SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

SBTi CHEMICAL SECTOR PATHWAYS AND IMPLEMENTATION CRITERIA: EXPLANATORY DOCUMENT

Version 1.0

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DISCLAIMER

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VERSION HISTORY

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Version 1.0	• Initial release of SBTi Chemical Sector Pathways and Implementation Criteria: Explanatory Document	December 2, 2025	December 2, 2025

CONTENTS

EXECUTIVE SUMMARY

The SBTi Chemical Sector Pathways and Implementation Criteria Explanatory Document ("explanatory document”) provides informative guidance to companies in the chemicals sector on topics relevant to setting ambitious climate targets. This informative document complements the SBTi Chemical Sector Pathways and Implementation Criteria document (“pathways criteria document) by providing additional background of the chemicals sector and details on key areas of focus by the SBTi. Also included is helpful information related to GHG accounting in the chemicals sector and the preparation of targets using both the pathways criteria document and the SBTi Corporate Net-Zero Standard and SBTi Corporate Near-Term Criteria.

This explanatory document does not contain normative elements that companies must follow in order to have their targets validated. The information in this informative document may prove helpful to chemical companies when developing targets; however, following the guidance is not necessary in order to have targets validated by SBTi Services.

A. INTRODUCTION

A.1 Introduction to the SBTi

The Science Based Targets initiative (SBTi) is a corporate climate action organization that enables companies and financial institutions worldwide to play their part in combating the climate crisis. We develop standards, tools and guidance which allow companies to set GHG emissions reductions targets in line with what is needed to keep global heating below catastrophic levels and reach net-zero by 2050 at the latest. The SBTi is incorporated as a UK charity, with a subsidiary SBTi Services Limited, which hosts target validation services (together with SBTi, the “SBTi Group”).

A.2 Introduction to the chemicals sector

The chemicals industry has one of the most complex and diverse value chains of all industrial sectors. Products from the chemicals sector are critical to nearly every aspect of modern life. These products vary from bulk industrial chemicals to highly specialized laboratory reagents. The health care, agriculture, construction, packaging, manufacturing, and transport industries all rely heavily on chemical products. Furthermore, demand for chemicals is expected to continue to grow in the decades to come (IEA, 2023c).

Much of the chemicals value chain is based on the building blocks of carbon and hydrogen. Today, the sector relies heavily on direct fossil-based feedstocks (e.g., coal, natural gas, natural gas liquids) or feedstocks that are products of crude oil refineries (e.g., naphtha) for the source of these building blocks. For this reason, the chemicals industry is the largest industrial consumer of energy in the world when both feedstocks and fuel consumption are considered (IEA, 2021).

B. ABOUT THIS DOCUMENT

B.1 Purpose of the SBTi Chemical Sector Pathways and Implementation Criteria Explanatory Document

This explanatory document is intended to accompany the normative SBTi Chemical Sector Pathways and Implementation Criteria document (“pathways criteria document”). While the pathways criteria document includes activity-specific metrics and pathways that may or shall be used by chemical companies, when applicable, this explanatory document includes only informative sections that are intended to help these companies when developing their targets. Companies utilizing the pathways in the pathways criteria document must follow all relevant normative elements from that document in order to have their targets validated; however, the guidance in this document is strictly optional to follow. In order to create a distinction from the normative elements in the pathways criteria document, this explanatory document has been separately published.

B.2 Document structure

The background and guidance in this document are presented in the following sections:

A **background on coverage and treatment of activities within the chemicals sector** includes more information on why the SBTi has developed sector and activity-specific pathways and criteria for the sector, and how the sector has been disaggregated for the purposes of pathway development. Additional information is given for why specific pathways and/criteria were developed for certain activities.

Additional **guidance on using the pathways and associated criteria** that are outlined in the normative pathways criteria document**.**

Instructions and examples for setting targets using the pathways from the pathways criteria document are also provided. These instructions are not intended to be normative, but provide instructive guidance to assist users and demonstrate the function of the SBTi Chemicals Sector Target-Setting Tool.

Additional guidance on scope 3 emissions is provided on areas of specific interest to the chemicals sector, building on existing GHG Protocol guidelines.

1. BACKGROUND ON COVERAGE AND TREATMENT OF ACTIVITIES WITHIN THE CHEMICALS SECTOR

1.1 Rationale for development of activity-specific pathways for the chemicals sector

The chemicals sector is responsible for the third highest emissions of GHGs in the global industrial sector, behind steel and cement production, contributing 1,330 megatons (Mt) of direct CO_2 emissions in 2022 (IEA, 2023c). Emissions from any unabated combustion of products made from hydrocarbons (e.g., plastics) at the end of their life add to these emissions.

Much of the chemicals value chain starts with the production of ammonia, methanol, ethylene, propylene, benzene, toluene, and mixed xylenes (the latter five known as high value chemicals, or HVCs). These seven building blocks are referred to as “primary chemicals” for the purposes of the pathways criteria document, consistent with the International Energy Agency’s (IEA) modeling of individual chemicals (IEA, 2021). Primary chemical production accounted for approximately two-thirds of all direct (scope 1) CO_2 emissions from the industry in 2020 (IEA, 2021) due to several driving factors:

- Production of primary chemicals involve energy-intensive processes, requiring large amounts of heat currently produced primarily through the combustion of fossil fuels.
- Process emissions may be directly generated from carbon contained in feedstocks when they undergo chemical processes.

While there are opportunities to reduce emissions from existing production routes, deep emissions reductions from primary chemical production are reliant on innovative technologies (IEA, 2023b). Therefore, the rate at which the sector can reduce its emissions from these chemicals in the short term may differ from the overall rate of decarbonization possible by the broader economy, as reflected by multiple pathways available in the literature [(IEA, 2021), (Kremer, et. al 2022)]. For these reasons, dedicated pathways are justified to allow companies to set targets on emissions related to primary chemical production.

Further challenges exist in the impacts made throughout the chemicals value chain. The chemicals value chain is not linear in nature, with many overlapping and intersecting material paths. Additionally, the downstream emissions of many chemical products are difficult to accurately quantify. The SBTi has assessed this complexity and has included informative guidance in this explanatory document for several issues related to scope 3 emissions from the chemicals sector, and has developed a recommended target and pathway to incentivize increased usage of sustainable non-fossil based feedstocks across the value chain.

The IPCC’s Sixth Assessment Report (2021) confirmed that climate change is already affecting every region on Earth, its impacts increasingly visible in the form of extreme weather, worsened droughts, and heightened risk of forest fires. The Paris Agreement's overarching goal, set in 2015, was to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, as well as reach net-zero CO_2 emissions by 2050 for the best chance of avoiding catastrophic climate breakdown. Even as the global temperature continues to rise, the goal must be to reverse the trend of increasing global GHG emissions and slow down warming to 1.5°C in time. The SBTi has thus developed activity-specific pathways to support science-aligned target-setting by companies with activities related to the chemicals sector.

1.2 Primary chemicals

The SBTi's Sectoral Decarbonization Approach (SDA) method is applicable to sectors that produce a relatively homogenous product, since the method relies on a single physical activity metric to establish a representative emissions intensity pathway for the sector (SBTi, 2015). Additionally, the SBTi relies on transparent and credible published emissions scenarios that include data at the sectoral level consistent with an overall carbon budget that aligns with a 1.5°C trajectory, which can be paired with projections of physical activity to establish activity-specific emissions intensity pathways. The chemicals sector, as a whole, is not a good candidate for a single emissions intensity pathway because the large number and variation in the products that are manufactured would make the establishment of a single pathway for the sector impractical.

The SBTi instead has focused on the establishment of activity-specific pathways for primary chemicals because each of these chemicals represents a homogeneous product for which a physical intensity metric that is comparable across companies may be developed, and there are published 1.5°C-aligned integrated emissions scenarios that contain emissions and production levels until 2050 for each primary chemical.

1.3 Chemicals produced in refineries

A significant quantity of chemicals are currently produced within oil refineries as co-products to the primary fuel products from the refinery. For example, propylene is co-produced with energy products within fluid catalytic cracking (FCC) units, and benzene, toluene, and xylenes are outputs from catalytic reforming processes.

The SBTi has not included chemicals produced from refineries within the sectoral scope of the chemicals sector. As co-products of refinery processes, allocating emissions from production of these chemicals between energy products and chemical products would be very difficult for the purposes of setting targets. Additionally, many emissions scenarios that include sectoral-level modeling, such as IEA's Net-Zero Emissions by 2050 (NZE) scenario, do not consider emissions from chemicals produced within refineries as part of the chemicals sector (IEA, 2023d).

1.4 Hydrogen

Hydrogen plays a crucial role in the chemicals sector as a vital feedstock for ammonia and methanol production. However, its production is currently very emissions intensive, resulting in large quantities of CO_2 as a by-product. Hydrogen is also promising as a carbon-free energy carrier that could directly replace fossil fuels in many applications, thus mitigating the CO_2 emissions at the point of combustion. Many 1.5°C-aligned emissions scenarios include a rapid and substantial increase in the use of hydrogen in new markets, as a direct energy source or as part of products that bypass the need for fossil-based hydrocarbon feedstocks (e.g., synthetic methane). The condition for achieving this environmental benefit in the energy sector hinges on producing hydrogen through zero or low-carbon methods. It is therefore critical that the SBTi addresses the production of hydrogen in its methods.

Current hydrogen demands are primarily for feedstocks to produce primary chemicals (ammonia and methanol), direct reduced iron (DRI) production, and crude oil refining (IEA, 2022)[1]. While smaller volumes are used in industries like electronics and glassmaking (IEA, 2022), nearly all current hydrogen demand stems from these applications. Presently, hydrogen production is dominated by fossil fuel-based routes in which CO_2 is also generated, or as a by-product from fossil-based processes within refineries (IEA, 2022). However, technologies[2] to produce low-emission hydrogen exist, and transitioning to these technologies is one of the primary routes to achieving a net-zero trajectory for the chemicals sector while meeting existing hydrogen demand.

The SBTi addresses the emissions associated with current hydrogen production as follows:

- Hydrogen for ammonia and methanol are included within the boundary of the ammonia and methanol activity-specific pathways described in the pathways criteria document, with ammonia and methanol production as the activity metric used to determine emissions intensity.
- Hydrogen for DRI is included within the boundary of the existing iron and steel sector activity-specific pathway, with steel production as the activity metric used to determine emissions intensity.

The activity-specific pathways for ammonia, methanol, and iron and steel are based on the IEA's NZE scenario, which maps a transition from traditional to low-emission production methods to meet demand for these existing markets.

While minimal in the current hydrogen demand profile, new markets for hydrogen, primarily as an energy carrier, are expected to increase in the coming decades (IEA, 2023c). The IEA's NZE scenario projects hydrogen and hydrogen-based fuels to contribute significantly to the transport and power sectors, in particular. This new demand for hydrogen will require an increase in the trade of merchant hydrogen. In the NZE scenario, hydrogen and hydrogen-based fuels are modeled as low-emissions fuels. Thus, new markets for hydrogen are met solely by low-emissions hydrogen in the model, as demonstrated by Figure 3.21 in the IEA's *Net Zero Roadmap: A Global Pathway to keep the 1.5°C Goal in Reach* (IEA, 2023c).

The activity-specific pathways described above provide a method for companies to set targets on emissions from the vast majority of existing hydrogen production using projections of demand for each product (e.g., ammonia, methanol, steel), while taking into account the necessity of such production transitioning to low-emissions methods. Other existing markets within the chemicals sector and broader industry represent a very small portion of hydrogen

[1] See Figure 2.19 and Table 3.3 in the cited source.
[2] Low carbon emission technologies include hydrogen produced from electrolysis of water using renewable electricity and steam methane reforming from natural gas with CCUS.

production today and do not warrant separate individualized pathways[3]. However, as new markets emerge, it is crucial that merchant hydrogen producers within the chemicals sector adopt low-emission production methods from the outset so that the climate benefits of hydrogen and hydrogen-based fuels can truly be realized. Consequently, the SBTi has not developed a separate activity-specific pathway for hydrogen production beyond the existing markets of ammonia, methanol, and iron and steel at this time.

However, in recognition that existing companies may produce ammonia for both non-energy and energy carrier end-uses, the SBTi has developed an additional optional pathway for emissions from ammonia production activities that encompasses both energy and non-energy end uses. The SBTi has assumed that the additional production does not contribute additional direct emissions, since its production will come from low-emissions technologies; however, in reality some direct emissions will occur due to incomplete capture rates on fossil fuel-based production with carbon capture and storage (CCS). The SBTi may investigate refinements to this approach in future work.

1.5 Nitric acid

During the production of nitric acid, N_2O is formed and emitted, when unabated. N_2O has a Global Warming Potential (GWP-100) of 265 (GHG Protocol, 2023), thus relatively small quantities of N_2O still contribute significant CO_2e emissions[4]. N_2O emitted from nitric acid production can be abated to a large extent at very limited costs (NACAG, 2023). The SBTi has established mandatory target-setting requirements on these emissions to:

- Ensure that companies who have not yet taken steps to abate a significant portion of their N_2O emissions from nitric acid production will be incentivized to do so, while simultaneously addressing other sources of emissions within their value chain(s); and
- Acknowledge that companies who have already abated this portion of their N_2O emissions from nitric acid production may consider any remaining N_2O emissions from nitric acid production as part of their company-wide target(s), and will thus not be expected to address them separately.

The production of adipic acid is the second largest contributor to industrial emissions of N_2O; however, N_2O emissions from adipic acid are significantly lower than those from nitric acid production (NACAG, 2023). For this reason, the SBTi has not, at this time, developed a benchmark for adipic acid production activities in the pathways criteria document.

1.6 All other chemicals

The pathways criteria document contains activity-specific pathways for setting scope 1, 2, and/or 3 targets on emissions associated with certain products or activities. In considering additional sector-specific pathways, the SBTi reviewed the IEA's NZE scenario, which was used as the basis to develop the activity-specific pathways for the primary chemicals described above. The NZE scenario also includes direct emissions from non-primary

[3] Not mentioned are existing pathways for cement, and potential future pathways for other industrial sectors. Hydrogen production for use in other applications will be considered as part of the activity-specific pathway boundary for that sector.

[4] An approximate estimate of emissions from for nitric acid production is at least 16 Mt CO_2e / year (derived from data obtained from (Nieto, 2023) and (AmericanChemistryCouncil, 2022)) or >35 Mt CO_2e / year (Joerss, 2023) for industrialized countries.

chemical production as part of the larger chemicals sector; however, non-primary chemicals are not analyzed using the same technology-rich integrated model that is used for primary chemicals. The model used for most non-primary chemicals accounts for emissions from energy usage, but does not include technological considerations in how these non-primary chemicals are produced, and does not project demand for individual chemicals themselves (IEA, 2023a). Further, process emissions (i.e., CO_2 emissions released from feedstocks rather than fuel combustion) are not included in the model for non-primary chemicals. Finally, there is a vast diversity in how non-primary chemical products are produced.

Despite these model differences used by the IEA for this segment of non-primary chemicals, the SBTi has determined that the IEA NZE scenario provides a more granular and sector-specific pathway for non-primary chemical production compared to the default SBTi cross-sector pathway. The cross-sector pathway is a global average of all CO_2 emissions from all segments of the economy, thus presenting similar limitations as those discussed above for the IEA NZE scenario. Therefore, the SBTi has chosen to allow companies producing non-primary chemicals to set targets based on a non-primary chemical pathway derived from the IEA NZE scenario. The trajectory of emissions from non-primary chemicals in the IEA NZE scenario is relatively flat between 2020 and 2030, with steeper emissions reductions occurring between 2030 and 2050. Furthermore, near-term targets set using this pathway with base years before 2030 may result in lower ambition than the cross-sector pathway. However, the long-term emissions reductions from non-primary chemicals by 2050 in the IEA NZE scenario are similar to those in the cross-sector pathway. More detailed information on the development of this pathway can be found in the SBTi Chemicals Sector Pathways Synthesis Report.

In future research, the SBTi may consider whether more granular activity or technology-specific pathways would further the goals of the SBTi to reduce the climate impact of the chemicals sector. Additionally, the treatment of direct emissions from industrial processes may be addressed further as part of the SBTi's Corporate Net-Zero Standard framework.

2. INFORMATIVE GUIDANCE FOR CHEMICALS SECTOR PATHWAYS

This section includes additional informative guidance for certain pathways and associated criteria that are included in the pathways criteria document. The guidance in this section provides useful information related to the criteria, but the guidance is not mandatory to follow.

This guidance has been organized into sections based on pathways described in the pathways criteria document.

2.1 Activity-specific pathways for ammonia production

Target boundary guidance

- The following type of emissions related to ammonia production processes are within the boundary of the ammonia production activity-specific pathway:
    - CO_2 process emissions.
    - GHG emissions from combustion to supply heat to the process, regardless of whether this heat is produced by the company itself or is imported.
    - GHG emissions from the production of electricity used in the process, regardless of whether this electricity is produced by the company itself (scope 1) or is imported (scope 2).
- The minimum target boundary has been set to ensure consistency with the underlying emissions scenario upon which the ammonia production activity-specific pathway has been based and to ensure comparability of targets between companies.
- The following processes are examples of sources within the boundary of the ammonia production activity-specific pathway:
    - Production of hydrogen used to produce ammonia. Example production types include, but are not limited to:
        - Steam methane reforming (SMR) of natural gas.
        - Electrified SMR of natural gas.
        - Oil partial oxidation.
        - Coal gasification.
        - Biomass gasification.
        - Methane pyrolysis.
        - Water electrolysis.
    - Production of nitrogen used to produce ammonia (e.g., air separation).
    - Production of ammonia (e.g., via the Haber Bosch process).
- In alignment with the IEA data on which this target-setting method is based, CO_2 generated during ammonia production that is then utilized to produce urea is not considered as a scope 1 emission. Nor are CO_2 emissions that are captured and sold as a product to other industries. Therefore, these emissions are not considered within the activity-specific target boundary.

- Companies may include emissions within the activity-specific target boundary from additional related sources which are expected to be minor relative to total production emissions, such as emissions from fuel pre-heaters, supplemental heaters, etc., but these are not mandatory.

Target boundary exclusion guidance

For more information on why the SBTi has developed a separated pathway to include the production of ammonia for use as an energy carrier, please see the description for the treatment of hydrogen in Section 1.

2.2 Activity-specific pathway for methanol production

Target boundary guidance

- The following emissions sources related to methanol production processes are within the boundary of the methanol production activity-specific pathway:
    - CO_2 process emissions.
    - GHG emissions from combustion to supply heat to the process, regardless of whether this heat is produced by the company itself or is imported.
    - GHG emissions from the production of electricity used in the process, regardless of whether this electricity is produced by the company itself (scope 1) or is imported (scope 2).

- The minimum target boundary has been set to ensure consistency with the underlying emissions scenario upon which the methanol production activity-specific pathway has been based and to ensure comparability of targets between companies.

- The following processes are examples of sources within the boundary of the methanol production activity-specific pathway:
    - Production of hydrogen/syngas used to produce methanol. Example production types include, but are not limited to:
        - SMR of natural gas.
        - Oil partial oxidation.
        - Coke oven gas (COG) reforming.
        - Electrified SMR of natural gas.
        - Gas heated reforming (GHR).
        - Coal gasification.
        - Biomass gasification.
        - Water electrolysis (requires a separate source of CO_2).
    - Capture of CO_2 to be used as feedstock.
    - Methanol synthesis.

- Companies may include emissions within the activity-specific target boundary from additional related sources which are expected to be minor relative to total production emissions, such as emissions from fuel pre-heaters, supplemental heaters, etc., but these are not mandatory.

2.3 Activity-specific pathway for HVC production

Target boundary guidance

- The following emissions sources related to HVC production processes are within the boundary of the HVC production activity-specific pathway:
    - CO_2 process emissions.
    - GHG emissions from combustion to supply heat to the process, regardless of whether this heat is produced by the company itself or is imported.
    - GHG emissions from the production of electricity used in the process, regardless of whether this electricity is produced by the company itself or is imported.

- The minimum target boundary has been set to ensure consistency with the underlying emissions scenario upon which the HVC production activity-specific pathway has been based and to ensure comparability of targets between companies. In the case of HVC produced via the methanol-to-olefins or methanol-to-aromatics production routes, only the final HVC production step is within the HVC production activity-specific boundary.

- The following processes are examples of sources within the boundary of the HVC production activity-specific pathway:
    - Steam cracking of naphtha (traditional and electric cracking).
    - Steam cracking of ethane (traditional and electric cracking).
    - Pyrolysis oil steam cracking (traditional and electric cracking).
    - LPG steam cracking.
    - Catalytic cracking of naphtha.
    - Ethanol dehydration.
    - Bioethanol dehydration.
    - Propane dehydrogenation.
    - Methanol-to-Olefins (MTO).
    - Methanol-to-Aromatics (MTA).

- Companies may include emissions within the activity-specific target boundary from additional related sources, such as emissions from fuel pre-heaters, supplemental heaters, etc., but these are not mandatory.

2.4 Activity-specific pathways for scope 3 category 11 N_2O emissions from the use-phase of sold nitrogen fertilizers

Target-setting guidance

- Targets set using the activity-specific pathway for scope 3 category 11 N_2O emissions from the use-phase of sold nitrogen fertilizers are considered to align with a 1.5°C level of ambition; however, the SBTi does not currently classify scope 3 targets based on temperature alignment.

- The activity-specific pathway for scope 3 category 11 N_2O emissions from the use-phase of sold nitrogen fertilizers only applies to the N_2O emissions resulting from the use-phase of synthetic fertilizers on land. These emissions fall under the GHG Protocol's scope 3 category 11: use of sold products (GHG Protocol, 2011). Targets set using this criterion would count toward the minimum near-term target coverage of scope 3 emissions required by the SBTi Corporate Net-Zero Standard and/or SBTi Corporate Near-Term Criteria.

- Companies may instead choose to set scope 3 category 11 emissions of N_2O from the use of sold synthetic nitrogen fertilizers using other methods. These emissions need only be covered by a single target.
- Applicable products: The activity-specific pathway for scope 3 category 11 N_2O emissions from the use-phase of sold nitrogen fertilizers applies to companies that produce any synthetic fertilizer that supplies nitrogen, thus contributing to N_2O emissions upon application in the use phase. Examples of these products include, but are not limited to:
    - Ammonia (sold for use as a fertilizer).
    - Ammonium nitrate.
    - Ammonium phosphate.
    - Ammonium sulfate.
    - Calcium ammonium nitrate.
    - Nitrogen potassium.
    - Nitrogen phosphorus potassium.
    - Nitrogen phosphorus.
    - Urea.

2.5 Activity-specific alignment pathway for the sourcing of alternative feedstocks

Target language guidance

Sample language for a target set using the activity-specific pathway for nitric production is as follows:

> *Company A commits to increase its share of purchased feedstocks that are composed of alternative non-virgin fossil sources from 10% by weight of carbon to 14% by weight of carbon by 2030 from a base year of 2022. This target excludes mechanically recycled feedstocks.*
>
> *Company A commits to increase its share of purchased feedstocks that are composed of alternative non-virgin fossil sources from 10% by weight of carbon to 55% by weight of carbon by 2050 from a base year of 2022. This target includes mechanically recycled feedstocks.*

Target-setting guidance

- The applicability of the activity-specific pathway for the sourcing of alternative feedstocks is based on the full scope 1, 2, and 3 emissions associated with carbon-containing materials manufactured by the company via activities within the scope, considering both upstream and downstream scope 3 categories. The pathway is applicable if these emissions constitute at least 5% of the sum of the company's total scope 1, 2, and 3 GHG emissions.

- The recommended alternative feedstock target accompanies, but does not replace, emissions reductions targets. This target is not intended to be specifically aligned with emissions reduction goals, because companies are provided flexibility in determining what sources of alternative feedstocks to purchase, and therefore each company's application of this target may be unique. This target lays a foundation for a feedstock transition through a minimum requirement to increase sourcing of alternative feedstocks in the near-term and, optionally, achievement of a net-zero aligned performance level in the long-term. Targets on alternative feedstocks do not count toward the minimum target coverage for scopes 1, 2, or 3.

- The activity-specific pathway for the sourcing of alternative feedstocks applies only to feedstocks that are purchased and used to manufacture additional products via activities within the scope of the chemicals sectoral boundary. Materials that are purchased and sold as-is, without further processing, do not qualify as feedstock when calculating the company's share of alternative feedstocks.

    - An exception is material outputs from mechanical recycling processes that can serve as replacements for chemicals produced using carbon-based feedstocks. Companies setting targets using the pathway that source and sell materials from mechanical recycling processes that are at least partially within the company's operational boundary, used to calculate its scope 1 and scope 2 corporate GHG inventory, may include these materials in their target calculation even if they do not further process these materials themselves.

- The activity-specific pathway for the sourcing of alternative feedstocks applies only to feedstocks that are utilized in the reporting year.

- The activity-specific pathway for the sourcing of alternative feedstocks applies to the production of chemicals that typically originate from feedstocks containing carbon molecules. Examples of these include, but are not limited to:
    - Methanol.
    - HVC.
    - Intermediate chemicals (e.g., polyethylene, styrene, propylene oxide).
    - Specialty chemicals (e.g., food additives, adhesives, dyes).
    - Ammonia (when based on SMR).
    - Urea.

- The activity-specific pathway for the sourcing of alternative feedstocks does not apply to feedstocks that do not contain carbon, such as hydrogen, nitrogen, or other inorganic materials.

- Re-use or recovery (e.g., solvent recovery[5]) does not qualify as alternative feedstock because this does not lead to the production of new chemical products— existing products are simply used for longer periods.

[5] For example, purifying solvents by distilling them periodically to remove heavy impurities that would build up over time.

Target boundary exclusion guidance

Ammonia production may be optionally excluded because there are low-emissions routes for ammonia production that do not involve any carbon feedstock, such as electrolysis using renewable electricity, also known as green ammonia. Companies pursuing green ammonia technologies will not be required to also set a target on increasing the share of alternative feedstocks used in non-electrolysis based production routes.

3. INSTRUCTIONS AND EXAMPLES FOR SETTING TARGETS

3.1 Setting targets on scope 1 emissions of N_2O from nitric acid production using the activity-specific pathway

The steps below outline instructions for companies using the SBTi's Chemicals Sector Target-Setting Tool to calculate targets on scope 1 N_2O emissions from nitric acid production. These steps also outline the function of the Tool when calculating targets.

1. Calculate the average N_2O emissions intensity in units of kg N_2O / tonne of nitric acid, across all operations in any year between the base year and the most recent year preceding target submission, inclusive, using the below formula. This year chosen as the basis for target formulation does not need to be the same year chosen as the company's base year for other targets.

Average N_2O Emissions Intensity (kg N_2O / tonne Nitric Acid) = Company-wide N_2O emissions from Nitric Acid production (kg N_2O) / Company-wide Nitric Acid Production (tonnes)

2. For companies producing nitric acid with an average annual emissions intensity **below 0.5 kg N_2O / t nitric acid** in the year chosen as the basis for target formulation, **no separate target is required**.
3. Companies producing nitric acid with an average annual emissions intensity **above 0.5 kg N_2O / t nitric acid** in the year chosen as the basis for target formulation set a target as follows:
    a. Estimate projected nitric acid production in a target year that is five years from the year chosen as the basis for target formulation and calculate the estimated absolute N_2O emissions in this year based on an average emissions intensity of 0.5 kg N_2O / tonne nitric acid using the following formula:

    Projected Absolute N_2O Emissions (kg N_2O) = 0.5 kg N_2O / tonne Nitric Acid x Projected Nitric Acid Production (tonne Nitric Acid)

    b. Calculate the projected absolute N_2O emissions in the target year based on a minimum ambition of 4.2% annual reduction that is consistent with a 1.5°C level of ambition for the same target year as step 3.a[6].
    c. If the absolute N_2O emissions in the target year calculated in steps 3.a are lower than the emissions calculated in step 3.b, the company sets a target to reduce their average N_2O emissions intensity from nitric acid production to **0.5 kg N_2O / t nitric acid or less** within five years of the year chosen as the basis for target formulation.

[6] The minimum ambition consistent with a 1.5°C goal may vary based on the chosen year, as calculated based on the SBTi's Criteria Assessment Indicators.

d. If the absolute N_2O emissions in the target year calculated in steps 3.a are higher than the emissions calculated in step 3.b, **no separate target is required**. In this case, N_2O emissions from nitric acid production would be considered as part of a company's company-wide scope 1 emissions target, as needed, in accordance with the SBTi Corporate Net-Zero Standard and SBTi Corporate Near-Term Criteria.

Below are examples for the application of the activity-specific pathway for scope 1 N_2O emissions from nitric acid production.

EXAMPLE 3.1: SAMPLE CALCULATIONS FOR A TARGET ON N_2O EMISSIONS FROM NITRIC ACID PRODUCTION

Two example calculations have been provided below. These calculations will be performed by the Chemicals Target-Setting Tool, but have been provided here for reference.

EXAMPLE 3.1.a: COMPANY A	
Base Year	2021
Chosen Year for Target Formulation	2023
Target Year	2028
N_2O emissions from nitric acid production in the year chosen for target formulation	12,000 kg
Nitric acid production in the year chosen for target formulation	15,000 t
Emissions intensity in the year chosen for target formulation	0.8 kg N_2O / t nitric acid
Projected nitric acid production in target year	15,000 t

Calculated N_2O emissions in target year based on emissions intensity of 0.5 kg N_2O / t nitric acid (step 3.a above):

0.5 kg N_2O / tonne nitric acid x 15,000 t nitric acid = ***7,500 kg N_2O***

Calculated emissions reduction consistent with a 1.5°C level of ambition for a 2026 target year (step 3.b above):

*4.2% * (2028 – 2020) =* ***33.6% emissions reduction***

Calculated N_2O emissions in target year consistent with a 1.5°C level of ambition:

12,000 kg N_2O x (1 – 33.6%) = ***7,968 kg N_2O***

Since the projected emissions calculated under step 3.a are lower than those calculated under step 3.b, Company A sets a target to reduce their average N_2O emissions intensity from nitric acid production to **0.5 kg N_2O / t nitric acid or less** by 2026.

Sample language for Company A's target set using criterion CHEM-C4 is as follows:

Company A commits to reduce the average scope 1 N_2O emissions intensity from its own nitric acid production to a value of 0.5 kg N_2O / tonne nitric acid or less by no later than 2026.

EXAMPLE 3.1.b: COMPANY B	
Base Year	2021
Chosen Year for Target Formulation	2023
Target Year	2028
N_2O emissions from nitric acid production in the year chosen for target formulation	12,000 kg
Nitric acid production in the year chosen for target formulation	15,000 t
Emissions intensity in the year chosen for target formulation	0.8 kg N_2O / t nitric acid
Projected nitric acid production in target year	20,000 t

Calculated N_2O emissions in target year based on emissions intensity of 0.5 kg N_2O / t nitric acid (step 3.a above):

0.5 kg N_2O / tonne nitric acid x 20,000 t nitric acid = ***10,000 kg N_2O***

Calculated emissions reduction consistent with a 1.5°C level of ambition for a 2026 target year (step 3.b above):

*4.2% * (2028 – 2020) =* ***33.6% emissions reduction***

Calculated N_2O emissions in target year consistent with a 1.5°C level of ambition:

12,000 kg N_2O x (1 – 33.6%) = ***7,968 kg N_2O***

Since the projected emissions calculated under step 3.a are higher than those calculated under step 3.b, **no separate target on N_2O emissions from nitric acid production is required.**

3.2 Setting targets on GHG emissions from ammonia production using the activity-specific pathways

The steps below outline instructions for companies using the SBTi's Chemicals Sector Target-Setting Tool to calculate targets using the ammonia production activity-specific pathway.

1. **Calculate base year emissions within the activity-specific target boundary:** Calculate the GHG emissions from each of the processes within the

activity-specific pathway boundary that fall within their value chain in their chosen base year and include these emissions within their ammonia production activity-specific target boundary, regardless of where they occur within the value chain. For example, a company operating only the Haber Bosch process that chooses to set a target using the ammonia production activity-specific pathway includes the emissions from the production of the hydrogen and nitrogen they purchase. This measure is necessary to ensure alignment of targets with the underlying emissions scenario and to provide a level playing field between companies with differing operations.

The SBTi Chemicals Sector Target-Setting Tool requires heat and process-related and electricity-related emissions within the activity-specific target boundary in the base year to be reported separately. The following guidelines should be used when calculating and reporting these emissions:

- Emissions from purchased and self-generated electricity are reported as electricity-related emissions in the SBTi Chemicals Sector Target-Setting Tool, regardless of whether these emissions occur in scopes 1, 2, or 3.
- Emissions from purchased and self-generated heat and process-related emissions are reported as heat- and process-related emissions in the SBTi Chemicals Sector Target-Setting Tool, regardless of whether these emissions occur in scopes 1, 2, or 3.

2. **Calculate base year production:** Calculate the total production of ammonia in the value chain in the chosen base year.

3. **Calculate target year production:** Project the production of ammonia in the chosen target year. This projection is based on the company's best estimates of future production.

- Detailed instructions for using the SBTi Chemicals Sector Target-Setting Tool are included in the Tool.

- The company's minimum target emissions intensity for ammonia production will be calculated as an output from the SBTi Chemicals Sector Target-Setting Tool.

Table 3.1. Emissions scope summary for an example company operating a Haber Bosch process only (thus purchasing hydrogen and nitrogen)

PROCESS	SCOPE AND CATEGORY	NOTES
Emissions from hydrogen production	Scope 3 category 1	Within ammonia production activity-specific pathway boundary
Emissions from nitrogen production	Scope 3 category 1	Within ammonia production activity-specific pathway boundary

Emissions from Haber Bosch process	Scopes 1 and 2	Within ammonia production activity-specific pathway boundary

Sample language for a near-term target set using an activity-specific pathway for ammonia production is as follows:

> *Company A commits to reduce scope 1, 2, and 3 GHG emissions from the production of ammonia for non-energy purposes 32.8% per tonne of ammonia produced by 2030 from a 2020 base year.*

3.3 Setting targets on GHG emissions from methanol production using the activity-specific pathway

The steps below outline instructions for companies using the SBTi's Chemicals Sector Target-Setting Tool to calculate targets using the methanol production activity-specific pathway.

1. **Calculate base year emissions within the activity-specific target boundary:** Calculate the GHG emissions from each of the processes within the activity-specific pathway boundary that fall within their value chain in their chosen base year and include these emissions within their methanol production activity-specific target boundary, regardless of where they occur within the value chain. For example, a company operating only the hydrogen production process that chooses to set a target using the methanol production activity-specific pathway includes the emissions from methanol produced from the hydrogen they sell. This measure is necessary to ensure alignment of targets with the underlying emissions scenario, and to provide a level playing field between companies with differing operations.

   The SBTi Chemicals Sector Target-Setting Tool requires heat and process-related and electricity-related emissions within the activity-specific target boundary in the base year to be reported separately. The following guidelines should be used when calculating and reporting these emissions:

   - Emissions from purchased and self-generated electricity are reported as electricity-related emissions in the SBTi Chemicals Sector Target-Setting Tool, regardless of whether these emissions occur in scopes 1, 2, or 3.
   - Emissions from self-generated heat and process emissions are reported as heat and process-related emissions in the SBTi Chemicals Sector Target-Setting Tool, regardless of whether these emissions occur in scopes 1, 2, or 3.

2. **Calculate base year production:** Calculate the total production of methanol in the value chain in the chosen base year.

3. **Calculate target year production:** Project production of methanol in the chosen target year. This projection is based on the company's best estimates of future production.

- Detailed instructions for using the SBTi Chemicals Sector Target-Setting Tool are included in the Tool.
- The company's minimum target emissions intensity for methanol production will be calculated as an output from the SBTi Chemicals Sector Target-Setting Tool.

Table 3.2. Emissions scope summary for a company operating the hydrogen production process only

PROCESS	SCOPE AND CATEGORY	NOTES
Emissions from hydrogen/syngas production	Scope 1 and 2	Within methanol production activity-specific pathway boundary
Emissions from methanol synthesis	Scope 3 category 10	Within methanol production activity-specific pathway boundary

Sample language for a target set using the activity-specific pathway for methanol production is as follows:

> *Company A commits to reduce scope 1, 2, and 3 GHG emissions from the production of methanol for non-energy purposes 26.4% per tonne of methanol produced by 2030 from a 2020 base year.*

3.4 Setting targets on GHG emissions from HVC production using the activity-specific pathway

The steps below outline instructions for companies using the SBTi's Chemicals Sector Target-Setting Tool to calculate targets using the HVC production activity-specific pathway.

1. **Calculate base year emissions within the activity-specific target boundary:** Calculate the GHG emissions from each of the processes used to produce any HVC within the activity-specific pathway boundary that fall within their value chain in their chosen base year and include these emissions within their HVC production activity-specific target boundary, regardless of where they occur within the value chain. This measure is necessary to ensure alignment of targets with the underlying emissions scenario, and to provide a level playing field between companies with differing operations.

   The SBTi Chemicals Sector Target-Setting Tool requires heat and process-related and electricity-related emissions within the activity-specific target boundary in the base year to be reported separately. The following guidelines should be used when calculating and reporting these emissions:

- Emissions from purchased and self-generated electricity are reported as electricity-related emissions in the SBTi Chemicals Sector Target-Setting Tool, regardless of whether these emissions occur in scopes 1, 2, or 3.
- Emissions from self-generated heat and process emissions are reported as heat- and process-related emissions in the SBTi Chemicals Sector Target-Setting Tool, regardless of whether these emissions occur in scopes 1, 2, or 3.

2. **Calculate base year production:** Calculate the total production of any HVC in the value chain, outside of refineries, in the chosen base year. The production of individual HVC are combined to determine a single value for total HVC production.

3. **Calculate target year production:** Calculate the projected production of any HVC in the chosen target year. The production of individual HVC are combined to determine a single value for total HVC production.

- Detailed instructions for using the SBTi Chemicals Sector Target-Setting Tool are included in the Tool.

- The company's minimum target emissions intensity for HVC production will be calculated as an output from the SBTi Chemicals Sector Target-Setting Tool.

Sample language for a target set using the activity-specific pathway for HVC production is as follows:

Company A commits to reduce scope 1, 2, and 3 GHG emissions from the production of high value chemicals (HVC) 22.6% per tonne of HVC produced by 2030 from a 2020 base year.

3.5 Setting targets on scope 1 GHG emissions from non-primary chemical production using the activity-specific pathway

The steps below outline instructions for companies using the SBTi's Chemicals Sector Target-Setting Tool to calculate targets using the activity-specific pathway for non-primary chemicals. These steps also outline the function of the Tool when calculating targets.

1. Calculate base year scope 1 GHG emissions from all activities included in the definition of non-primary chemical production that will be included in the target boundary.
2. Establish the target year(s). The target years for near-term targets and long-term targets will be the same target year used to set targets on other emissions sources (excluding targets set on scope 1 N_2O emissions from nitric acid production using the activity-specific pathway for nitric acid production).
3. For near-term targets, the required reduction in scope 1 GHG emissions from non-primary chemical production is based on the percent reduction in emissions between the base year and the target year from the activity-specific pathway for non-primary chemical production. For net-zero targets, the required reduction in scope 1 GHG emissions from non-primary chemical production is based on the

percent reduction in emissions between the base year and 2050 from the activity-specific pathway for non-primary chemical production. Pathway emissions values for each year are available in pathways criteria document.

The following example demonstrates sample calculations for determining target ambition using the activity-specific pathway for scope 1 emissions from non-primary chemical production activities.

EXAMPLE 3.2: SAMPLE CALCULATIONS FOR TARGET SET USING NON-PRIMARY CHEMICAL ACTIVITY-SPECIFIC PATHWAY		
		Non-primary chemical pathway value
Company's chosen base year	**2023**	367.6 Mt CO_2
Company's chosen near-term target year	**2030**	355 Mt CO_2
Company's chosen net-zero target year	**2045**	20* Mt CO_2
Company's activity-specific near-term target ambition	**3.4% reduction from base year**	
Company's activity-specific net-zero target ambition	**94.6% reduction from base year**	

*Net-zero targets are based on the pathway value in 2050 regardless of the target year chosen by the company for setting a net-zero target.

Sample language for a near-term target set using the activity-specific pathway for scope 1 emissions from non-primary chemical production activities is as follows:

Company A commits to reduce absolute GHG emissions from the production of non-primary chemicals 3.4% by 2030 and 94.6% by 2045 from a base year of 2023.

3.3 Setting targets on scope 3 category 11 emissions of N_2O from sold synthetic nitrogen fertilizers using the activity-specific pathway

The steps below outline instructions for companies using the SBTi's Chemicals Sector Target-Setting Tool to calculate targets using the activity-specific pathway for scope 3 category 11 N_2O emissions from the use of sold nitrogen fertilizers. These steps also outline the function of the Tool when calculating targets.

1. Calculate base year scope 3 N_2O emissions in category 11 from all synthetic N-fertilizer products.
2. Establish the target year(s). The target years for near-term targets and long-term targets will be the same target year used to set targets on other emissions sources (excluding targets set on scope 1 N_2O emissions from nitric acid production).

3. Calculate the required reduction in scope 3 category 11 N_2O emissions based on the minimum level of ambition aligned with the required reduction between 2020 and 2030 (near-term) or 2050 (long-term) in N_2O emissions per year.

    - Near-term ambition based on **13%** reduction between 2020 and 2030.
    - Long-term ambition based on **17%** reduction between 2020 and 2050.

Sample language for a net-zero target set using this criterion is as follows:

> *Company A commits to reduce absolute emissions of N_2O from the use of sold synthetic nitrogen fertilizers in the field in scope 3 category 11 10.4% by 2028 and 17% by 2050 from a base year of 2020.*

4. ADDITIONAL GUIDANCE ON SCOPE 3 ACCOUNTING

In this section the SBTi has provided informative guidance on several key scope 3 accounting issues relevant to the chemicals sector. This information is not intended to replace the GHG Protocol as the standard companies must use to develop their corporate GHG emission inventories. Rather, this is intended to supplement the GHG Protocol by providing chemicals-sector specific guidance on relevant topics or possible interpretations of the GHG Protocol guidelines on these topics. The guidance contained in this appendix is not normative, meaning companies are not required to follow it. The topics included in this annex were chosen because they have particular relevance to the chemicals sector, or because of a perceived need for additional clarity. Any future revisions to the GHG Protocol or the SBTi's cross-sectoral requirements may take precedence over the informative guidance in this appendix.

4.1 Accounting for downstream use-phase and end-of-life emissions from products (scope 3 categories 11 and 12)

Accurately tracking scope 3 emissions downstream of a company's operational boundary poses a challenge. However, it is essential to meticulously consider the function and ultimate fate of all products, including intermediate ones, generated by chemical companies when estimating downstream emissions impacts.

Chemical products find application in diverse sectors such as foods, pharmaceuticals, hygiene products, plastics, and various consumer goods. Emissions occurring during the use phase or at the end-of-life of these products can often be estimated using available guidance. For instance, there are calculation methods specifically designed to estimate emissions from products landfilled at the end of their life, with a focus on consumer items typically used and discarded by end-users. However, estimating downstream emissions for products like pharmaceuticals, food additives, and personal hygiene items can be more intricate due to the varied ways they are consumed or disposed of.

For example, food additives may be either discarded or consumed, potentially entering wastewater systems and contributing to GHG emissions during treatment processes or being released into the environment. Personal hygiene products are also likely to end up in wastewater systems after use.

To develop a comprehensive scope 3 inventory, chemical companies should make a concerted effort to estimate downstream emissions, including those associated with consumable products. A key recommendation is the detailed mapping of the downstream value chain to ensure accurate estimates. Collaborative initiatives with other companies or experts can further enhance research and data availability, fostering methodological consistency across the sector.

This concerted effort to estimate downstream emissions is relevant for hydrocarbons, but also for N_2O from fertilizers from the field emissions (scope 3 category 11). For this sector and category, developing better methodologies to quantify emissions and emission reductions would help fertilizer companies to quantify improvements.

4.2 Accounting for emissions in scope 3 categories 10, 11, and 12

Many chemical companies produce and sell intermediate products that may be further processed into hundreds of additional products. In certain cases, the company selling the intermediate product may not reasonably know all the downstream processing steps, or the exact end use for their intermediate product; therefore, accurately estimating the full downstream GHG profile for their products can be difficult.

The SBTi expects companies to account for all scope 3 categories including downstream emissions from intermediate products and services, where relevant. The use of primary data is preferred, but secondary data is also acceptable when calculating scope 3 emissions[7]. In the instance that a company faces barriers to calculating emissions from one category of scope 3, the company should demonstrate its best efforts to calculate these emissions, and this shall not preclude them from providing reasonable estimates of emissions in other categories.

For example, if a company faces barriers to calculating emissions from the processing of sold intermediate products (scope 3 category 10) because the uncertainty in potential processing steps is too large, they may potentially be able to justifiably exclude these emissions from their inventory, as outlined in the GHG Protocol (GHG Protocol, 2011). However, the company should demonstrate its best efforts to calculate these emissions, and this shall not preclude them from providing an estimate of emissions in other categories (e.g., emissions at end-of-life in scope 3 category 12).

4.3 Accounting for emissions from biobased materials within a company's value chain

Feedstocks and fuels derived from biological carbon may offer promising alternatives to fossil-based materials. These biobased materials and biofuels can originate from crops cultivated for this specific purpose or from agricultural and other residual wastes of organic materials. Biobased materials present potential climate benefits compared to their fossil counterparts because their carbon content originates from the atmosphere. Consequently, the eventual release of biogenic CO_2 during a product's production, use phase, or at end-of-life through incineration or decomposition, does not lead to a net addition of CO_2 to the atmosphere.

However, the overall impact of these materials throughout their life cycle can be substantial. This impact encompasses environmental burdens and GHG emissions from land use change, land management, and additional non-biogenic emissions generated during the processing of biomass into usable products. Emissions of other GHGs, such as CH_4, from the combustion or decomposition of biobased products must also be accounted for within GHG inventories. Therefore, conducting a robust accounting of life cycle emissions associated with biogenic materials is crucial.

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[7] Primary data comes from specific activities within a company's own value chain. Secondary data is not specific to a company's value chain, for example industry or geographic averages.

Chemical companies incorporating biobased products into their value chain should adhere to the current guidance from the GHG Protocol regarding the accounting of GHG emissions in scopes 1, 2, and 3 related to these materials. This guidance necessitates a comprehensive assessment of GHG emissions linked to purchased biobased materials across all scopes, encompassing both net biogenic emissions and non-biogenic emissions. Specifically, companies must factor in emissions from the land sector attributable to the biogenic material they are acquiring. This includes, but is not limited to, emissions resulting from land use change and net CO_2 emissions from land management.

4.4 Accounting for emissions from carbon capture and utilization within a company's value chain

Carbon capture, utilization and storage (CCUS) refers to the process of capturing CO_2 from an industrial emissions point source or directly from the atmosphere and then using it in other processes (e.g., integrated into a product or fuel) or sequestering it in permanent storage (e.g., geologic reservoirs).

However, corporate-level accounting for emissions related to Carbon Capture and Utilization (CCU), where CO_2 is utilized as a carbon source for products, lacks detailed guidance in the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, as of the publication of this document.

To provide clarity, this section offers guidance based on GHG Protocol accounting principles. The GHG Protocol dictates that emissions from sold products should be accounted for in the reporting company's scope 3 inventory. The same principle should apply when CO_2, captured and sold as a product, is utilized downstream in the value chain. The captured CO_2 would not be included in the original emitting company's scope 1 emissions as it has not been emitted within the company's operational boundary. However, the downstream scope 3 impacts of the sold CO_2 should be included in scope 3 by the company that sells it. This shift from scope 1 to scope 3 aligns with the GHG Protocol Scope 3 Accounting and Reporting Standard. The emissions associated with the capture of the CO_2 (e.g., from the energy consumed in the capture process) remain part of the capturing companies' scope 1 emissions, while they are accounted for in scope 3 category 1 for the company using the CO_2.

A practical representation of this method is urea-based fertilizer production, in which CO_2 is captured (typically during ammonia production) and utilized subsequently to produce urea but is eventually emitted in the fertilizer's use-phase.

Figure 4.1 and Table 4.1 illustrate a simplified example on how companies could account for fossil-based CCU related emissions. This example, adjusted from the Global CO_2 Initiative, represents hypothetical emissions associated with the production of 1 t of methanol (Michailos, et al., 2018). Company A captures 1.45 t of CO_2 from the emissions from their steam cracker and sells the CO_2 as a product to Company B. Company A's scope 2 emissions associated with the energy used to capture the CO_2 itself are 0.05 t of CO_2, and 0.22 t of CO_2 are not captured and are therefore emitted directly from Company A's process. Company B utilizes the CO_2 from Company A to manufacture methanol and emits 0.08 t of CO_2 within their scope 1 (from process emissions, not emissions from incineration of other fuels*).* The sold methanol is burned as a fuel downstream the value chain outside the companies' boundaries. Thus, the CO_2 from the fuel combustion is accounted for within scope 3 category 11 (emissions from the use of sold products) for both Company A and Company B.

Figure 4.1. Sample of carbon flow for CCU-based applications

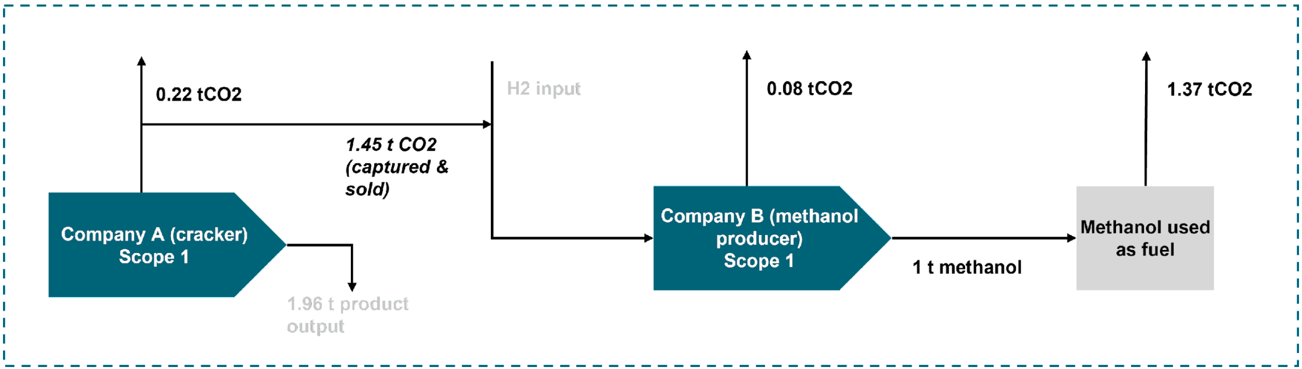

Table 4.1. Sample of GHG inventory calculations for CCU-based applications

COMPANY	SCOPE 1 & 2 EMISSIONS	SCOPE 3 EMISSIONS		
		CATEGORY 1 - EMISSIONS FROM PURCHASED PRODUCTS	*CATEGORY 10 – PROCESSING OF SOLD PRODUCTS*	*CATEGORY 11 - EMISSIONS FROM SOLD PRODUCTS*
Company A	0.27 t*	--**	0.08 t	1.37 t
Company B	0.08 t	0.05 t**	--	1.37 t

** Includes 0.05 t of scope 2 emissions associated with the carbon capture process.*
*** Company A and B should also account for any scope 3 category 1 emissions associated with other purchased products; however, these emissions are outside the scope of this example.*

Captured CO_2 that is integrated into products may also be emitted at the end-of-life of the product, rather than during the use phase. In this case, a similar method as above would apply, with the captured CO_2 instead being accounted for within scope 3 category 12 (emissions from the end-of-life of sold products) for both the emitting and the utilizing companies. Existing requirements and guidance on scope 3 emissions accounting should be used when estimating these emissions.

This guidance on accounting for value chain emissions associated with CCU-based products should be combined with guidance on accounting for biobased materials if the initial captured CO_2 is of biogenic origin.

4.5 Accounting for emissions from recycling processes within a company's value chain

Increasing the circularity of the chemicals value chain holds the potential for environmental benefits. However, accounting for emissions related to recycling processes poses challenges for companies purchasing recycled materials, those producing recyclable products, and those involved in both. Two ways in which recycling can offer emissions advantages include:

- The difference in emissions between extracting and processing virgin material versus preparing recycled material for reuse; and
- A reduction in emissions that would otherwise have occurred if the waste had been sent to a landfill or other waste treatment method (GHG Protocol, 2013).

Accounting methodologies for allocating emissions from recycling processes propose system cuts that allocate the emissions burden appropriately, since recycling extends the usefulness of the material from a linear life cycle to a circular one. This ensures that companies purchasing recycled content and producing recyclable materials do not double-count the emissions associated with multiple use cycles of their products. However, some methodologies may not balance the benefits from recycling between the recycling companies and the companies whose products are recycled, and not all companies are incentivized to pursue circularity based solely on the reduction in scope 3 emissions compared to a linear lifecycle model.

For instance, the recycled content accounting method recommended by the GHG Protocol (GHG Protocol, 2013) allocates emissions from recycling processes to scope 3 category 1 of the company purchasing the recycled material. The company would not account for any emissions in scope 3 categories 5 or 12 that are themselves recycled. A benefit in overall scope 3 emissions for this company could be seen when compared to a linear fossil alternative if:

- Emissions from the recycling process are lower than the upstream (category 1) emissions associated with the linear alternative; and/or
- There are emissions from the end-of-life processes for non-recycled products, and the company can accurately estimate these emissions; and/or
- The company can accurately estimate the quantity of their products that are recycled at end-of-life, thus assume no end-of-life emissions to these products.

In practice, emissions benefits from increased circularity can be difficult to quantify. Companies may be limited by data availability in accurately estimating the end-of-life fate of their own products, especially if they are producing primary or intermediate products that are eventually sold and disposed of across different global regions. Additionally, depending on the source of emission factors used, emissions from end-of-life processes for non-recycled wastes may carry low or no emissions burden, making the alternative circular route less advantageous. For example, in the World Business Council for Sustainable Development (WBCSD) Guidance for Accounting & Reporting Corporate GHG Emissions in the Chemical Sector Value Chain, guidance is given that no emissions should be attributed to products at end-of-life when a product is landfilled, and if the product is known not to degrade within 100 years (WBCSD, 2013).

To fully account for and maximize the positive impacts of recycling, companies should:

- Fully account for emissions from the recycling processes for products in their value chain, without double-counting.
- Source recycled materials that are produced with minimal direct GHG emissions, preferably using renewable electricity as the primary energy source.
- Fully and accurately account for upstream emissions associated with virgin alternatives to recycled materials in order to ensure the benefits of circular alternatives are properly captured.
- Increase visibility into the end-of-life fate of products sold for a more accurate accounting of end-of-life emissions.
- Collaborate with downstream customers, communities, and governments to increase recycling collection rates and material handling efficiency.
- Maximize the recyclability of the products being sold to boost the likelihood of diversion from waste streams and successful recycling.

Additional collaboration between interested stakeholders to further develop accounting methodologies that fairly and accurately quantify emissions from the recycling of products derived from chemicals may provide an opportunity to further incentivize a move toward a circular chemical value chain.

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SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION