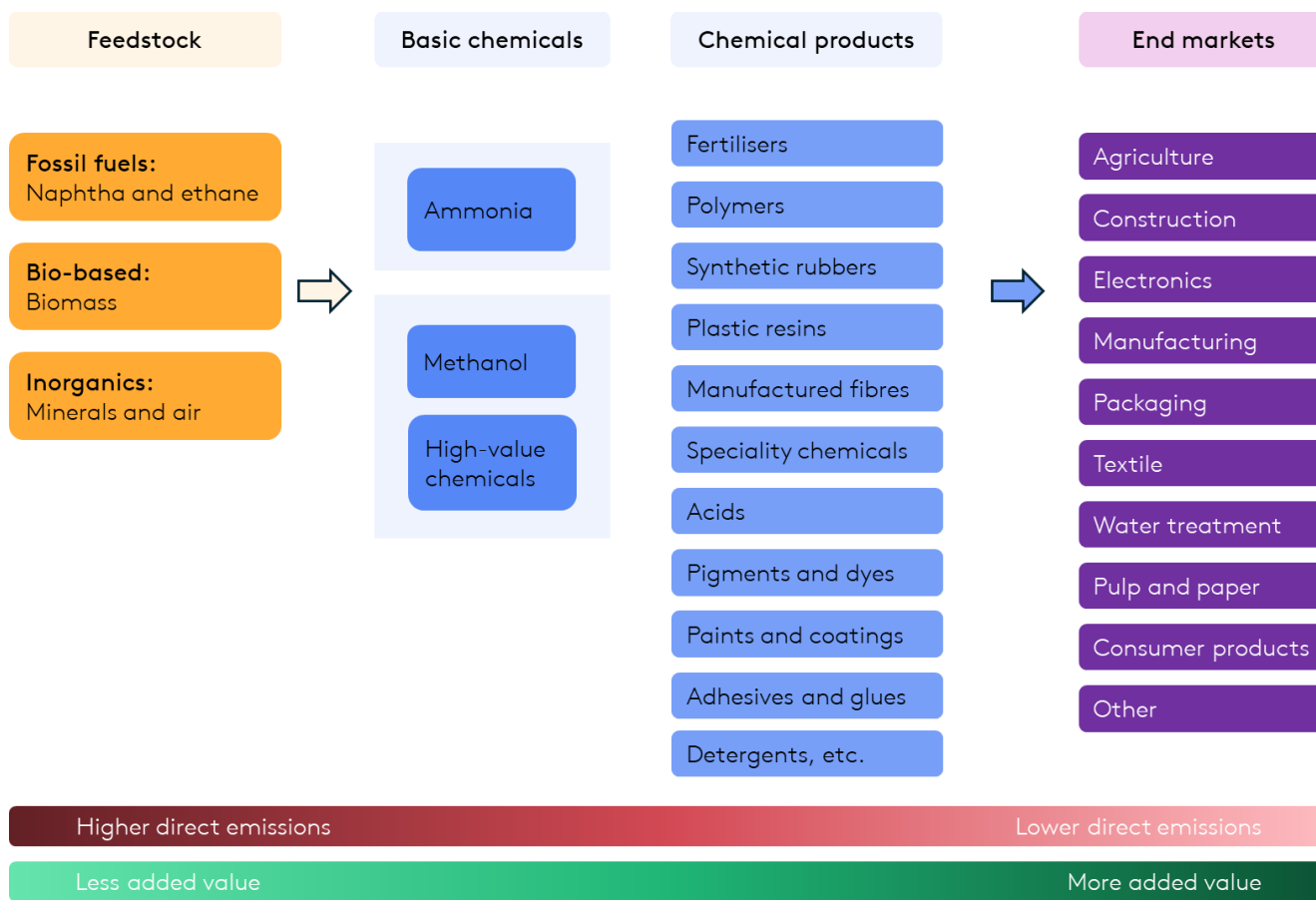
Beyond CO₂, the chemicals sector is a significant contributor to non-CO₂ greenhouse gas emissions, including some of the greenhouse gases with the highest global warming potential (GWP). Industrial nitrous oxide (N₂O) emissions arise directly from processes such as nitric acid production, while the application of synthetic fertilisers releases additional N₂O, responsible for approximately 6.2% of global agricultural emissions [8]. The sector is also the primary producer of products that release fluorinated gases (F-gases) during their use, making it the largest industrial contributor to F-gas emissions globally [9].

Abating these emissions requires diverse strategies tailored to the sector's reliance on fossil fuels, complex production processes and diverse use cases. Beyond energy efficiency and the use of clean fuels and feedstocks, plastic recycling also plays a significant role in the decarbonisation strategies of the chemicals sector. However, the feasibility and effectiveness of these measures vary widely across different chemical products and production processes. While improvements in energy efficiency and process integration can yield short-term emissions reductions, deeper decarbonisation will likely require the large-scale deployment of carbon capture, utilisation and storage (CCUS), along with a fundamental transformation of feedstock supply chains [7].

Figure 2.1 presents an overview of the chemicals sector. The diagram underscores the foundational importance of basic chemicals, which serve as essential building blocks for the production of all downstream chemical products. Within this figure, ammonia is identified separately, recognising its critical role as the principal input for fertiliser manufacturing. For the purposes of this illustration, the complex and highly interconnected process chains are not depicted; instead, the flows of materials from feedstocks to basic chemicals, and subsequently from chemical products to end-use markets, are presented in a simplified manner to enhance clarity and facilitate understanding.

⁴ Based on data provided by FTSE Russell covering nearly 8,000 companies. The calculation of market cap coverage can change due to fluctuating valuations of the companies covered, due to increases in the total universe of companies which TPI receives from data suppliers, or due to company sectoral reclassifications.

Figure 2.1. Overview of the chemicals sector: from feedstock to selected end markets



2.2. Key challenges unique to the chemicals sector

As we set out to evaluate decarbonisation pathways for the chemical industry, the first — and perhaps most fundamental — challenge is the sector’s extraordinary product heterogeneity. Unlike steel or power, where a tonne of output or a megawatt-hour of electricity provides a common metric, chemicals span thousands of distinct molecules and specialised formulations. Operational emissions, therefore, vary hugely, not only between firms but even within individual product lines, rendering any single output-based intensity metric uninformative.

A second complication is the significant disconnect between a product’s emissions intensity and its contribution to sectoral revenue. Basic chemicals such as ammonia, methanol and other high-value chemicals dominate the sector’s CO₂ profile — accounting for roughly 60% of operational emissions [7] — yet they generate less than one-sixth of total sales [10]. Downstream speciality chemicals, plastics and consumer-facing formulations, by contrast, exhibit lower direct emissions but command far higher margins. This inverse relationship is highlighted in Figure 2.1.

Third, many firms pursue highly integrated business models, stretching from energy-intensive upstream synthesis to less energy-intensive downstream compounding and blending. The balance of these activities shapes a firm’s aggregate emissions profile and can complicate peer comparisons.

Finally, the sector’s reliance on hydrocarbons as feedstock, together with the diversity of use-phase emissions, obliges us to consider embodied carbon. Carbon embedded in fertilisers, plastics or F-gases may be released decades after production.

In sum, the chemicals sector presents a unique combination of challenges for assessing the alignment of companies with international climate goals. In response to these challenges, this methodology provides a framework to assess chemical companies with specific product mixes, different positions within the value chain, and varying transition risks.

2.3. Establishing the assessment boundary: three chemicals subsectors

Defining subsectors for the chemicals sector

The broad range of chemical products — in both their emissions profiles and economic value — presents a central challenge: establishing a meaningful and comparable Carbon Performance metric that reconciles the sector's diverse carbon intensities with its uneven distribution of value generation. **To address this challenge, we divide the sector into distinct subsectors that exhibit similar emissions profiles and transition trajectories. This approach enables the creation of more homogeneous groupings, within which Carbon Performance can be compared more consistently and fairly.**

Industrial categorisation systems define subsectors within the chemicals sector primarily for statistical or financial reporting purposes. For example, the International Standard Industrial Classification (ISIC) published by the United Nations Statistics Division divides the manufacture of chemical products (division 20) and plastics (division 22) into 11 distinct classes [11]. Similarly, the Industry Classification Benchmark (ICB) by FTSE Russell includes categories such as Speciality Chemicals, Fertilisers, Chemicals and Synthetic Fibres, and Diversified [12]. However, these classifications are not designed to reflect the variability of emissions sources and intensities across the sector and therefore do not capture the distinctions necessary for Carbon Performance assessment. In developing our methodology, we aimed to maintain compatibility with existing classifications where possible, while keeping subsector splitting to a minimum to ensure practicality and clarity.

The first and most apparent division within the chemicals sector is based on the economic value of products. We distinguish between primary and non-primary chemicals. We define primary chemicals as a subset of basic chemicals that includes methanol and high-value chemicals (HVCs). Ammonia is also commonly classified as a primary chemical, but here we treat it separately as an agricultural chemical (see below). Methanol and HVCs are produced through high-temperature, emissions-intensive processes and typically generate lower revenue per unit than downstream products. In contrast, non-primary chemicals — including plastics, speciality chemicals and consumer-facing products — tend to have lower emissions during production but higher economic value.

A second division addresses differences in greenhouse gas profiles, particularly emissions that occur beyond the production phase. Agricultural chemicals stand apart in this regard, as a significant portion of their emissions arises during the use phase. Accordingly, we define a dedicated agricultural chemicals subsector, which includes ammonia, the key input for nitrogen-based fertilisers.

Table 2.1 summarises our three subsectors of the chemicals sector and their definitions.

Table 2.1. Subsectors defined by the TPI Centre for the chemicals sector

Subsector	Definition
Agricultural chemicals	This subsector covers the value chain of agricultural chemicals, starting from the production of ammonia and urea through to the manufacture of nitrogen-based fertilisers. It also includes non-ammonia-based fertilisers, such as those derived from phosphorus and potassium. In addition, other applications of ammonia — including its use as a clean fuel, in explosives, and in various industrial processes — are also categorised within this subsector, as they are closely linked in terms of production processes.
Primary chemicals	With ammonia classified under agricultural chemicals, this subsector encompasses methanol and high-value chemicals (HVCs). HVCs typically include light olefins — such as ethylene and propylene — and primary aromatics, including benzene, toluene and xylenes. Sometimes referred to as basic organic or bulk chemicals, these substances serve as essential building blocks for a wide array of downstream chemical products and materials.
Non-primary chemicals	We define the non-primary subsector as including a broad array of products, including inorganic chemicals, plastic resins, synthetic rubbers, manufactured fibres, speciality chemicals, and consumer chemical products. Pharmaceuticals are excluded from this category due to their relatively low direct emissions intensity, which would otherwise distort benchmark comparisons within the subsector.

Emissions boundaries by subsector

Here we set the assessment boundaries in terms of emissions. For all subsectors, we consider the following emissions scopes and categories material: direct fuel and process emissions (Scope 1), indirect emissions from electricity and steam generation (Scope 2), indirect emissions from upstream fossil fuel production (Scope 3, Category 1), and indirect emissions from the downstream processing of sold chemicals (Scope 3, Category 10).

Emissions from the use of sold chemical products (Scope 3, Category 11) can originate from various sources: the application of fertilisers and urea in agriculture, the use of industrial gases, and the leakage of F-gases during the use of products such as refrigerants, blowing agents and fire extinguishers [13]. However, among our three subsectors, we only include emissions from the use of sold agricultural chemicals. These primarily include N₂O emissions from fertiliser application and CO₂ emissions from the agricultural use of urea. All other sources of use-phase emissions are excluded on the grounds of (im)materiality and consistency. CO₂ emissions from non-agricultural uses of urea, such as in diesel exhaust fluids, are negligible [14], as are emissions from the use of industrial gases.

F-gases contribute disproportionately to overall emissions intensities due to their high GWP. However, we exclude them because otherwise they would distort the analysis too much. Limited modelling of F-gases in climate scenarios further hinders consistent benchmarking. This methodological choice does not imply that reductions in F-gases are unimportant; rather, investors should remain mindful of their significant warming impact and encourage companies to pursue dedicated mitigation measures.

We also exclude Scope 3, Category 12 emissions from the end-of-life treatment of sold products. These emissions vary widely depending on the type of chemical, the treatment method, and the ultimate disposal or recycling pathway. This variation introduces greater uncertainty and reduces the accuracy of calculated emissions, both at the corporate reporting level and when estimating global totals. In addition, disclosure remains relatively low: as of 2023, only 55% of sampled chemical companies reported end-of-life emissions.

Table 2.2 summarises the most relevant emissions scopes and categories for the three chemicals subsectors, along with their corresponding emissions sources. It also presents the share of companies that disclose emissions in each scope or category, based on CDP 2023 responses from a sample of 83 high-market-cap companies.

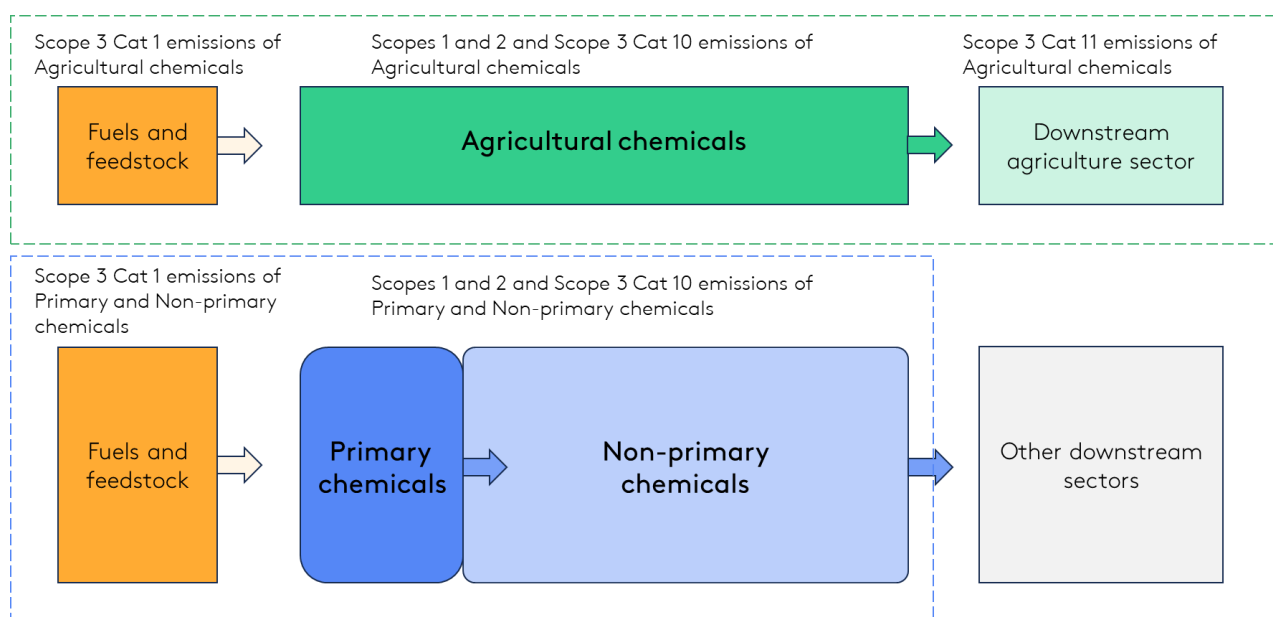
Figure 2.2 summarises the approach we take. In the next section, we outline the methodology used to derive global benchmarks — aligned with international climate goals — based on the established sector boundaries.

Table 2.2. The relevant emissions sources in the chemicals sector

Scopes	Categories	Emissions sources	Inclusion in the TPI Centre's subsectors			% of companies reporting the scope/category
			Agricultural chemicals	Primary chemicals	Non-primary chemicals	
Scope 1		Direct fuel and process emissions				100
Scope 2		Indirect electricity and steam generation emissions				98
Scope 3	Category 1: purchased goods and services	Indirect emissions of upstream fossil fuel production				87
		Indirect emissions of purchased chemicals				
	Category 10: processing of sold products	Indirect emissions from the processing of sold chemicals				72*
	Category 11: use of sold products	Emissions from the use of fertilisers and urea in agriculture				
		Emissions from the use of industrial gases				
		Leakage of fluorinated gas emissions during the use of products (e.g. refrigerants, blowing agents, fire extinguishers)				
	Category 12: end-of-life treatment of sold product	Emissions from landfilling, incineration, recycling, chemical degradation, or residual emissions				55

Notes: *Category 10 may not be applicable to some companies. Some companies report categories 10 and 11 together.

Figure 2.2. Overview of the TPI Centre's defined chemicals subsectors, with allocated emission scopes and key emission sources



3. Benchmarks

This section outlines our methodology for constructing emissions benchmarks for the chemicals sector. Section 3.1 explains how emissions trajectories are derived under different warming scenarios. Section 3.2 details the activity data required for developing intensity-based benchmarks. In Section 3.3, we derive subsector benchmarks based on both intensity and absolute approaches, and introduce the concept of subsector-weighted benchmarking to calculate appropriate benchmarks for individual companies, for both the absolute and intensity approaches.

3.1. Estimating emissions

For the chemicals sector, we obtain emissions trajectories mainly from the International Energy Agency (IEA), via its *World Energy Outlook 2024* [6], *The Future of Petrochemicals* [7], and *Ammonia Technology Roadmap* [14] reports. The IEA has established expertise in modelling the cost of achieving international emissions targets. It also provides access to the modelling inputs and outputs in a form suitable for applying both the SDA and ECA.

The IEA's work can be used to derive three benchmark emissions pathways, against which companies are evaluated:

1. **A National Pledges scenario**, based on the IEA's Stated Policies Scenario (STEPS), which is consistent with the global aggregate of emissions reductions related to policies introduced or under development as of mid-2023. This scenario gives a probability of 50% of holding the global temperature increase to 2.4°C by 2100 [6].
2. **A Below 2°C scenario**, based on the IEA's Announced Pledges Scenario (APS), which is consistent with the overall aim of the Paris Agreement to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels" [15], albeit at the lower end of the range of ambition. This scenario gives a probability of 50% of holding the global temperature increase to 1.7°C by 2100 [6].
3. **A 1.5°C scenario**, based on the IEA's Net Zero Emissions (NZE) by 2050 scenario, which is consistent with the overall aim of the Paris Agreement at the high end of the range of ambition. This scenario gives a probability of 50% of holding the global temperature increase to 1.4°C by 2100 [6].

The definition of distinct subsectors for the chemicals sector, as outlined in Section 2.3, necessitates the calculation of emissions trajectories at the subsector level. This requires disaggregating overall sectoral emissions into separate trajectories for each subsector, reflecting their differing emissions sources and profiles.

The agricultural chemicals subsector has a distinct emissions trajectory and portfolio because of the inclusion of use-phase emissions associated with the application of fertilisers and urea in agriculture. These emissions contribute significantly to global greenhouse gas totals and are consistently identified in climate models as among the most challenging to abate in net zero scenarios [16]. This is due to their diffuse nature arising from millions of small-scale sources, and the limited availability of scalable mitigation options beyond behavioural and agronomic changes in farming practices.

In contrast, emissions from the primary and non-primary chemicals subsectors are interlinked. Producers of primary chemicals (methanol and HVCs) typically report downstream emissions under Scope 3, Category 10 (processing of sold products), reflecting the transformation of their product by downstream users. Meanwhile, non-primary chemical producers, who purchase and further process these inputs, account for upstream emissions under Scope 3, Category 1 (purchased goods and services), representing the embedded emissions of the primary chemicals they acquire. As a result, the benchmark numerator for both subsectors reflects their overlapping life cycle emissions.

To calculate the carbon emissions of each subsector under each warming scenario, we:

1. Estimate the total emissions of the chemicals sector across Scope 1, Scope 2 and Scope 3, Categories 1 and 10;
2. Estimate the emissions associated with agricultural chemicals specifically for Scope 1, Scope 2 and Scope 3, Categories 1, 10 and 11;
3. Allocate the emissions calculated under (1) and (2) to each of our three subsectors.

The methodology, assumptions and data sources used are elaborated in Table 3.1.

Table 3.1. Methodology, assumptions and data sources for estimating benchmark emissions by scope and category

Emissions from the chemicals sector value chain
Estimating the Scope 1 emissions of the chemicals sector: The IEA's <i>World Energy Outlook 2024</i> provides historical CO₂ emissions data for the chemicals sector, along with projections under three emission scenarios. These figures include both direct energy-related CO₂ emissions and process emissions within the sector [6]. To account for other non-CO₂ greenhouse gases (excluding hydrofluorocarbons [HFCs]), we apply the ratio of these gases to CO₂ emissions observed in the US chemicals sector, adjusting the global CO₂ figures accordingly [17]. On that basis, the CO_{2e}/CO₂ ratio decreased from 1.10 in 2019 to 1.07 in 2023. This ratio is held constant at its 2023 value of 1.07 through to 2050, implying that all greenhouse gases are assumed to grow and decline at the same rate across the scenarios.
Estimating the Scope 2 emissions of the chemicals sector: To estimate the Scope 2 emissions from electricity and heat, we need to estimate the electricity and heat consumption of the chemicals sector. The IEA's <i>World Energy Outlook 2024</i> reports final energy consumption for the sector, but does not break it down by energy carrier [6]. We assume that the share of electricity and heat in total energy use is the same as that observed across the industrial sector more broadly. This share is then applied to the energy portion of the chemicals sector's total energy use, excluding feedstock, to estimate electricity and heat consumption. Based on data from the IEA's <i>Future of Petrochemicals</i> report, we use a ten-year average (2006–15) to split total energy use in the chemicals sector into 43% for energy and 57% for feedstock [7]. We then apply the global average CO₂ intensity for electricity and heat to estimate Scope 2 emissions. While on-site power generation (Scope 1 from a corporate accounting perspective) is excluded from the IEA's Scope 1 emissions for the chemicals sector, both purchased and self-generated electricity are included in total 'electricity and heat' consumption. As a result, no adjustment is made for on-site generation.
Estimating the Scope 3, Category 1 emissions of the chemicals sector: From the corporate reporting perspective, Scope 3, Category 1 emissions encompass upstream emissions from purchased goods and services, including the extraction, processing and refining of fossil fuels, as well as emissions embedded in purchased chemical products. However, in constructing the sector-level benchmark, the latter is inherently accounted for in the Scope 1 emissions of the chemicals sector itself. Therefore, to avoid double-counting, the benchmark emissions calculation focuses solely on upstream emissions from fossil fuel extraction and processing. To quantify these emissions under each warming scenario, two key inputs are required: (A) the emissions intensity of upstream oil, gas and coal production activities, and (B) the chemicals sector's total consumption of each fuel type, including both energy and feedstock use. Emissions are calculated by multiplying the fuel-specific emissions intensities by their respective consumption levels in each scenario and summing the results across all fuels. To estimate the upstream emissions intensity of the oil and gas sector, we assume that the emissions intensities of upstream oil and gas activities follow the same growth and decline trends as the broader oil and gas sector. We apply a constant ratio of 0.217, which represents the share of emissions from upstream extraction and processing relative to the total value chain emissions of the oil and gas sector, based on 2022 data [18]. This ratio is then applied to scale the oil and gas benchmark emissions intensities across all scenarios. For coal, we use the emissions intensity of coal mining activities — specifically, extraction and processing — as estimated in the TPI Centre's coal mining methodology. To project fossil fuel consumption in each warming scenario, we use data from the IEA's publicly available reports. For the National Pledges scenario, we rely on the <i>World Energy Outlook 2022</i>, which provides projections for total energy and feedstock consumption in the chemicals sector under STEPS [19]. To estimate the share of each fuel type (coal, oil and gas), we use data from the IEA's <i>The Future of Petrochemicals</i> report, which presents disaggregated fuel consumption projections under the Reference Technology Scenario (RTS) [7].

For the **Below 2°C** scenario, where fuel-specific projections for chemicals are not directly available, we assume that coal, oil and gas consumption in the sector will grow at the same rate as in the global industrial sector. We derive these growth rates from the *World Energy Outlook 2024* industry energy consumption projections [6].

For the **1.5°C** scenario, we use the *World Energy Outlook 2022*, which provides detailed projections of energy and feedstock use in the chemicals sector under the NZE pathway, disaggregated by fuel type [19].

Estimating the Scope 3, Category 10 emissions of the chemicals sector:

We assume that all emissions associated with the processing of sold chemical products occur within the chemicals sector itself. As a result, these emissions are captured within the sector's Scope 1 emissions.

Emissions from the agricultural chemicals value chain

Estimating the Scope 1 and 2 emissions of the agricultural chemicals subsector:

The IEA's *Ammonia Technology Roadmap* reports both direct and indirect emissions from ammonia production, including emissions from power consumption and urea hydrolysis, through 2050 across three emissions scenarios: STEPS, Sustainable Development Scenario (SDS) and NZE [14]. We adopt these figures as the Scope 1 and Scope 2 emissions of the agricultural chemicals subsector.

Estimating the Scope 3, Category 1 emissions of the agricultural chemicals subsector:

The IEA's *Ammonia Technology Roadmap* provides projections of energy consumption per tonne of ammonia production through 2050 across the three emissions scenarios, disaggregated by fuel type (i.e. coal, oil and natural gas) [14]. These figures encompass both process energy and feedstock use. To estimate total upstream emissions, we multiply the fuel-specific energy intensities by the corresponding ammonia production volumes projected in the same source. We then apply the same upstream emissions factors for oil and gas, as well as for coal mining, that are used in the broader chemicals sector benchmarks.

Estimating the Scope 3, Category 10 emissions of the agricultural chemicals subsector:

We assume that all emissions associated with the processing of sold agricultural chemical products occur within the agricultural chemicals subsector itself. As a result, these emissions are fully captured within the subsector's Scope 1 emissions.

Estimating the Scope 3, Category 11 emissions of the agricultural chemicals subsector:

The IEA's *Ammonia Technology Roadmap* projects ammonia and urea production under three climate scenarios, along with ammonia use in 2050 [14]. Currently, around 70% of global ammonia production is allocated to the agricultural sector. In the **National Pledges** scenario, we assume this share remains constant through 2050. However, due to the growing role of ammonia in green power generation and maritime fuels, its agricultural share is projected to decline to 39% in the **Below 2°C** scenario and 29% in the **1.5°C** scenario by 2050. To estimate ammonia used in agriculture, we interpolate linearly from the 2020 value of 70% to the scenario-specific 2050 values. For urea, we assume that 90% of production is used in agriculture across all scenarios, based on current usage patterns [14].

To calculate N₂O emissions from fertiliser application, we adopt an emission factor of 1.325% of nitrogen content, based on empirical research [20]. We then use the conversion factor for N₂O-N to N₂O (molecular weight ratio 44/28) and a GWP of 273 tonnes of carbon dioxide equivalent (tCO₂e) per tonne of N₂O, in line with the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report [21]. For CO₂ emissions from urea application, we follow the 2006 IPCC Guidelines, which specify an intensity of 0.2 tonnes of carbon per tonne of urea [22]. We then apply the molecular weight ratio for CO₂ to C (44/12) to convert to CO₂ emissions.

Following the calculation of emissions for all warming scenarios across the relevant scopes and categories, we allocate these emissions to the agricultural, primary and non-primary subsectors. This allocation is summarised in Table 3.2.

Table 3.2. Allocation of estimated emissions across the agricultural, primary and non-primary subsector benchmarks

Subsector	Scope 1 and 2	Scope 3, Category 1	Scope 3, Category 10	Scope 3, Category 11
Agricultural	Scope 1 and 2 agricultural chemicals	Scope 3, Category 1 agricultural chemicals	(Included in Scope 1)	Scope 3, Category 11 agricultural chemicals
Primary	Scope 1 chemicals sector + Scope 2 chemicals sector – Scope 1 and 2 agricultural chemicals	Scope 3, Category 1 chemicals sector – Scope 3, Category 1 agricultural chemicals	(Included in Scope 1)	Not applicable
Non-primary	Scope 1 chemicals sector + Scope 2 chemicals sector – Scope 1 and 2 agricultural chemicals	Scope 3, Category 1 chemicals sector – Scope 3, Category 1 agricultural chemicals	(Included in Scope 1)	Not applicable

3.2. Establishing a common denominator for emissions intensity: sales revenue

In the SDA, an ideal denominator for emissions intensity should meet two key criteria. First, it should be closely correlated with the company's core activities that drive greenhouse gas emissions. Second, it should be supported by company disclosures, meaning it is regularly and publicly reported by a significant share of companies in the sector.

In the chemicals sector, the wide diversity of products renders comparisons of emissions intensities using physical metrics such as tonnes produced or sold meaningless, despite these meeting the first criterion above. Furthermore, our analysis of companies' publicly available reports shows that most chemical producers do not consistently disclose production volumes anyway.

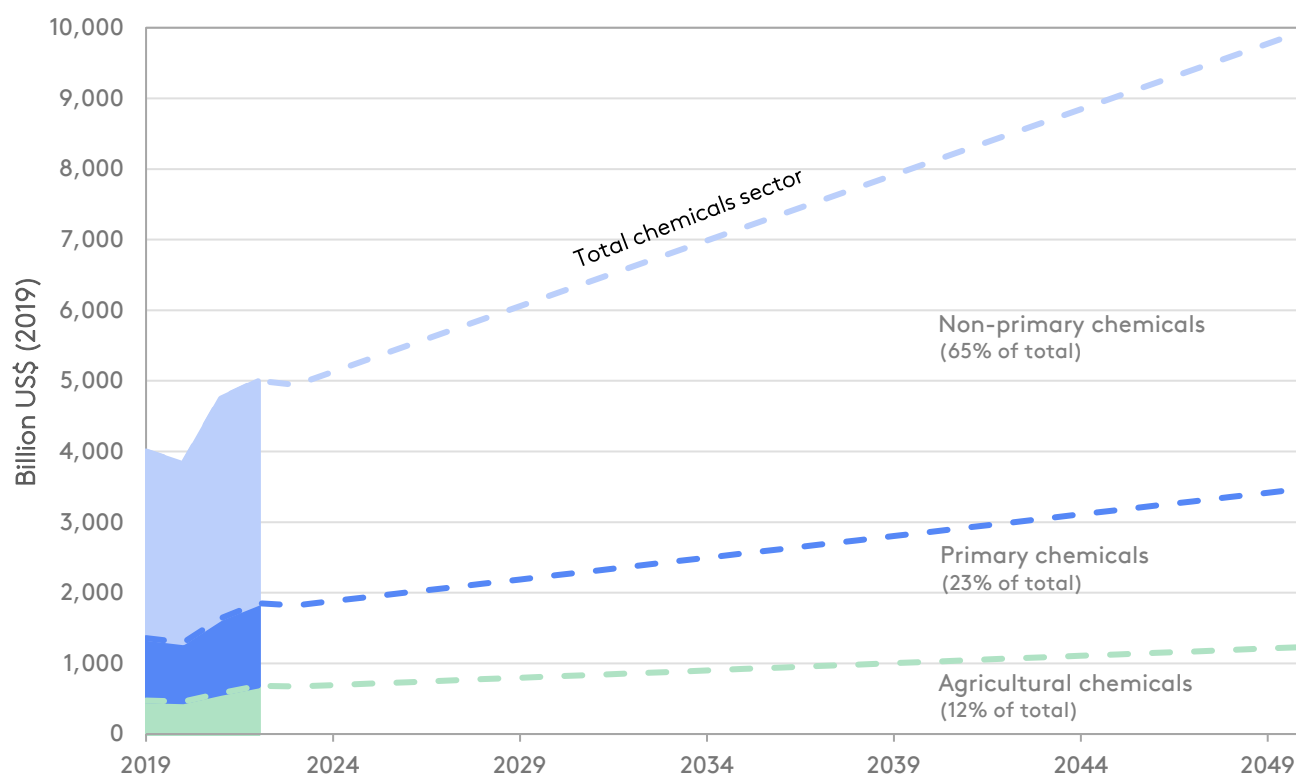
An alternative to physical output is financial measures of activity, such as revenue. These measures are widely disclosed across the sector and better account for the heterogeneity of chemical products. Their primary limitation lies in their exposure to price volatility and market fluctuations, which can obscure underlying trends in emissions performance. Considering the relative advantages and disadvantages of alternative approaches, we have chosen to adopt sales revenue as the denominator for emissions intensity calculations in this assessment.

Total global sales revenues of the chemicals sector (excluding pharmaceuticals) increased from US\$4.1 trillion in 2018 to US\$5.7 trillion in 2022 [10] and should continue to grow in the future. To project sales revenues up to 2050, we assume that the chemicals sector will grow at the same real rate as global GDP, as modelled by the IEA's *World Energy Outlook* [6]. To maintain consistency across the benchmark period, we adjust sales values to constant 2019 US\$ using historical global inflation data reported by the World Bank [23]. Under this approach, global chemical sales (excluding pharmaceuticals) are projected to reach approximately US\$10.0 trillion (constant 2019 prices) by 2050.

Between 2018 and 2022, agricultural chemicals accounted for 12% of total revenues, primary chemicals for 23%, and non-primary chemicals for 65% [10]. In our benchmark analysis, we assume these proportions remain constant through 2050 across all scenarios. Accordingly, these subsectors are projected to generate revenues of US\$1.2 trillion, US\$2.2 trillion and US\$6.5 trillion (2019 constant), respectively, by mid-century.

Figure 3.1 illustrates the historical trends and projected sales trajectories by subsector of the chemicals sector through 2050.

Figure 3.1. Historical and projected sales revenues of the chemicals sector by subsector



3.3. Intensity-based and absolute emissions benchmarks

Following the calculation of projected emissions and sales revenues, the next step is to derive emissions reduction benchmarks for each subsector under both the emissions intensity and absolute emissions approaches. In the intensity-based method, benchmarks are expressed as emissions per unit of sales revenue, calculated by dividing projected emissions by projected revenues in each warming scenario. Under the absolute emissions approach, benchmarks are normalised to a common baseline year, and the rate of emissions reduction is calculated for each subsector across the benchmark period.

Subsector benchmarks: intensity metric

Emissions intensity benchmarks for the three chemicals subsectors — agricultural, primary chemicals and non-primary chemicals — are presented in Figure 3.2 across three warming scenarios. The underlying emissions intensity data, expressed in tCO_{2e} per US\$1,000 (2019), are summarised in Table 3.3. As shown, agricultural chemicals exhibit the highest emissions intensity, reflecting the inclusion of downstream emissions from fertiliser and urea use in agricultural applications. Non-primary chemicals represent the lowest-emitting subsector, with a benchmark level of 0.58 tCO_{2e} per US\$1,000 in 2019. Unlike the other two subsectors, emissions intensity in agricultural chemicals is not projected to reach net zero by 2050 in the 1.5°C scenario, due to high N₂O emissions from fertiliser use and limited mitigation options in the agricultural sector for reducing fertiliser-related emissions.

Figure 3.2. Emissions Intensity benchmarks for the chemicals sector by subsector

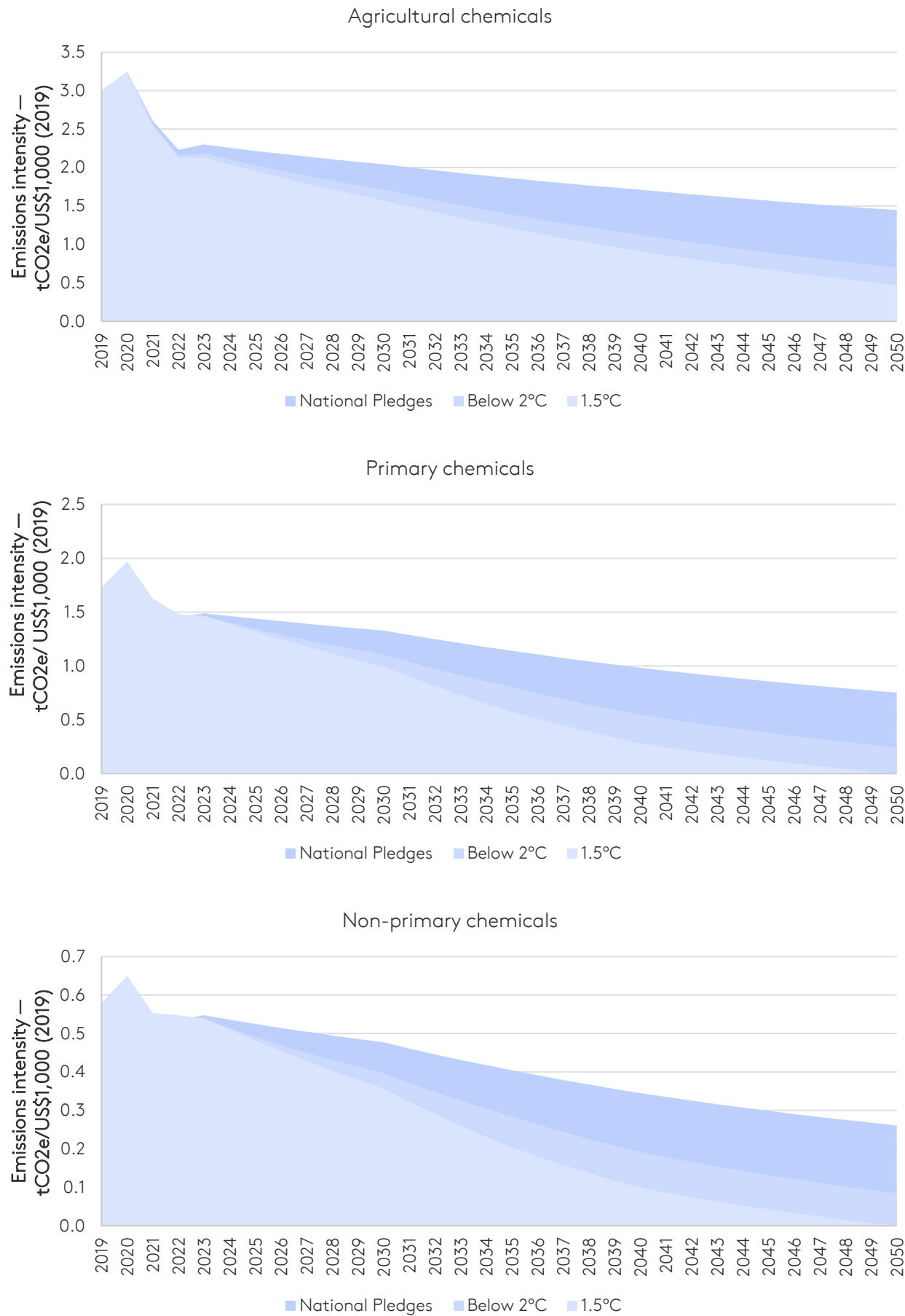


Table 3.3. Emissions intensity benchmarks for the chemicals sector by subsector

		2019	2030	2040	2050
Agricultural chemicals					
National Pledges	Sales revenue billion US\$ (2019)	473	817	1,024	1,231
	Emissions MtCO ₂ e	1,418	1,669	1,755	1,784
	Emission intensity tCO ₂ e/US\$1,000 (2019)	3.00	2.04	1.71	1.45
Below 2°C	Emissions MtCO ₂ e	1,418	1,399	1,152	863
	Emission intensity tCO ₂ e/US\$1,000 (2019)	3.00	1.71	1.12	0.70
1.5°C	Emissions MtCO ₂ e	1,418	1,285	932	579
	Emission intensity tCO ₂ e/US\$1000 (2019)	3.00	1.57	0.91	0.47
Primary chemicals					
National Pledges	Sales revenue billion US\$ (2019)	886	1,434	1,840	2,247
	Emissions MtCO ₂ e	1,530	1,933	1,771	1,603
	Emission intensity tCO ₂ e/US\$1,000 (2019)	1.73	1.35	0.96	0.71
Below 2°C	Emissions MtCO ₂ e	1,530	1,625	948	531
	Emission intensity tCO ₂ e/US\$1,000 (2019)	1.73	1.13	0.52	0.24
1.5°C	Emissions MtCO ₂ e	1,530	1,444	415	8
	Emission intensity tCO ₂ e/US\$1,000 (2019)	1.73	1.01	0.23	0.00
Non-primary chemicals					
National Pledges	Sales revenue billion US\$ (2019)	2,641	3,993	5,239	6,484
	Emissions MtCO ₂ e	1,530	1,904	1,809	1,692
	Emission intensity tCO ₂ e/US\$1,000 (2019)	0.58	0.48	0.34	0.25
Below 2°C	Emissions MtCO ₂ e	1,530	1,625	948	531
	Emission intensity tCO ₂ e/US\$1,000 (2019)	0.58	0.41	0.18	0.08
1.5°C	Emissions MtCO ₂ e	1,530	1,444	415	8
	Emission intensity tCO ₂ e/US\$1,000 (2019)	0.58	0.36	0.08	0.00

Subsector benchmarks: absolute emissions metric

The choice of emissions metric, absolute versus intensity-based, has implications for how subsectors are benchmarked. While an emissions intensity metric yields three distinct benchmarks, one for each subsector (agricultural, primary and non-primary chemicals), the use of absolute emissions benchmarks results in only two: agricultural and non-agricultural chemicals. This is because primary and non-primary chemicals have the same emissions trajectories, as discussed in Section 3.1.

The absolute emissions benchmarks evaluate changes in company emissions relative to a common baseline, to which both the benchmarks and company pathways are indexed. Indexing to a single year may present a misleading picture of a company's actual emission trajectory due to year-on-year fluctuations driven by factors such as economic conditions, mergers and acquisitions, and divestment. To reduce the influence of such anomalies, we adopt a three-year averaging approach. Each subsector benchmark is normalised to the average emissions over 2020–22, indexed to 100%.

The resulting absolute reduction benchmarks are expressed as emissions relative to this baseline over time, as detailed in Table 3.4.

Table 3.4. Absolute emissions reduction benchmarks for the chemicals sector by subsector

		2019	2020–22 average	2030	2040	2050
Agricultural chemicals						
National Pledges	Emissions MtCO ₂ e	1,418	1,510	1,669	1,755	1,784
	Indexed emissions % relative to 2020–22 subsector average	94	100	111	116	118
Below 2°C	Emissions MtCO ₂ e	1,418	1,484	1,399	1,152	863
	Indexed emissions % relative to 2020–22 subsector average	96	100	94	78	58
1.5°C	Emissions MtCO ₂ e	1,418	1,473	1,285	932	579
	Indexed emissions % relative to 2020–22 subsector average	96	100	87	63	39
Non-agricultural chemicals						
National Pledges	Emissions MtCO ₂ e	1,530	1,687	1,933	1,771	1,603
	Indexed emissions % relative to 2020–22 subsector average	91	100	115	105	95
Below 2°C	Emissions MtCO ₂ e	1,530	1,687	1,625	948	531
	Indexed emissions % relative to 2020–22 subsector average	91	100	96	56	32
1.5°C	Emissions MtCO ₂ e	1,530	1,687	1,444	415	8
	Indexed emissions % relative to 2020–22 subsector average	91	100	86	25	1

3.4. Deriving subsector-weighted benchmarks

While calculating subsector benchmarks enhances the granularity of emissions assessments across different product segments, companies often operate across multiple subsectors of the chemicals value chain — each with distinct emissions profiles and transition pathways. For these integrated companies, applying separate Carbon Performance assessments per subsector is not feasible, as this would require emissions data disaggregated by subsector — information that is typically not publicly available.

To address the lack of disaggregated emissions reporting for integrated companies, we introduce a subsector-weighted benchmarking approach that constructs a single, portfolio-oriented benchmark for each company. By combining relevant subsector benchmarks according to a company's product mix, this method captures the diversity of business models in the chemicals sector and supports a more accurate assessment of overall transition risk.

To map companies' operations across the defined subsectors, we use the sales segmentation reported in their financial statements. We first exclude revenues from non-chemical business segments, such as oil and gas refining and other commodities and services. Then, we calculate the five-year average shares of chemical sales revenues allocated to each subsector. These shares are subsequently used to derive each company's subsector-weighted average benchmark.

To calculate the intensity-based subsector-weighted benchmarks for each company in the chemicals sector based on the company's proportional involvement in agricultural chemicals (w_{Ag}), primary chemicals (w_P) and non-primary chemicals (w_{Np}), we use the formula presented in Equation 1:

$$EI_{company\ benchmark} = w_P \times EI_P + w_{np} \times EI_{np} + w_{Ag} \times EI_{Ag} \quad (\text{Equation 1})$$

where $EI_x = \frac{E_x}{S_x}$, and $w_P + w_{Np} + w_{Ag} = 1$

Similarly, to calculate the absolute emissions-based subsector-weighted benchmarks based on the relative share of agricultural (w_{Ag}) and non-agricultural (w_{Nag}) chemicals in the company's portfolio, we apply the formula in Equation 2:

$$E_{company\ benchmark-indexed} = w_{Nag} \times E_{Nag-indexed} + w_{Ag} \times E_{Ag-indexed} \quad (\text{Equation 2})$$

where $w_{Nag} + w_{Ag} = 1$

4. Results from applying the method to the chemicals sector

We begin this section by presenting the distribution of current emissions intensities across the chemicals sector and comparing these to our benchmarks (Section 4.1). We then apply the proposed Carbon Performance methodology to assess the forward-looking alignment of 20 selected chemical companies, comparing the outcomes under both the intensity-based and absolute emissions approaches. The detailed results of this analysis are provided in Sections 4.2 to 4.4.

4.1. Current emissions intensity

To assess the distribution of emissions intensities across companies with different product portfolios, and to compare their positions against our estimated benchmarks, we collected 2022 emissions data from CDP responses and 2022 sales revenue figures from company financial disclosures. Our sample consists of 83 companies, selected based on market capitalisation. Collectively, these companies represent approximately 63% of the total market capitalisation of the global chemicals sector and reported a combined total of around 510 MtCO₂e in Scope 1 and 2 emissions, accounting for roughly 28% of the sector's total Scope 1 and 2 emissions in 2022.

We calculate the companies' emissions intensities based on the emissions boundaries described in Section 2.3.⁵ The full list of these companies and their calculated emissions intensities is presented in Appendix 1. Due to data limitations, we are unable to adjust company revenues to exclude income derived from non-chemical activities. Sensitivity analysis indicates that, on average, the difference between revenue from chemicals and total revenue among companies in our sample is within 10%. This suggests that the approach is sufficient to provide a general understanding of emissions intensities within the sector and to facilitate meaningful comparison with our estimated benchmark values.

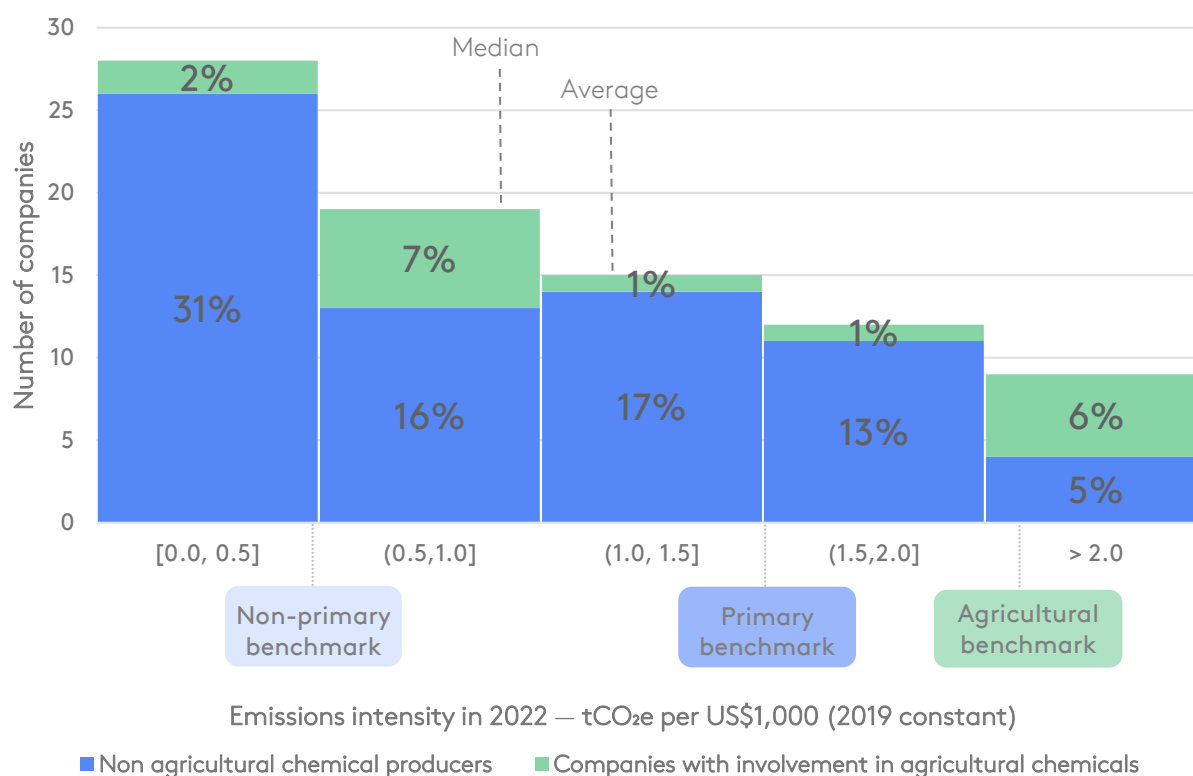
As shown in Figure 4.1, the average emissions intensity of chemical companies in our sample is 1.2 tCO₂e per US\$1,000 revenue. However, the distribution is strongly right-skewed, with a median intensity of 0.9 tCO₂e per US\$1,000, indicating that a small number of high-emitting companies raise the average. The lowest emissions intensity observed in the sample is 0.03 tCO₂e per US\$1,000, while the highest is 9.8 tCO₂e per US\$1,000.⁶

The distribution of emissions intensities among companies engaged solely in the production of primary and non-primary chemicals (i.e., excluding agricultural chemicals) aligns relatively well with the corresponding benchmarks. The benchmark intensities are 0.5 tCO₂e per US\$1,000 (2019 constant) for non-primary chemicals and 1.5 tCO₂e per US\$1,000 (2019 constant) for primary chemicals. Fifty-six per cent of companies involved in one or both activities fall within this range, with 38% of companies displaying lower emissions intensities and 6% higher. Most companies involved in the production of agricultural chemicals sit below the agricultural chemicals benchmark of 2.2 tCO₂e per US\$1,000. However, it is difficult to compare such companies with the benchmark because agricultural chemicals producers are often involved in the production of other chemicals too.

⁵ For companies across all three subsectors — primary chemicals, non-primary chemicals and agricultural chemicals — we included Scope 1 and 2 emissions, as well as Scope 3 emissions from Categories 1 (purchased goods and services) and 10 (processing of sold products). For the 15 companies involved in agricultural chemicals production, we additionally included emissions from Category 11 (use of sold products).

⁶ To align with the benchmark values, all intensities are expressed in tCO₂e per US\$1,000 in 2019 dollars.

Figure 4.1. Frequency distribution of emission intensities among the 83 analysed chemical companies



4.2. Overview of targets

Using our proposed methodology, we assess the alignment of emissions reduction targets of 20 companies selected based on: (a) having significant Scope 3 emissions in the relevant material categories, and (b) ensuring adequate representation across the three chemicals subsectors. The sample of companies is listed in Table 4.1. The detailed assessment steps, including the projection of company emissions pathways and the application of targets, are explained in Appendix 2.

Most companies in our sample have set more than one emissions reduction target – 14 out of 20 have defined both medium-term (2029–35) and long-term targets (beyond 2035). Specifically, 90% of companies have set medium-term targets, while 75% have established long-term targets. Additionally, a few companies have set short-term targets up to 2028 that we can include.⁷

All targets set by the 20 assessed companies include at minimum Scope 1 and 2 emissions. However, only one-fourth have established long-term targets that encompass all relevant categories of Scope 3 emissions.

Among the target types, companies tend to favour absolute emissions reduction targets over intensity-based ones, with only one accepted intensity target observed in this sample.

⁷ Some targets were excluded due to unclear base year values or ambiguous scope and coverage.

Table 4.1. Overview of emissions reduction targets for 20 assessed chemical companies

Company	Target years	Targeted scopes	Target type	Targeted reduction (base year)
1. Air Liquide	2035	1, 2	Absolute	33% (2020)
	2050	1, 2, 3 (all relevant categories)	Net zero	100%
2. AkzoNobel	2030	1, 2, 3 (all relevant categories)	Absolute	42% (2020)
	2050	1, 2, 3 (all relevant categories)	Net zero	100%
3. Alpek SAB de CAV	2030	1, 2, 3 (all relevant categories)	Absolute	27.5% Scopes 1 and 2 (2019); 13.5% Scope 3 (2019)
4. ARKEMA*	2030	1, 2, 3 (all relevant categories)	Absolute	48.5% Scopes 1 and 2 (2019); 54% Scope 3 (2019)
5. BASF	2030	1, 2	Absolute	25% (2018)
	2050	1, 2, 3 (category 1)	Net zero	100%
6. Braskem SA	2030	1, 2	Absolute	15% (2020)
	2050	1, 2, 3 (all relevant categories)	Net zero	100%
7. Chemours*	2030	1, 2	Absolute	60% (2018)
	2050	1, 2	Net zero	100%
8. Dow	2030	1, 2	Absolute	15% (2020)
	2050	1, 2, 3 (all relevant categories)	Net zero	100%
9. DuPont de Nemours	2030	1, 2, 3 (category 1)	Absolute	50% Scopes 1 and 2 (2019); 25% Scope 3 (2020)
	2050	1, 2	Net zero	100%
10. Incitec Pivot	2025	1, 2	Absolute	5% (2020)
	2030	1, 2	Absolute	25% (2020)
	2050	1, 2	Net zero	100%
	2035	1, 2	Absolute	35% (2021)
12. LyondellBasell	2030	1, 2, 3 (all relevant categories)	Absolute	42% Scopes 1 and 2 (2020); 30% Scope 3 (2020)
	2050	1, 2	Net zero	100%
13. Mosaic	2040	1, 2	Net zero	100%
14. Nissan Chemicals	2027	1, 2	Absolute	30% (2018)
	2050	1, 2	Net zero	100%
15. OCI	2030	1, 2	Intensity (per physical unit)	20% (2019)
	2050	1, 2	Net zero	100%
16. Orbia*	2030	1, 2	Absolute	47% (2019)
	2050	1, 2	Net zero	100%
17. PTT Global Chemical	2030	1, 2	Absolute	20%
	2050	1, 2, 3 (all relevant categories)	Absolute	100% Scopes 1 and 2 (2020); 50% Scope 3 (2020)
18. SABIC	2030	1, 2	Absolute	20% (2018)
	2050	1, 2	Net zero	100%
19. Solvay	2030	1, 2, 3 (all relevant categories)	Absolute	30% Scopes 1 and 2 (2018); 24.2% Scope 3 (2018)
20. Yara International	2025	1, 2	Absolute	12% (2019)
	2030	1, 2	Absolute	30% (2019)

Note: *The company has direct and indirect HFC emissions, which are excluded from this assessment.

4.3. Carbon Performance: the intensity approach

We calculate each company's target alignment based on its subsector classification. Among the 20 companies assessed, none are pure-play primary chemicals producers. Nine are classified as non-primary chemical producers, three as agricultural chemicals producers, and the remaining eight operate across at least two subsectors and are therefore categorised as integrated companies. Integration between primary and non-primary subsectors is more common, with five companies operating across both. However, three companies also combine agricultural and non-agricultural chemicals businesses (Table 4.2).

Alignment with the benchmarks is highest in the long term (2050), followed by the medium term (2035) and short term (2028). However, most companies do not align with either the 1.5°C or Below 2°C scenarios in any timeframe. By 2050, five companies (25%) are aligned with the 1.5°C scenario, with an additional four companies (20%) aligned with National Pledges. In 2035, only two companies (10%) align with 1.5°C, while three companies (15%) align with National Pledges. In the short term (2028), three companies (15%) are aligned with 1.5°C, and one company (5%) with National Pledges. This pattern of better long-term than medium- or short-term alignment mirrors what we see in other sectors.

Alignment patterns also differ across subsectors. Among agricultural chemical companies, alignment is relatively stronger with the National Pledges benchmark: two of the three firms in this group meet that standard by 2050, though none align with the 1.5°C scenario. Non-primary chemical companies show the weakest overall performance, with most failing to align in any timeframe and only a minority aligning with the 1.5°C benchmark in the long term. Integrated companies fall in between: by 2050, outcomes are split evenly, with half remaining misaligned and the other half divided between 1.5°C and National Pledges.

In the long term, alignment scores depend on whether companies' net zero targets cover all relevant emissions scopes. Companies that do are aligned with the 1.5°C benchmark, while those that omit key categories — for example, some agricultural chemicals companies exclude downstream emissions — are not. In the short term, alignment is driven mainly by current emissions intensity, itself shaped by business models and past mitigation efforts. Medium-term outcomes reflect both these factors and, in addition, the ambition of companies' medium-term targets.

Table 4.2. Subsector weights and Carbon Performance alignment scores for 20 chemical companies in the short, medium and long term according to the intensity approach

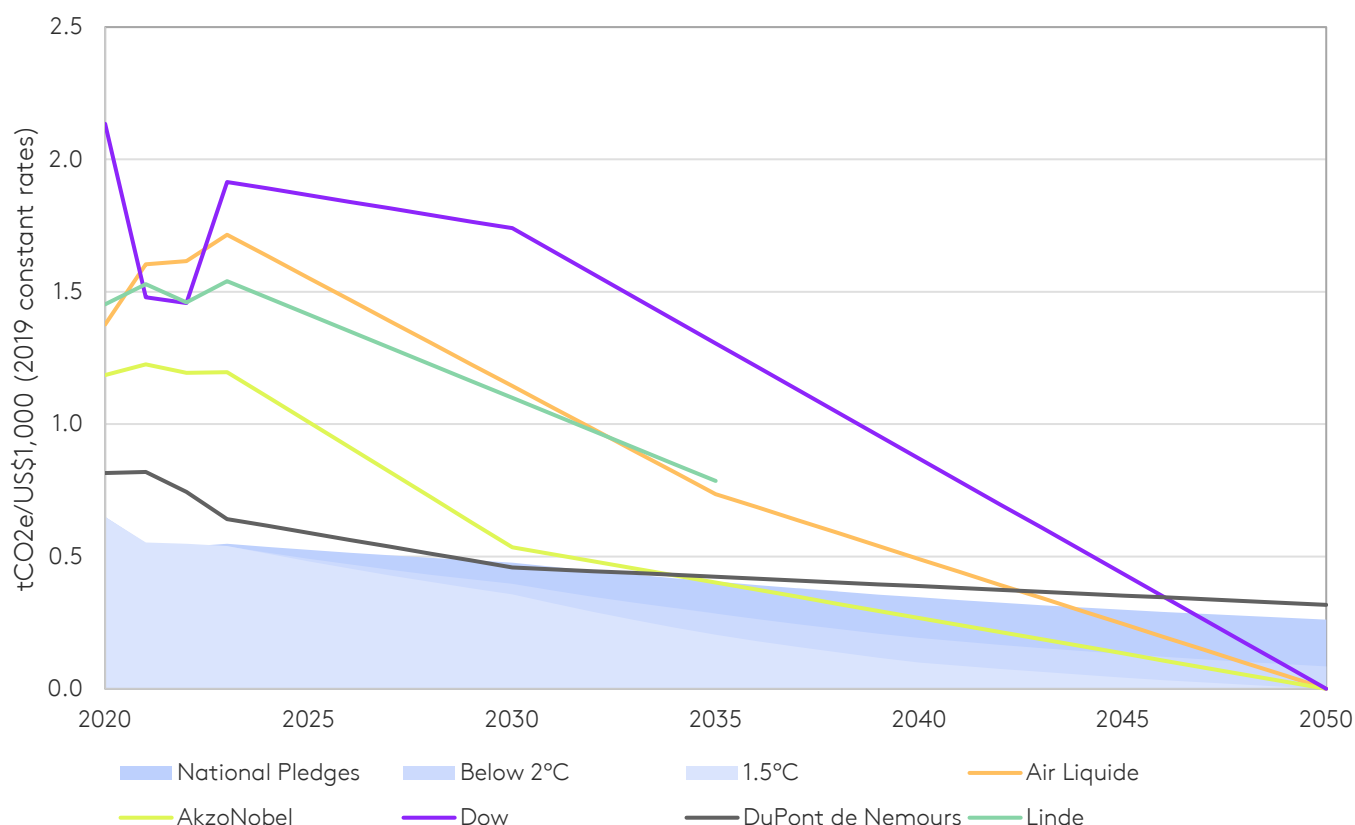
Company	Calculated 2023 intensity tCO ₂ e/US\$1,000 (2019)	Subsector weights			Alignment scores (intensity approach)		
		Primary	Non- primary	Agricultural	Short term (2028)	Medium term (2035)	Long-term (2050)
1. Air Liquide	1.72	0%	100%	0%	Not Aligned	Not Aligned	1.5°C
2. AkzoNobel	1.20	0%	100%	0%	Not Aligned	National Pledges	1.5°C
3. Alpek SAB de CAV	2.48	0%	100%	0%	Not Aligned	Not Aligned	Not Aligned
4. ARKEMA	1.28	0%	100%	0%	Not Aligned	Not Aligned	Not Aligned
5. BASF	1.10	17%	83%	0%	Not Aligned	Not Aligned	1.5°C
6. Braskem SA	0.49	15%	85%	0%	1.5°C	National Pledges	1.5°C
7. Chemours	3.90	0%	100%	0%	Not Aligned	Not Aligned	Not Aligned
8. Dow	1.91	0%	100%	0%	Not Aligned	Not Aligned	1.5°C
9. DuPont de Nemours	0.64	0%	100%	0%	Not Aligned	Not Aligned	Not Aligned
10. Incitec Pivot	2.16	0%	0%	100%	National Pledges	National Pledges	National Pledges
11. Linde	1.54	0%	100%	0%	Not Aligned	Not Aligned	Not Aligned
12. LyondellBasell	2.01	12%	88%	0%	Not Aligned	Not Aligned	Not Aligned
13. Mosaic	1.27	0%	0%	100%	1.5°C	1.5°C	National Pledges
14. Nissan Chemicals	0.76	0%	67%	33%	1.5°C	1.5°C	National Pledges
15. OCI	8.58	14%	0%	86%	Not Aligned	Not Aligned	Not Aligned
16. Orbia	1.33	6%	94%	0%	Not Aligned	Not Aligned	Not Aligned
17. PTT Global Chemical	1.70	46%	54%	0%	Not Aligned	Not Aligned	National Pledges
18. SABIC*	2.98	0%	92%	8%	Not Aligned	Not Aligned	Not Aligned
19. Solvay	2.95	0%	100%	0%	Not Aligned	Not Aligned	Not Aligned
20. Yara International	4.28	0%	0%	100%	Not Aligned	Not Aligned	Not Aligned

Note: *The last reported year for this company is 2022.

To enable peer-to-peer comparison of entire emissions intensity trajectories, Figure 4.2 illustrates the emissions pathways of five companies that share a common benchmark — the non-primary chemicals subsector benchmark — as an example.

The companies shown in the figure have emissions intensities above the benchmarks initially. What brings companies such as AkzoNobel, Air Liquide and Dow into alignment with the benchmarks is the strength of their medium- and/or long-term emissions reduction targets. In the intensity approach, the higher a company's current emissions intensity, the more ambitious its future targets must be to reach alignment. In the next subsection, we compare the emissions pathways of the same companies using the absolute emissions approach to illustrate how the two methodologies differ in interpreting alignment.

Figure 4.2. Emissions intensity pathways of companies operating exclusively in the non-primary chemicals subsector, compared with the non-primary benchmark



4.4. Carbon Performance: absolute emissions

In the absolute emissions approach, benchmarks are defined for two subsectors only, agricultural and non-agricultural chemicals. As a result, companies integrated across primary and non-primary chemicals are treated uniformly, and only three companies in our sample remain classified as integrated — those with both agricultural and non-agricultural operations. For these companies, we apply the same weighted subsector shares used previously to construct benchmarks that reflect their specific business portfolios. The alignment scores of the 20 assessed companies based on the absolute emissions approach are presented in Table 4.3.

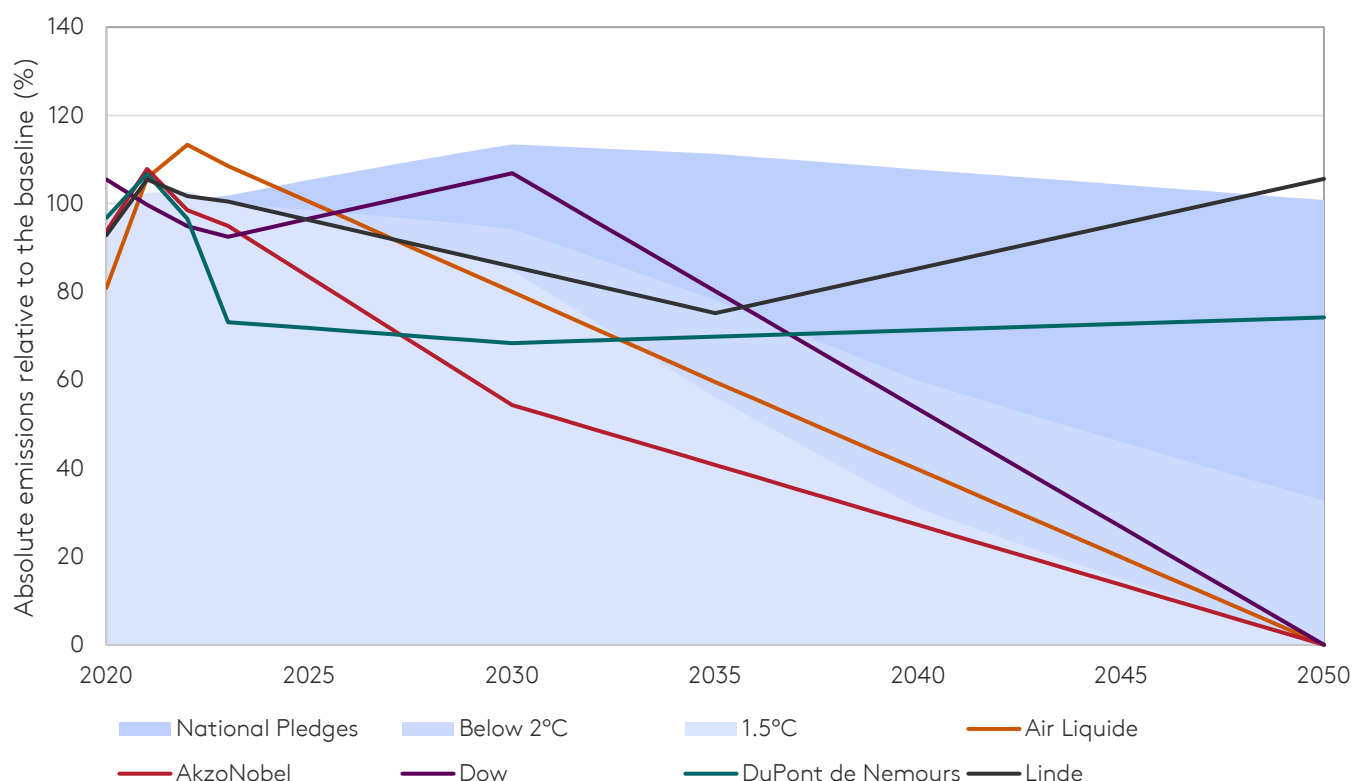
In contrast to the intensity approach, most companies are aligned with at least one low-carbon scenario in the absolute emissions approach, and alignment tends to decline rather than increase over time. In the short term (2028), eight companies (40%) are aligned with the 1.5°C benchmark, while seven (35%) are aligned with National Pledges. In the medium term (2035), seven companies (35%) remain aligned with either the 1.5°C or Below 2°C scenarios, and seven (35%) continue to align with National Pledges. In the long term (2050), only six companies (30%) align with the 1.5°C or Below 2°C scenarios, and five (25%) with National Pledges.

Table 4.3. Subsector weights and Carbon Performance alignment scores for 20 chemical companies in the short, medium and long term according to the absolute emissions approach

Company	Subsector weights		Alignment scores (absolute emissions approach)		
	Non-agricultural	Agricultural	Short term (2028)	Medium term (2035)	Long term (2050)
1. Air Liquide	100%	0%	1.5°C	Below 2°C	1.5°C
2. AkzoNobel	100%	0%	1.5°C	1.5°C	1.5°C
3. Alpek SAB de CAV	100%	0%	1.5°C	National Pledges	Not Aligned
4. ARKEMA	100%	0%	1.5°C	Below 2°C	National Pledges
5. BASF	100%	0%	National Pledges	National Pledges	1.5°C
6. Braskem SA	100%	0%	National Pledges	National Pledges	1.5°C
7. Chemours	100%	0%	Not Aligned	Not Aligned	Not Aligned
8. Dow	100%	0%	National Pledges	National Pledges	1.5°C
9. DuPont de Nemours	100%	0%	1.5°C	Below 2°C	National Pledges
10. Incitec Pivot	0%	100%	Not Aligned	Not Aligned	Not Aligned
11. Linde	100%	0%	1.5°C	Below 2°C	Not Aligned
12. LyondellBasell	100%	0%	1.5°C	Below 2°C	National Pledges
13. Mosaic	0%	100%	Not Aligned	National Pledges	Not Aligned
14. Nissan Chemicals	67%	33%	National Pledges	Not Aligned	Not Aligned
15. OCI	14%	86%	National Pledges	National Pledges	National Pledges
16. Orbia	100%	0%	Not Aligned	Not Aligned	Not Aligned
17. PTT Global Chemical	100%	0%	National Pledges	National Pledges	Below 2°C
18. SABIC	92%	8%	Not Aligned	Not Aligned	Not Aligned
19. Solvay	100%	0%	National Pledges	Not Aligned	Not Aligned
20. Yara International	0%	100%	1.5°C	Below 2°C	National Pledges

Figure 4.3 presents absolute emissions pathways for the same five companies analysed with respect to their emissions-intensity pathways in Figure 4.2. It helps to shed light on the differences between the approaches. In the absolute emissions approach, all companies are treated as starting from a common baseline, placing them by design on the benchmark level at the outset. These companies' emissions reduction targets are then sufficient to drop their absolute emissions below the benchmarks and thereby align in the short to medium term. However, in the medium to long term, some companies fall out of alignment due to the absence of long-term targets extending to 2050 (e.g. Linde), or because their targets do not cover all material emissions scopes (e.g. DuPont de Nemours). An upward-sloping trajectory in these cases reflects assumed constant emissions intensity for the scopes of emissions not covered by targets. In these cases, emissions grow in line with sector growth, assuming a constant market share for the company.

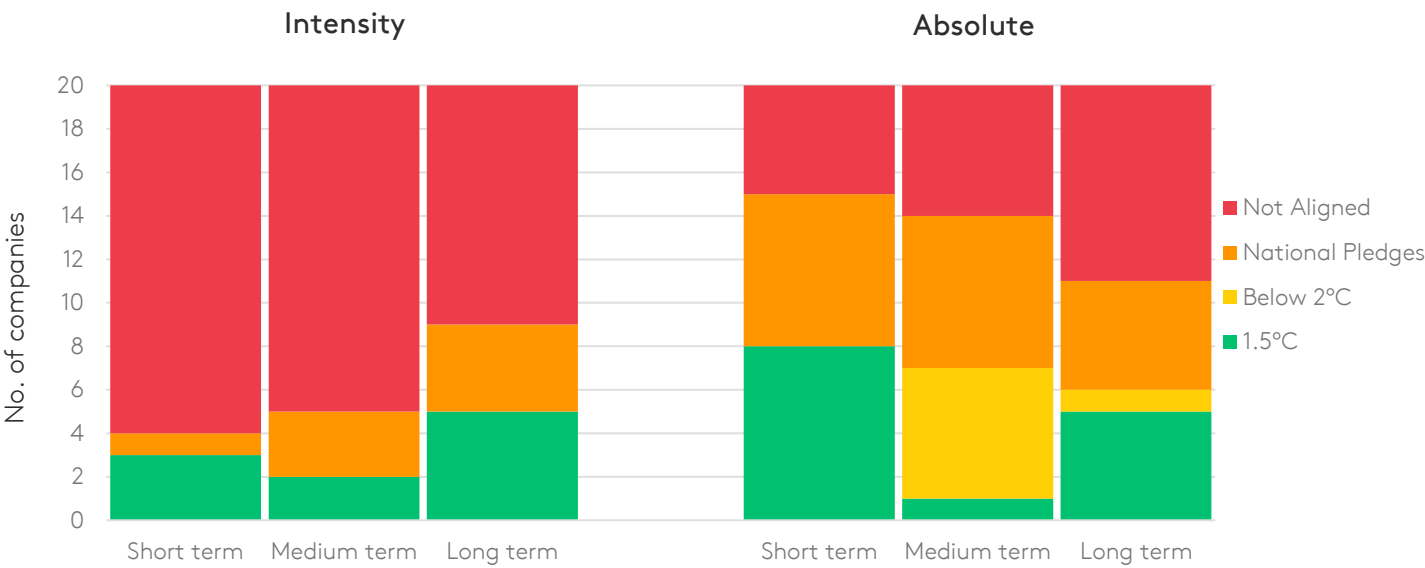
Figure 4.3. Absolute emissions pathways of companies operating exclusively in the non-agricultural chemicals subsector, compared with the non-agricultural benchmark



The contrast between the results of the Carbon Performance assessments under the two approaches is further illustrated in Figure 4.4. More companies are aligned with the benchmarks in any time horizon when assessed using the absolute emissions approach. However, the difference is particularly stark in the short to medium term. In the long term, under both approaches it is only companies with net zero targets that cover all relevant emissions scopes that align with the 1.5°C scenario.

This result might seem surprising given that absolute emissions approaches are often thought of as being more stringent. However, this perception only holds if a company's current emissions intensity is already below the benchmark levels used in the intensity approach. In such cases, an intensity emissions pathway allows for a slower reduction trajectory compared to what would be required in the absolute benchmarks, where the starting point is on the benchmark level. On the other hand, for companies whose current emissions intensity is higher than relevant benchmarks — which is the situation for most of the 20 companies assessed in this analysis — a much steeper reduction is necessary to achieve alignment. It is therefore important to keep in mind that the direction and size of the difference in the results produced by the two approaches depend on the characteristics of the company sample.

Figure 4.4. Comparison of alignment scores for 20 assessed companies using intensity-based and absolute emissions approaches



5. Discussion and limitations

In this paper, we propose a new methodology to assess the Carbon Performance of chemical producers. A key consideration is the sector's heterogeneity in emissions sources, intensity levels, and greenhouse gas profiles. To address this, we divide the sector into three subsectors: agricultural chemicals, primary chemicals, and non-primary chemicals. For each subsector, we define specific emissions boundaries and derive emissions trajectories:

- a. **Primary and non-primary chemicals:** Scopes 1, 2 and 3 (purchased goods and services, and processing of sold products).
- b. **Agricultural chemicals:** Scopes 1, 2 and 3 (purchased goods and services, processing of sold products, and use of sold products).

A central question is whether an absolute or intensity approach is more suitable for benchmarking performance against climate scenarios. **We prefer the emissions intensity metric (tCO₂e per US\$1,000 revenue)** for the following reasons:

- I. **Recognition of current performance.** The intensity approach incorporates companies' starting Carbon Performance into their trajectory. High-intensity companies generate the same revenue with more emissions, while low-intensity companies reflect earlier mitigation progress. By contrast, the absolute approach indexes all companies to a common baseline, which does not take into account efficiency differences and past decarbonisation efforts.
- II. **Differentiated expectations and efficiency.** In the intensity method, companies with higher starting intensities must adopt more ambitious reduction targets to become aligned, while those with lower intensities can follow a more gradual path. This design places the onus for action on the most carbon-intensive firms, where substantial and often lower-cost abatement opportunities are typically found, promoting overall economic efficiency. By contrast, the absolute method treats all companies equally and applies the same emissions reduction rates regardless of starting position, which does not reward efficient producers.

We acknowledge that the absolute emissions approach has its own benefits and the intensity approach its limitations. Using revenue as the denominator introduces sensitivity to price volatility, although it remains the only consistent and widely available metric across the diverse chemicals sector. Moreover, while intensity benchmarks can appear permissive in principle if absolute emissions rise with output, the SDA mitigates this concern by rooting intensity pathways in an underlying absolute carbon budget. Finally, by dividing the sector into three subsectors and excluding F-gases, we mitigate the risk that intensity benchmarks unfairly entrench advantages for less carbon-intensive product portfolios. We welcome feedback on whether absolute emissions or emissions intensities should be used in the chemicals sector.

Further limitations

The chemicals sector has a blurred boundary with the upstream oil and gas industry, largely due to the integration of refineries into petrochemical complexes. To enable a fair assessment of Carbon Performance, companies should clearly distinguish, both in their emissions disclosures and financial statements, between refined oil and gas products sold externally and those used internally to produce primary chemicals. Failure to make this distinction can result in an overestimation of emissions intensity.

Some chemical companies are planning to transition into the production of clean fuels. The production of biofuels and bio-based feedstocks should, in principle, be assessed within the oil and gas sector. However, if chemical companies do not separately disclose the emissions and sales revenues generated from these products, it becomes difficult to allocate these activities to one of the defined subsectors. To date, this has been rare among assessed companies, and we take a conservative approach of excluding the relevant sales revenues from the calculations while retaining the associated emissions.

On the other hand, some clean fuel options are originally chemical products, such as methanol, hydrogen and ammonia. Hydrogen can also be used as a clean reducing agent in other industries, such as steelmaking. In principle, we do not account for the avoided emissions from using these fuels compared to their high-carbon alternatives. Use-phase emissions from these fuels are included in the calculation of emissions intensity only if the company is involved in agricultural chemicals production. The agricultural chemicals benchmark explicitly incorporates the emerging use of ammonia as a clean fuel in Paris-aligned scenarios, ensuring that reductions in fertiliser-related emissions are appropriately accounted for. Since hydrogen does not emit greenhouse gases during use, this generally does not create boundary issues. The main challenge arises if a company produces methanol used as a clean fuel while also reporting Scope 3, Category 11 emissions associated with agricultural chemicals. In such cases, we estimate the CO₂ emissions from methanol combustion using global emissions factors and exclude them from the company's reported Scope 3, Category 11 emissions.

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Appendices

Appendix 1. List of companies with market capitalisation and calculated emission intensities

	Company name	Market capitalisation (January 2025) billion US\$	Emissions intensity in 2022 tCO ₂ e/US\$1,000 (2019)		Company name	Market capitalisation (January 2025) billion US\$	Emissions intensity in 2022 tCO ₂ e/US\$1,000 (2019)
1	Linde PLC	232.7	1.46	2	L’Air Liquide	108.2	1.85
3	Shin-Etsu Chemical Co Ltd	80.8	0.65	4	Ecolab Inc	73.9	0.43
5	Air Products and Chemicals Inc	72.6	2.39	6	Saudi Basic Industries Corporation SJSC	58.2	3.41
7	Givaudan SA	47.1	0.35	8	BASF SE	45.0	0.92
9	Dow Inc	37.1	1.67	10	Dupont De Nemours Inc	35.6	0.85
11	Wanhua Chemical Group Co Ltd	34.8	1.48	12	PPG Industries Inc	30.4	0.06
13	LyondellBasell Industries NV	29.9	1.66	14	International Flavors & Fragrances Inc	27.0	0.81
15	Nutrien Ltd	23.7	0.38	16	LG Chem Ltd	18.9	0.28
17	Symrise AG	18.2	0.42	18	RPM International Inc	17.1	0.03
19	Nippon Paint Holdings Co Ltd	16.7	0.12	20	Nippon Sanso Holdings Corp	15.2	0.89
21	Celanese Corp	14.7	0.43	22	Eastman Chemical Co	12.7	2.70
23	Covestro AG	12.0	1.10	24	Nitto Denko Corp	11.8	0.17
25	Akzo Nobel NV	11.6	1.37	26	Albemarle Corp	11.5	0.33
27	Sociedad Quimica y Minera de Chile SA	10.9	0.37	28	Evonik Industries AG	10.7	1.25
29	Nan Ya Plastics Corp	10.4	1.08	30	Brenntag SE	10.0	1.21
31	Asahi Kasei Corp	9.8	0.59	32	Formosa Plastics Corp	9.5	1.91
33	Toray Industries Inc	9.0	0.81	34	Mitsubishi Chemical Group Corp	8.6	2.00
35	Mosaic Co	8.3	0.94	36	Yara International ASA	8.1	3.23
37	Axalta Coating Systems Ltd	8.1	0.04	38	FMC Corp	7.8	0.34

39	Formosa Chemicals and Fibre Corp	7.1	1.61	40	Croda International PLC	6.9	0.39
41	Arkema SA	6.8	1.25	42	Cabot Corp	6.4	1.85
43	Element Solutions Inc	6.2	0.17	44	OCI NV	5.7	9.82
45	JSR Corp	5.7	0.17	46	Valvoline Inc	5.5	1.88
47	ICL Group Ltd	5.2	0.52	48	Scotts Miracle-Gro Co	5.1	0.04
49	UPL Ltd	5.1	0.64	50	Kuraray Co Ltd	4.9	0.61
51	Nissan Chemical Corp	4.9	0.78	52	Wacker Chemie AG	4.8	1.03
53	Mitsui Chemicals Inc	4.8	0.98	54	Clariant AG	4.8	0.67
55	Avient Corp	4.7	1.95	56	Solvay SA	4.5	1.29
57	H.B. Fuller Company	4.4	0.32	58	SKC Co Ltd	4.2	1.55
59	NOF Corp	4.2	0.32	60	Indorama Ventures PCL	4.2	2.15
61	Huntsman Corp	4.1	0.85	62	Mitsubishi Gas Chemical Co Inc	4.0	1.55
63	Incitec Pivot Ltd	3.8	2.48	64	PTT Global Chemical PCL	3.6	1.51
65	Johnson Matthey PLC	3.4	0.17	66	Kansai Paint Co Ltd	3.1	0.46
67	Air Water Inc	3.1	0.93	68	Kumho Petro Chemical Co Ltd	3.0	1.21
69	Chemours Co	3.0	5.33	70	Lotte Chemical Corp	2.9	0.99
71	Umicore SA	2.8	0.35	72	Hanwha Solutions Corp	2.8	0.91
73	Methanex Corp	2.8	1.06	74	Lanxess AG	2.7	1.36
75	Kingboard Holdings Ltd	2.6	0.64	76	Minerals Technologies Inc	2.5	0.51
77	K+S AG	2.1	0.40	78	Orbia Advance Corporation SAB de CV	1.9	1.47
79	Alpek SAB de CAV	1.2	1.91	80	Teijin Ltd	1.9	0.69
81	Braskem	1.6	0.36	82	Ingevity Corp	1.3	0.29
83	Dsm BV	0.2	1.12				

Appendix 2. Assessment steps

Applying the proposed subsector-weighted benchmarking approach to the chemicals sector requires companies to disclose all material scopes of emissions, provide a breakdown of sales across each business segment that can be allocated to the defined subsectors, and set company-wide targets in a way that allows analysts to apply these targets consistently to the company's Carbon Performance.

A Carbon Performance assessment of chemical companies involves several key steps, as listed below:

1. **General research on the company's products and business lines:** This step is necessary to develop an initial understanding of the company's involvement in different subsectors, as well as any activities related to oil and gas refining or the manufacture of products that emit fluorinated gases.
2. **Emissions data collection:** Emissions data are collected from company publications and disclosures. Use-phase emissions, reported under Scope 3, Category 11, are gathered only for companies involved in agricultural chemicals, while emissions associated with non-chemical business segments are excluded. HFC emissions are also excluded from the emissions calculation.
3. **Collection of sales revenue data by subsector:** A breakdown of sales revenue information is collected from the company's financial statements or other publicly available resources. If necessary, reported figures are converted to US\$ and subsequently adjusted to constant 2019 US\$ using GDP deflators. Non-chemical activities, such as oil and gas operations, are excluded, and the remaining revenue segments are categorised into three subsectors: agricultural chemicals, primary chemicals and non-primary chemicals. The annual share of each subsector in total sales is calculated, and a five-year average of these shares is then derived.

Some integrated companies operating across multiple subsectors do not disclose segmented revenue information, or their reported segments do not align with the subsector boundaries defined in this paper and may combine multiple subsectors into a single category. To address this issue in the assessments, we classify any mixed primary and non-primary segments as non-primary as a conservative approach.

4. **Applying the targets and deriving the emissions intensity pathway:** Emission reduction targets are collected from the company's publicly available disclosures.

For the absolute emissions targets, we apply the reduction rate to the base year value to project emissions in the target year(s). To estimate future sales revenues, we apply subsector-specific growth rates derived from benchmark projections, projecting forward from the last year of reported financial data. Using these emissions and revenue projections, we derive the company's emissions intensity pathway, expressed in tCO_{2e} per 1,000 constant 2019 US\$.

Some companies define their targets as emissions intensity per tonne of product, particularly for their primary chemicals production, including ammonia.⁸ To calculate the implied emissions target in the target year, in the absence of production forecasts publicly disclosed by the company, we use the growth rates for primary chemicals as reported by the IEA in the *World Energy Outlook* reports and the *Ammonia Technology Roadmap* for ammonia specifically. In a few rare cases, companies set targets for fertiliser emissions per tonne of nitrogen content. In such instances, we apply the same growth rate as ammonia production. After calculating the targeted emissions, we then derive the company's emissions intensity per sales revenue by projecting its sales revenues for the target year(s).

5. **Deriving the benchmarks:** The company's benchmarks are constructed by weighting the subsector benchmarks according to the five-year average shares of each subsector in the company's portfolio.

⁸ This approach is also in line with the guidelines suggested by the SBTi for target setting for ammonia, methanol and HVCs production. For further details, see: Science Based Targets initiative (SBTi), Chemicals Sector Guidance: Consultation Draft, available at: <https://files.sciencebasedtargets.org/production/files/SBTi-Chemicals-Sector-Guidance-Consultation-Draft.pdf>.

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