ecomatters

White paper:
Navigating Scope 3 emissions accounting over time

T +31 (0) 30 22 72 904
E info@ecomatters.nl
W www.ecomatters.nl

Ecomatters B.V.
Weg der Verenigde Naties 1
3527KT Utrecht
The Netherland

Table of Contents

Introduction

Purpose and contents

Accounting for company greenhouse gas (GHG) emissions involves several dynamic aspects that companies need to take into account. As methodologies are refined, data availability improves and emission factors become more accurate, maintaining a reliable GHG emissions inventory requires ongoing attention.

This paper explores how these changing aspects influence a company's emissions accounting over time. It focuses on how GHG emissions calculations (particularly for Scope 3) and the resulting emissions inventory interact with annual sustainability reporting cycles, emissions reduction target setting, and monitoring progress. To support this, the paper outlines key considerations for data collection, developing and maintaining methodological consistency and determining when recalculations or baseline restatements are appropriate. The paper includes real-world examples from the work with our client the chemicals company Nobian, to illustrate how companies can approach Scope 3 accounting in a structured way.

Scope

This paper covers aspects that encompass three interrelated activities:

1. developing and updating the GHG emissions inventory with the Greenhouse Gas Protocol;
2. setting and monitoring emissions reduction targets under the science-based targets initiative (SBTi) or by the company itself; and,
3. reporting on the first two activities in the annual sustainability report.

Figure 1 shows how these three activities are interconnected and affect each other. In the next section of the paper, each aspect will be explained briefly. While some of the considerations discussed in this paper are primarily relevant during initiation of the emissions accounting system, most of the points addressed focus on changes that occur over time. When such changes occur, this can prompt recalculating the baseline or adjusting targets, which subsequently impacts the whole accounting system both retroactively and going forward.

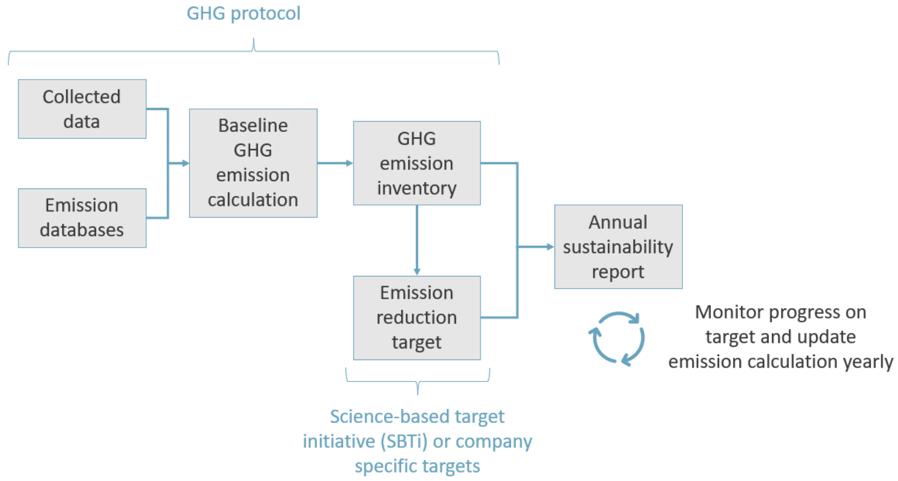

Figure 1 Company emissions accounting system

This paper mainly addresses Scope 3 GHG emissions, as they represent a significant share of a companies' total Scope 1, 2 and 3 emissions, especially in the energy and chemical sector[1]. However, many of the points noted also apply to Scope 1 and 2 GHG emissions, as shown in some of the examples provided.

[1] CDP Technical Note: Relevance of Scope 3 Categories by Sector

Emissions accounting

GHG emissions inventory

The company's GHG emissions inventory covers the volume of GHG emissions expressed as carbon dioxide-equivalent (CO_2-eq.), which includes carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emissions for the organisation and its value chain. This process begins with calculating the initial baseline and is followed by annual calculations to assess, communicate, and monitor progress.

A company's GHG emissions cover:

- Scope 1 emissions, which are direct emissions from the company's operations (e.g. fuel combustion in boilers, operation of vehicles, chemical processes, etc.).
- Scope 2 emissions are indirect emissions from purchased energy (e.g. purchased electricity, heating or cooling).
- Scope 3 emissions, as visible in the Figure 2 below, involve emissions from both upstream and downstream processes, which are divided into 15 categories (as per the Greenhouse gas (GHG) protocol). The upstream categories are related to the purchase of services or materials, whereas the downstream processes are related to the use and disposal of the produced services or products.

In general, data and information about emission factors are easier to obtain for Scope 1 and 2 than for Scope 3.

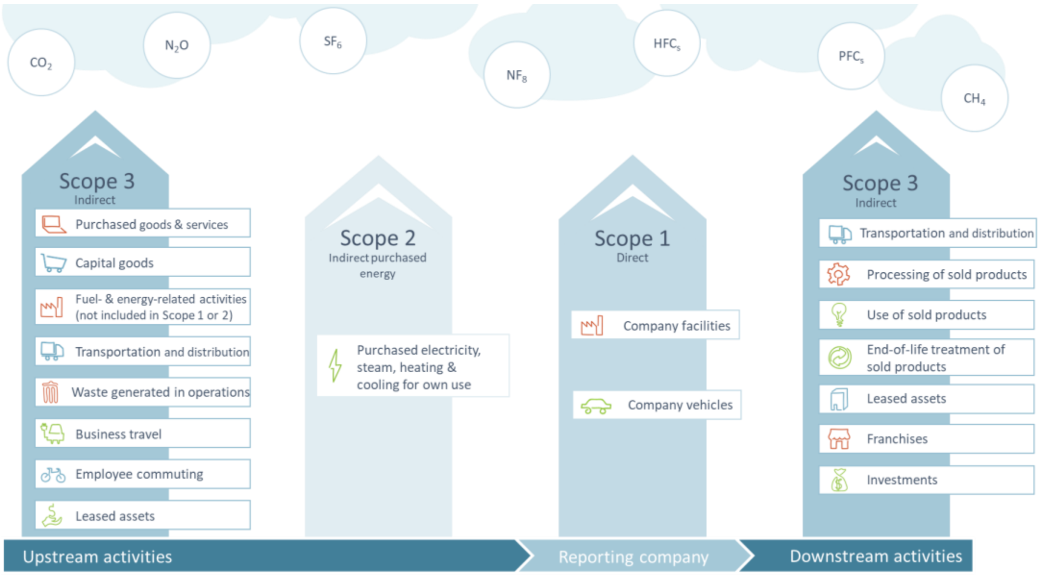

Figure 2 - Greenhouse Gas protocol guidance on Scope 1,2,3 categories

Baseline Scope 3 calculation

As a first step, the company must decide which Scope 3 emissions to include in the emissions inventory (i.e. setting the boundary). This involves identifying which of the fifteen Scope 3 categories are relevant to the company's operations, primarily based on the materiality of emissions in a specific category relative to the company's total value chain emissions. Also, data availability may play a role to determine which categories to include.

Determining the boundaries of operations covered by the calculations varies in complexity depending on the company structure. This increases with more subsidiaries and participations. It informs the choice between setting the boundary using either the equity share or operational control approach.

The equity share approach attributes emissions based on how much of an operation the company owns, while the control approach attributes all emissions from operations the company controls, either through financial authority or operational decision-making, regardless of ownership percentage.

Nobian example: Boundary setting for Scope 3 calculations

In the boundary setting, Nobian made the decision to apply the equity share approach for their joint ventures with other industrial partners. This meant for instance that in joint ventures where Nobian holds a 50% equity stake it applied the equity share approach in its emissions accounting. This means that 50% of the joint ventures' total emissions (across Scope 1, 2, and relevant Scope 3 categories) are included in Nobian's own GHG inventory.

After the boundaries are set, an overall judgement of categories is performed to identify the relevant categories for the company. The categories are assessed for relevancy and included or excluded in the Scope 3 calculation based on the specific context of the company.

Subsequently, a representative year where all relevant data is available is chosen as a baseline year. There are several factors in choosing the most relevant year. For example, the chosen year should not be positively or negatively extraordinary in terms of production or activities. More importantly, the baseline year must have reliable and available data that could be used for the calculation.

Data collection

Following the selection of a baseline year, the approach to data collection has to be determined. In general, the approach can be either activity-based, spend-based or a combination of both. The activity-based approach relies on actual operational data while the spend-based approach uses financial expenditure as a way to assess emissions. While spend-based methods can be useful when activity data is unavailable, they tend to be less accurate due to factors such as inflation, fluctuating market prices, and inaccurate financially based emission factors. Therefore, activity-based data is generally preferred for its higher accuracy. The decision should also consider the expected impact of each category on the overall Scope 3 footprint, with more precise methods prioritised for high-impact categories. It is essential to identify reliable, consistent, and auditable data sources to ensure traceability and to support future verification or assurance processes.

Nobian example: Commuting and business travel in a chemical company

Nobian has evaluated all Scope 3 categories and determined that business travel and employee commuting represented a combined total of less than 0.5% of its overall Scope 3 emissions in their baseline year. Given the minor contribution of these categories to the total emissions, the company opted for a simplified, cost-effective data collection method. Instead of detailed activity-based data collection (e.g., individual travel logs or exact fuel usage per commuter), the company relied on available finance data (travel expenses per mode of transport for business travel) and HR data (work-home distance for commuting) to estimate emissions.

Emission databases

To calculate Scope 3 emissions, emission factors (EFs) are required, which can be derived from different sources. Examples include large-scale emission databases like ecoinvent and Global Logistics Emissions Council (GLEC) Framework, etc. Emission factors are standard values that estimate the amount of greenhouse gases emitted per unit of activity, such as per kilowatt-hour of electricity used or per litre of fuel burned. After selecting the relevant EFs the emissions for a category can be calculated using the collected data.

Emissions reduction target setting

After finalising the baseline calculations, companies can choose to set targets for emission reduction. These targets can either be developed in-house or in accordance with a broadly adopted framework such as SBTi. The SBTi framework requires science-based targets in line with the latest climate science and the Paris Agreement's goal of limiting global warming to 1.5 °C above pre-industrial levels. SBTi provides frameworks and guidance for setting these targets. Targets are calculated from the baseline year and aligned with medium- (2030) and long-term (2050) decarbonisation pathways based on publicly available SBTi scenarios.[2]

Nobian example: Near-Term and Long-Term targets

Nobian has submitted Near-Term and Long-Term targets for Sope 1 and 2 and for Scope 3. Here is an overview of the approved targets by SBTi:

- **Near-Term Targets**: Nobian commits to reduce absolute Scope 1 and 2 GHG emissions with 50% by 2030 from the 2020 base year.* Nobian also commits to reduce absolute Scope 3 GHG emissions with 25% within the same timeframe.
- **Long-Term Targets**: Nobian commits to reduce absolute Scope 1 and 2 GHG emissions with 100% by 2040 from the 2020 base year.* Nobian also commits to reduce absolute Scope 3 GHG emissions with 90% by 2050 within the same timeframe.

**The target boundary includes land-related emissions and removals from bioenergy feedstocks.*

Annual sustainability reporting

The annual sustainability report enables the company to showcase year-on-year developments in its reported emissions. It serves as a tool for stakeholders (e.g. investors, financiers, partners, governments, NGOs, etc.) to track company performance against emission reduction targets. The sustainability report can be incorporated into the annual financial statements, with the included GHG emissions inventory and target performance subject to audit. Even when annual sustainability reporting is voluntary, it remains highly encouraged. Under the GHG Protocol, companies are urged to publish yearly reports, and although third-party verification is not mandatory, it is recommended to enhance credibility. Similarly, the Science Based Targets initiative (SBTi) mandates annual progress updates on targets and suggests external assurance, although it is not required.

Under the EU's Corporate Sustainability Reporting Directive (CSRD), many companies will be legally required to publish audited sustainability information on an annual basis, including Scope 3 GHG emissions. Companies falling under the CSRD scope must prepare for structured, digital reporting aligned with the European Sustainability Reporting Standards (ESRS). Early implementation of annual GHG reporting therefore ensures readiness for CSRD compliance.

Applying the same methodology used for the baseline to the GHG emission inventory calculations in each year's annual sustainability report ensures full comparability across reporting years. Beyond presenting absolute emissions, the report should highlight the specific actions taken to reduce the company's emissions and translate these initiatives into measurable outcomes. It may also include emissions intensity metrics (e.g. expressing emissions per unit of product, revenue, or another key business indicator) to give a normalised view of decarbonisation progress amid changing activity levels.

[2] Nobian news article for validated SBTi targets: https://www.nobian.com/news/nobians-net-zero-science-based-targets-validated-by-sbti-science-based-targets-initiative

Full transparency is highly advised, especially when factors outside the company's control (such as geopolitical disruptions, shifts in supply-chain routes, or changes in energy mixes) affect reported emission reductions. For example, the recent geopolitical shifts in Europe have altered natural gas supply chains, leading to increased imports of liquefied natural gas (LNG) from the U.S., which generally involve higher GHG emissions mainly due to additional liquefaction and transatlantic transport. See also the "

Databases updates" section for a detailed case study on how such updates were handled. Updates or corrections of historical data (for example, improved calculation methods or new supplier data) should be clearly explained so stakeholders can trust the consistency and integrity of the reported emissions.

Calculating Scope 3 emissions for reporting year and monitoring progress

To maintain an up-to-date GHG emission inventory, Scope 3 emissions should be calculated for each reporting year using the chosen data collection methods and emission factors, ensuring methodological consistency. These updated figures are then compared to the baseline to monitor progress against the (science-based) targets and to assess the effectiveness of reduction measures.

Since Scope 3 data often originates from various departments (such as procurement, logistics, energy planning, operations improvements, etc.), effective intra-company collaboration is essential to gather accurate and timely information.

Nobian example: Scope 1 and 2 reductions do not always correspond to Scope 3 emissions

A shift from using natural gas in their operations (leading to Scope 1 emissions) and fossil-fuel based purchased energy (included in Scope 2 emissions) to using renewable energy sources led to a visible drop in Nobian's Scope 1 and 2 emissions against the 2020 baseline emissions. However, expectations for a proportional decrease in Scope 3 (category 3 - energy) were not met. This was largely because the Scope 3 impact for energy includes not only the production of the fuel (e.g. natural gas), but also, in the case of renewable energy sources such as wind electricity, the upstream emission associated with the construction and maintenance of the wind park. The latter involves mainly steel and concrete which is hardly available as a lower carbon material. Thus, although switching to renewable energy significantly reduces direct emissions from energy use (Scope 1 and 2), Scope 3 emissions still occur in the supply chain. This highlights a common misconception: reductions in Scope 1 and 2 do not always correspond to (similar) reductions in Scope 3.

Baseline recalculation

Over time, companies may undergo structural changes or adopt updated methodologies, both of which can significantly affect reported emissions. In such cases, recalculation of the baseline may be necessary to maintain consistency and comparability with current reporting. According to best practices, triggers for baseline recalculation include mergers or acquisitions, divestments, changes in calculation methods, and significant updates in emission factors. In case of a 5% deviation, it is good practice to recalculate the original baseline figures. Recalculating ensures that the trajectory of the reduction target remains meaningful and accurately reflects the organisation's emissions performance. To maintain traceability for external assurance and internal consistency, clear methodological documentation and version control (version before and after recalculation) are highly advised.

Target setting adjustment and recalculation

When recalculating a baseline, it is essential to clearly document what was changed, why the adjustment was made, and whether it impacts emission reduction targets. In line with SBTi guidance, recalculations that result in a significant change (typically more than 5% of base year emissions) or that alter the target's scope, ambition, method, or timeframe may require targets to be reassessed and potentially resubmitted for revalidation. However, if the recalculation does not materially affect these elements, targets can remain unchanged, and only the baseline emissions need to be updated. In all cases, transparent communication is key, and companies should explain whether any observed changes in reported progress are due to updated data or actual performance shifts. This approach supports consistency, credibility, and trust in long-term climate strategies.

Considerations

Building on the context of maintaining an accurate GHG emission inventory, the following sections highlight key considerations and provide additional background on specific aspects and mitigation activities to address.

Upstream and downstream data collection

When developing the GHG emission inventory, it is crucial to follow the GHG Protocol's data collection hierarchy and weigh the trade-offs when gathering upstream and downstream value chain data. For instance, a company can consider:

Primary vs secondary data

- Prioritising site-specific measurements or direct supplier data offers higher relevance and accuracy but demands more time, costs, and coordination. In contrast, using industry averages or third-party databases reduce effort and improve coverage but increase uncertainty.

Granularity vs scope

- Using an activity-based approach provides more accurate and product-specific insights across major emissions sources. If activity data is unavailable or if precision is not critical, a spend-based method can simplify data collection and still offer sufficient coverage, especially for low-impact categories. This tiered approach ensures practicality without losing focus on accuracy where it matters most.

Timeliness vs completeness

- There can be a trade-off between reporting emissions in a timely manner and ensuring completeness. By extrapolating emissions based on partial data, a fast turnaround can be achieved, but risking omitting late-reported activities. On the other hand, if waiting for finalised data, completeness improves but may increase the risk to fall behind the reporting cycle.

Depth of engagement vs resource availability for data collection

- Supplier engagement can yield robust upstream data but can be resource-intensive, while downstream use-phase data collection often relies on customer estimates or proxies, requiring decisions on how much effort to devote to each end of the value chain given limited budget.

When these decisions are made, consideration should be given to the use of the resulting Scope 3 (baseline) calculations. In most cases (particularly when the results are audited annually) a higher emphasis on primary, granular, and complete data is favoured.

Introduce a tiered approach to data collection

Depending on the chosen trade-offs, a tiered approach can help balance accuracy and efficiency. First, identify high-impact “hotspots” in the company’s value chain (a certain percentage of suppliers or customers, by purchased weight, spend or emissions) and allocate resources to collect primary data from those partners. For example, emissions from Category 1 (Purchased goods and services, including Raw Materials) account for 58% of total Scope 3 emissions on average in the chemical sector[3]. For key suppliers, it is wise to invest in new collaborations or strengthen existing partnerships. Establish clear expectations from the outset and outline how they will evolve over time to improve the quality of outcomes.

For the remaining, lower-impact tiers, rely on industry averages or spend-based proxies to conserve resources and minimise respondent fatigue, while keeping overall uncertainty within acceptable bounds.

Nobian example: Change in data collection approach

A methodological update was implemented with respect to the data collection for raw materials transportation. This ensures that it more accurately reflects the emissions associated with transport activities. Previously, transport included raw materials contributing to 99% of the CO_2-eq emissions from the raw material production category (Scope 3 - Category 1). The updated approach shifted to include transport of raw materials contributing to 99% of the total weight of purchased raw materials (covering the major suppliers of raw materials). This adjustment simplified the process while maintaining accuracy, as weight is a directly relevant metric for transport emissions. This change allowed for a more appropriate and efficient reflection of transportation emissions.

Supplier specific emission factors

Collecting supplier-specific emissions data can yield varying levels of detail, from simple CO_2 figures without context to fully reviewed life cycle assessment (LCA) studies. Since not all suppliers provide specific emission factors, and data quality can differ, placing emphasis on validated supplier emissions enhances both reliability and comparability, especially if this consists of third-party reviewed LCAs or certifications (e.g. ISCC PLUS, Together for Sustainability (TfS), or Environmental Product Declarations). Supplier-specific emission factor might be lower compared to more generic or conservative secondary data sources, such as those found in ecoinvent or other databases. The practice of using supplier-specific EFs is gaining momentum, not only because it improves inventory accuracy, but also due to increasing regulatory and market pressure. Under upcoming European legislation, the introduction of a digital product passport will require manufacturers to disclose product-specific environmental information. At the same time, environmental information, e.g. in the form of product carbon footprints are becoming a more important factor in procurement decisions, influencing buyer preferences and sustainability-driven sourcing.

[3] CDP Technical Note: Relevance of Scope 3 Categories by Sector

Nobian example: Impact of supplier-specific emission factors on Scope 3 emissions

When calculating emissions for high-impact raw materials, Nobian prefers to use the actual product carbon footprint provided by the supplier via third-party reviewed LCAs that follow reliable standards. In this case, a supplier-specific emission factor for a bulk raw material significantly reduced Nobian's Scope 3 GHG inventory.

Generally, when provided with EFs from LCA studies, it is important to understand the scope, assumption n and datasets used in the study. In one case, EF discrepancies were found between a supplier-reported value and a third-party database. Engaging with the supplier helped to understand the differences in system boundaries and LCA assumptions. This allowed for more accurate data selection and quality control, improving the precision of Scope 3 reporting.

Downstream applications

One of the most significant challenges in Scope 3 emissions accounting comes from the limited control over the downstream supply chain. This is particularly pronounced in the chemical industry, where basic chemicals are used in various industries and applications, each with differing emissions profiles. While upstream emissions can often be addressed through supplier engagement and procurement practices, downstream use-phase emissions are more complex to quantify due to broad or uncertain end-uses, especially when selling to distributors. This drives up uncertainty margins and increases the likelihood of biased or skewed results.

Nobian example: Category 10 and 11 methodology

For most of Nobian's product portfolio, categories processing of sold products (Category 10) and use of sold products (Category 11) are excluded because the company's basic chemicals are sold into a wide variety of downstream applications. As such, there is no longer a clear or direct relationship between Nobian's products and the resulting CO_2 emissions from their processing or use, making it impractical to estimate emissions with sufficient accuracy.

However, for a limited number of greenhouse gas products, emissions were quantified. This was done by using primary data on sales volumes, combined with expert judgment to estimate both processing and use-phase emissions. The methodology follows best-practice principles where data is available and material, while transparently excluding unknown or unverifiable sources.

Improving collaboration across the value chain offers a path to higher accuracy by deepening understanding of end-use patterns, validating assumptions, and enhancing data quality. When downstream customers develop their GHG emissions inventories and set targets, there is an opportunity for collaboration: improving the accuracy of emissions data in their value chain benefits both parties by enabling the sharing of more precise emission figures between each other.

Methodological updates

While the GHG Protocol undergoes infrequent major updates, typically once per decade with targeted updates or guidance issued periodically, the SBTi revises its standards and guidance more regularly. SBTi releases new criteria or sector-specific guidance documents approximately every 1–2 years, although these updates are not adhering to a fixed update schedule.

Any relevant updates to SBTi and the GHG Protocol guidelines introduce changes to the conventions previously followed. As these standards evolve to increase precision and ambition, companies must continuously reassess their own methodologies and ensure alignment with updated guidance documents and standards. This process often includes conducting gap analyses, documenting changes in scope or calculation methods, and explaining the rationale for any alterations in the emission calculations or targets derived from them. While beneficial in the long run, these updates require resources and flexibility to remain compliant without compromising long-term comparability. Beyond staying current with evolving standards not much other mitigations strategies are possible.

Additionally, in case of internal methodological changes, it is important to cover these methodological updates and their implications in the annual sustainability report and consider recalculations where necessary to maintain data integrity. This information is helpful when conducting any data gap assessment.

Nobian example: methodology update of a full category

Previously, Nobian calculated Scope 3 emissions from capital goods (category 2) using generic spend-based emission factors, which were often imprecise and lacked project-specific relevance. In 2024, a methodological update along with a baseline restatement for this category replaced these generic spend-based estimates with material-specific emission factors tailored to each project type. The new approach estimates the actual quantities of key materials used in projects, that have a relevant impact such as steel, titanium, and glass reinforced plastics (GRP). This approach significantly improved accuracy and made the results more actionable for decision-making and emissions reduction planning.

Databases updates

Emission databases undergo frequent revisions to enhance accuracy and resolve under- or overestimation issues in EFs, which leads to regular EF value updates. These changes could potentially significantly affect yearly results, even if operational inputs remain constant. As the data quality and system boundaries improve over time, companies must adapt their EF application accordingly.

This brings into question whether to “freeze” EFs for consistent year-over-year comparisons or dynamically update them to reflect the most current emission calculations. The choice has implications on transparency, trend interpretation, and target progress tracking. Emission factors are not static. As they evolve, the data behind them improves. This presents a challenge for long-term comparability and baseline recalculations.

While freezing the EFs simplifies comparisons, it may miss improvements in data quality and potential geopolitical changes (see text box below).

Nobian example: improvement of emission factor calculation in natural gas

In recent updates, the ecoinvent database improved the calculation method for fugitive emissions related to natural gas production. These were not fully included in the EFs used for the baseline year, causing a discrepancy when comparing historical data with updated calculations. To maintain consistency and ensure fair target setting, the baseline was manually recalculated to include these fugitive emissions based on the latest EFs. Without this correction, future comparisons would have underestimated reductions.

This approach was used because older emission factors cannot be applied to newer data, and vice versa, as the ecoinvent database also reflects geopolitical developments. Specifically for natural gas, the sources of natural gas changed in recent years, thereby changing the EF for natural gas production.

An alternative is to use the most recent EFs that are available each year, thereby including new insights and updates to how EFs are calculated. This approach is more accurate but requires additional effort. A clearly defined strategy for handling EF updates ensures consistent methodology and avoids unnecessary recalculations. Additionally, any changes to emission factors should be explained in the annual sustainability report.

Emission intensity variations

Emission intensity, whether based on physical production volumes or monetary values, can vary due to external market dynamics, inflation, or structural changes in production processes. For high-volume industries with low margins (e.g., basic chemicals), monetary metrics may distort GHG emission inventory, especially when commodity prices fluctuate. Reporting emission intensity based on production volumes is therefore generally more transparent and reflects operational changes more accurately. However, when a company has a diverse mix of products with varying emissions profiles, production volume-based intensity metrics may also be influenced by changes in product composition in the overall portfolio. In such cases, intensity figures could either provide more insight or, if applied incorrectly, lead to misinterpretation. This could be caused by inflation, different product portfolio, entering new markets and finding new business opportunities or exiting markets. As an example for consideration, sector-specific demand shifts can also temporarily skew intensity metrics, requiring contextual clarification when the GHG emission inventory is disclosed.

Main takeaways

In summary, effective GHG emissions accounting requires a dynamic, transparent approach that balances methodological consistency with the flexibility to incorporate evolving data, emission factors and standards. By setting clear boundaries, prioritising data collection in high-impact categories and maintaining thorough documentation (supported by periodic baseline recalculations and target adjustments if needed), companies can reliably track their emissions trajectory and demonstrate progress against (science-based) targets. The Nobian case highlights how proactive supplier engagement and a tiered data collection strategy can enhance both accuracy and efficiency in practice. Ultimately, a robust governance framework and regular updates to methodologies and databases are essential to ensure credible, comparable and actionable GHG emissions accounting over time.

The main takeaways are:

- Define clear boundaries and maintain consistent baseline calculations to ensure comparability and traceability in GHG accounting and target setting.
- Maintain a good view on triggers for baseline recalculation and target adjustments (e.g. mergers, methodology updates, etc.).
- Consider trade-offs for data collection:
    - Primary vs secondary data;
    - Granularity vs scope;
    - Timeliness vs completeness;
    - Depth of engagement vs resource availability for data collection.
- Consider a tiered data collection approach balancing accuracy and efficiency for engagement.
- Engage suppliers to obtain specific emission factors, prioritising third-party-validated data to improve Scope 3 accuracy.
- Regularly monitor updates to the GHG Protocol and SBTi, conduct gap analyses on any new guidance, and document methodology changes to ensure ongoing alignment and auditability.
- Developing a defined strategy for handling emission-factor updates (freeze vs. yearly update) avoids unnecessary data volatility.
- Adopt production volume-based intensity metrics for clearer operational insights, but contextualise any fluctuations to ensure metrics remain meaningful.