ACT

ACT | ASSESSING LOW CARBON TRANSITION ®

Assessing low-Carbon Transition

Chemical Sector Methodology

(version 1.1 – September 2021)

ACKNOWLEDGMENTS

ADEME and CDP warmly thank the members of the Technical Working Group for their inputs and feedbacks on the methodology (see list of members in Annex).

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1. Introduction

The 2015 United Nations Climate Change Conference (COP21) in Paris further strengthened the global recognition of limiting dangerous climate change. Political agreement was reached on limiting warming to well below 2 degrees above pre-industrial levels. The project 'Assessing low Carbon Transition' (ACT) measures a company's alignment with a future low-carbon world. The goal is to drive action by companies and encourage businesses to move to a low carbon pathway with regards to their climate strategy, business model, investments, operations and GHG emissions management. The general approach of ACT is described in the ACT Methodological Framework document[1]. The public expression of short, mid and long-term emission reduction targets, is considered as a demonstration of a "willingness" (or commitment) to transition that is then compared with a specified low-carbon transition scenario that depends on the sector of activity considered (e.g. the Sectoral Decarbonization Approach developed by the Science Base Target initiative). This is then further assessed through a range of detailed indicators which the Framework provides and sector methodologies should detail. The ACT methodology is not explicitly aligned with the TCFD guidelines[2], but they are complementary and have a common goal: help companies to manage their risks related to climate change and support them to identify opportunities provided by the shift towards a low-carbon model.

The Chemical sector: a large diversity of actors and products

The chemical industry is a pillar of the current world economy. It aims to convert raw materials such as oil & gas products, minerals, metals or water into thousands of end-products. Different categories exist within the sector as stated within the NACE code 20: industrial inorganic chemicals; plastics and synthetics; drugs; soap, cleaners, and toilet goods; paints and allied products; industrial organic chemicals; agricultural chemicals; and miscellaneous chemical products.

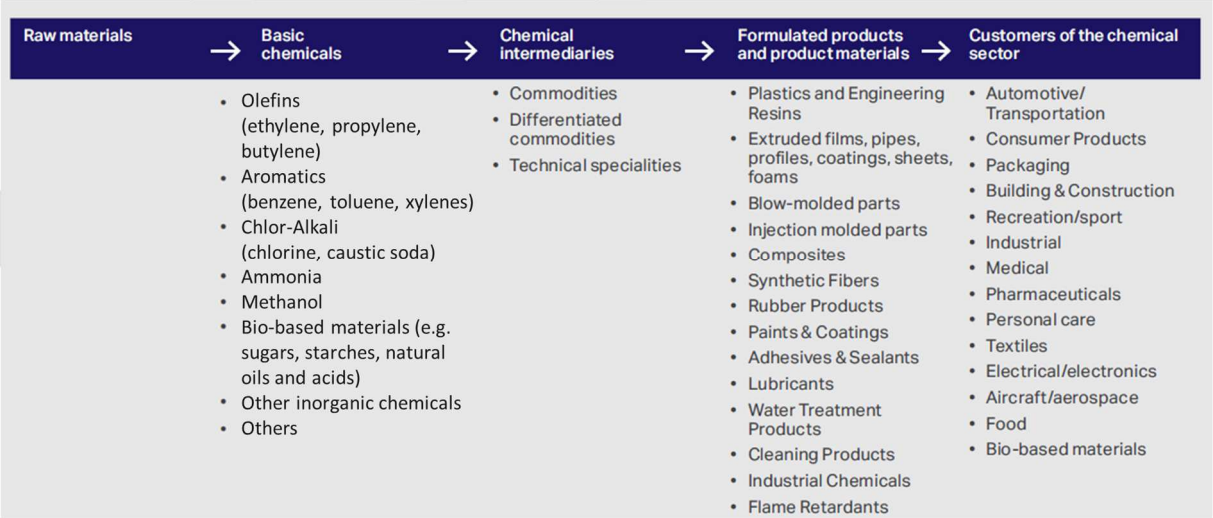


FIGURE 1: CHEMICAL SECTOR VALUE CHAIN. FROM (1)

[1] ACT framework

[2] Recommendations of the Task Force on Climate-related Financial Disclosure (June 2017)

A big challenge to be addressed in the ACT Chemicals methodology is to get a rating system that suits to all actors and activities.

Focus on the primary chemicals

On the upstream side of the value chain of the Chemical sector there are a few main chemicals, which are often referred to as 'primary' or 'basic'. Petrochemistry corresponds to the transformation of crude oil and natural gas into raw materials. The main outputs are[3]:

- **Ethylene**, **propylene** and **BTX** (benzene, toluene and xylenes, which are aromatic compounds) mainly resulting from naphtha cracking or fluid catalytic cracking. These chemicals are mainly used as precursors for polymers (polyethylene, polypropylene) or secondary chemicals (styrene, cumene, terephthalic acid, etc.)
- **Ammonia**, **methanol** and **hydrogen**[4] mainly resulting from natural gas reforming. Ammonia is the basis of a high share of the fertilizers used worldwide, methanol is mainly used for fuels, and hydrogen is a reagent to produce ammonia and methanol and appears today as a potential key-element to decarbonize many sectors as a vector for energy transportation and storage.

Inorganic chemistry produces a wide range of products. Due to high carbon intensity and volumes of production, chlorine has the highest overall associated emissions within inorganic chemistry. It is used as a raw material to obtain a large panel of chemicals and products, amongst which polyvinyl chloride (PVC), one of the most common polymers.

Since the whole chemical sector relies on these several basic chemicals and since they are extremely carbon-intensive (covering approximately two thirds of the direct emissions of the entire sector), they are given a particular focus in the ACT methodology.

Statistics of the sector

Among heavy industries, the chemical sector accounts for 18% of the heavy industries emissions, which amounts to 1.5 $GtCO_2$ scope 1 worldwide**Erreur ! Signet non défini.**, which corresponds to about 4% of global CO_2 emissions[5].

Direct CO_2 emissions from the production of seven primary chemicals[6] amounted to 880 $MtCO_2$ in 2018, a nearly 4% increase from the previous year, which was driven by growth in production. The chemical industry is not the most emission intensive industry in terms of direct CO_2 emissions: it ranges third behind the cement and the iron & steel industries. However, the chemical sector is the largest industrial energy consumer - accounting for 15% of total primary demand for oil on a volumetric basis and 9% of gas demand (IEA, Energy Technology Perspectives 2020). This is largely because around half of the chemical subsector's energy input is consumed as feedstock – where fuel is used as raw material input rather than as a source of energy**Erreur ! Signet non défini.**. Hence the chemical industry would be the most emission intensive industry if feedstock would be considered as an emission.

In 2019, the amount of chemicals produced in the world reached 2 Gt with the main products being ammonia (9.3% of production, 185 Mt/year), ethylene and propylene (12.8% of production, 255 Mt/year), BTX (5.5% of production, 110 Mt/year), chlorine (3% of production, 60 Mt), methanol (5% of production, 100 Mt/year) and hydrogen (3.5% of production, 70 Mt/year). Energy demand from the Chemical sector is projected to increase by half by 2050, according to the IEA (IEA, The Future of Petrochemicals, 2018).

Levers to decarbonize the sector

Since the chemical sector is highly complex and encompasses very different actors both in terms of size, activities and end-products, various solutions are available to decrease the GHG emissions of the sector. All

[3] Various processes can be used to obtain some of these primary chemicals, the main ones are described here.

[4] In this report, "hydrogen" is used to refer to hydrogen gas H_2 (not the isolated H atom).

[5] Considering annual global CO_2 emissions to be 36.44 Gt (2019), data from https://ourworldindata.org/co2-emissions

[6] Including ammonia, ethylene, propylene, BTX, methanol.

of these solutions are not applicable to all activities, but the ACT Chemicals methodology has been designed to take into account, to the extent possible, only relevant levers of decarbonization for every assessed company. The main levers identified are:

- Switch to renewable sources of energy for chemical processes
- Alternatives to fossil fuels feedstocks
- Circular economy practices
- Energy efficiency
- Carbon capture use and storage (CCU and CCS) technologies

More detail about the production processes and impact of primary chemicals (related energy consumption and GHG emissions), and about the levers of decarbonization of the sector, are available in Appendix 10.4.

This document introduces the **ACT Chemicals methodology**. It includes of all the elements addressed in the various segments of the chemical sector. The assessment methodology is composed of 9 modules, with quantitative indicators (GHG emissions performance, etc.) and qualitative ones (supplier engagement, management practices, etc.). An pilot (roadtest) phase is planned and will help test the methodology with real company data and collect feedback to improve it and make it more operational.

2. Principles

The selection of principles to be used for the methodology development and implementation are explained in the general ACT Framework. Table 1 recaps the principles that were adhered to when developing the methodology.

TABLE 1: PRINCIPLES FOR IMPLEMENTATION

RELEVANCE - Select the most relevant information (core business and stakeholders) to assess low-carbon transition.
VERIFIABILITY - The data required for the assessment shall be verified or verifiable.
CONSERVATIVENESS - Whenever the use of assumptions is required, the assumption shall be on the side of achieving a 2° maximum global warming.
CONSISTENCY - Whenever time series data is used, it should be comparable over time.
LONG-TERM ORIENTATION - Enables the evaluation of the long-term performance of a company while simultaneously providing insights into short- and medium-term outcomes in alignment with the long-term.

3. Scope and Boundaries

In order to assess companies in the most accurate way in regard to their activity and the available benchmark 3 company types have been identified:

- Type A companies: Companies exclusively focused on producing primary chemicals (either Ammonia, Methanol, Ethylene, Propylene, BTX, Chlorine or Hydrogen)
- Type B companies: Companies that produce any other chemicals and do not produce any primary one as defined above.
- Integrated companies: Companies producing both primary chemicals and other chemicals.

In order to be assessed, type A and integrated companies shall inform the share of their scope 1+2 emissions attributable to each of the primary chemicals while scope 1+2 emissions for other chemicals they produced shall be aggregated (for a total of 100%). Type B companies shall inform their total scope 1+2 emissions and report their relevant scope 3 emissions. If the company does not have details on the split of the its scope 1&2 emissions per chemical, then this split can be estimated based on the split by weight of each category of chemical and a default emission factor per chemical.
Example: If the assessed company exclusively produces two products P1 and P2 (type A products), then it shall inform the share of emissions induced by each of the product. If the process is the same for both products, then the weight share per product (X% for P1 and Y% for P2, with X%+Y%=100%) can be used as a proxy for the allocation of emissions.

The scope and boundaries definition proposed here are based on the analysis presented in the literature review dedicated to the chemical sector, and on the analysis of scope and boundaries in the other existing ACT methodologies.

3.1.SCOPE OF THE SECTOR

3.1.1. SCOPE OF ACTIVITIES

The ACT chemicals methodology covers the overall chemical manufacturing industry starting from the manufacturing plant (feedstock production not included). Any company operating facilities which are included in the chemical industry can be assessed by the ACT methodology.

The activities of the chemicals segment **included** in the ACT scope are the following:

- Manufacturing of chemicals and chemical products [NACE – 20]

The following activities, which are related to the chemicals value chain, are **not included** in the scope of the ACT methodology for this sector:

- Manufacturing of refined petroleum products [NACE – 19.20]
- Manufacture of basic pharmaceutical products and pharmaceutical preparations [NACE – 21]
- Manufacturing of rubber and plastics products [NACE – 22]
- Mining and quarrying [NACE – 05-09]
- Each manufacturing NACE codes except for the 20 Manufacturing of chemicals and chemicals products that uses chemicals such as Manufacture of textiles [NACE – 13]

The inclusion and exclusion of activities are summarized below in Figure 2.

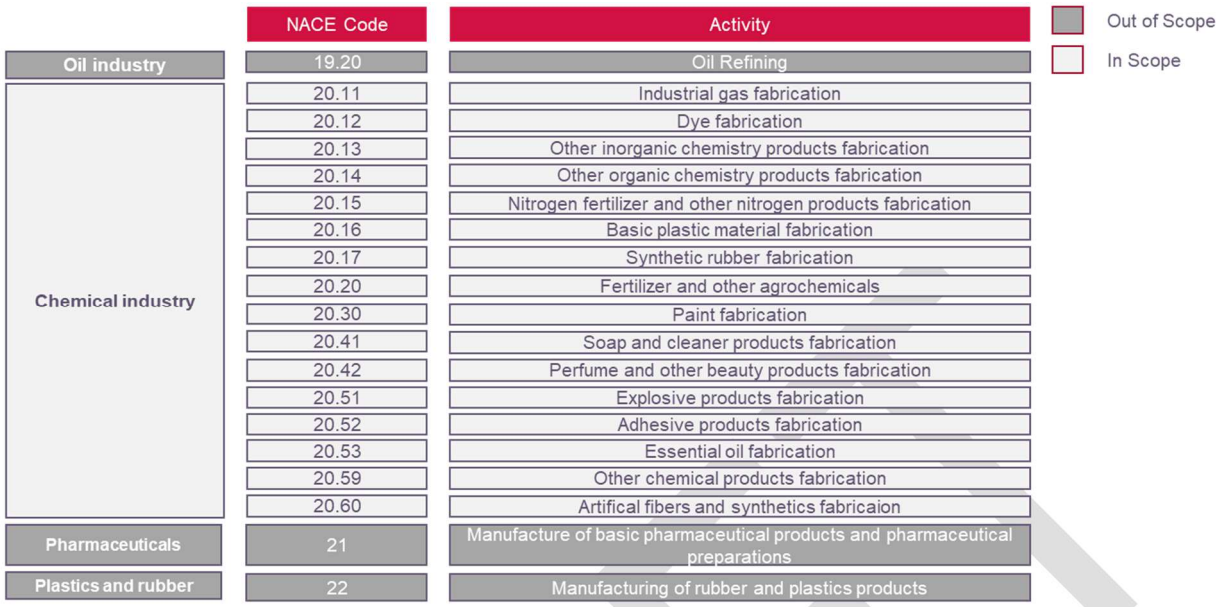


FIGURE 2: ACTIVITIES RELATED TO THE CHEMICAL SECTOR

RATIONALE FOR ACTIVITIES NOT INCLUDED

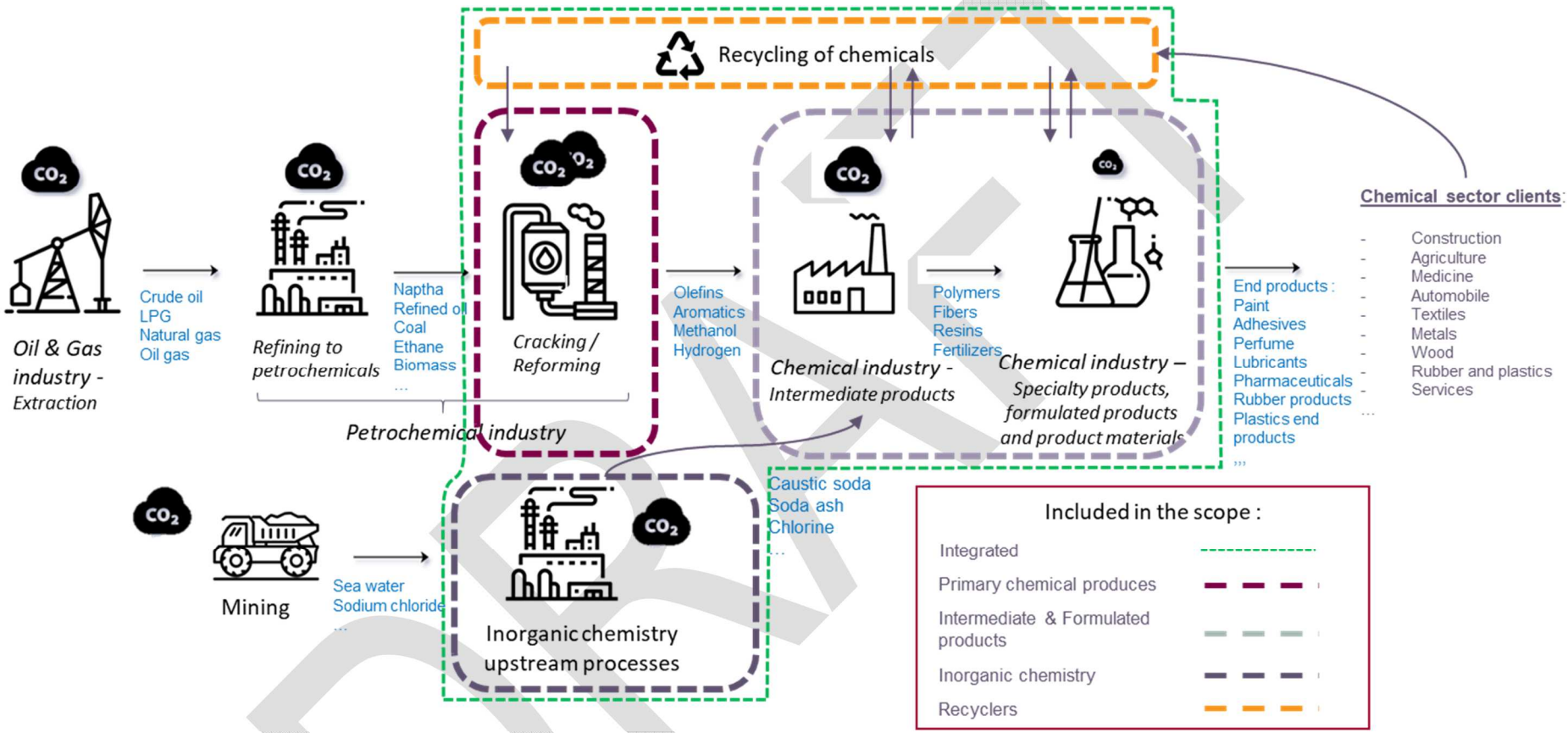
The scope of the methodology is defined to focus on companies which are the highest emitters but also have the most potential and most efficient levers to reduce emissions of the chemical sector. As a result, the following are not included in the ACT Chemicals methodology:

- NACE – 19.20, *Manufacturing of refined petroleum products* is partly covered by the ACT Oil & Gas methodology for what accounts for energy outputs of the Oil & Gas industry, the other products can be accounted for using the Generic ACT methodology. Indeed, refined petroleum products are not part of the chemical industry.
- NACE – 21, *Manufacture of basic pharmaceutical products and pharmaceutical preparations*, are excluded due to their low share of sectoral emissions[7] and to the high variety of products and processes (which would require multiple specific decarbonization pathways).
- NACE – 22, *Manufacturing of rubber and plastics products*, as such activities are more related to engineering than to the chemical sector.

Extraction and mining of raw materials are covered by other ACT methodologies (i.e. ACT Oil & Gas and ACT Generic). As much as separating these activities from the rest of the chemical sector is acknowledged to be difficult, the mining activities are not covered because the processes are extremely different to chemical production processes.

[7] Pharmaceuticals industry globally emits every year about 52 MtCO2e (https://www.logmore.com/post/pharma-industry-carbon-footprint), i.e. 3-4% of the chemical industry emissions.

FIGURE 3 : SYNTHESIS FLOW CHART OF THE SCOPE PROPOSITION



3.2. BOUNDARIES

In order to cover relevant emission sources and to facilitate the data collection on the companies' side, ACT methodology focuses on the main sources of GHG emissions throughout the value chain.

3.2.1. TYPES OF GREENSHOUSE GAS CONSIDERED

The chemical sector emits different kinds of greenhouse gases. In 2010, CO_2 accounted for over three quarters of the overall chemical sector emissions on a global scale (see table below). As technologies and practices reducing the emissions of powerful GHG are spreading across the globe, this ratio is likely to keep increasing: in the EU, the share of CO_2 now accounts for over 95% of the sectoral emissions (CEFIC, 2020). As a consequence, CO_2 is the most important contributor that should be captured by the ACT methodology.

TABLE 2 : WEIGHT OF THE DIFFERENT GHG IN THE CHEMICAL SECTOR'S EMISSIONS, SOURCE: IPCC 5TH REPORT

Greenhouse Gas	2010 Emissions Mt CO_2e	Share (%)
CO_2	1159	76%
HFC	207	14%
N_2O	140	9%
SF_6	12	1%
CH_4	5	< 1%

The literature review did not reveal a robust and globally accepted benchmark for the non-CO_2 emissions of the chemical sector. As a consequence, the emission reduction pathways will only cover CO_2 emissions when there is an individual CO_2-emissions benchmark defined (type A companies). For the other categories of companies (type B and integrated), all relevant non-CO_2 emissions will be considered as the Absolute Contraction Approach covers all GHG emissions.

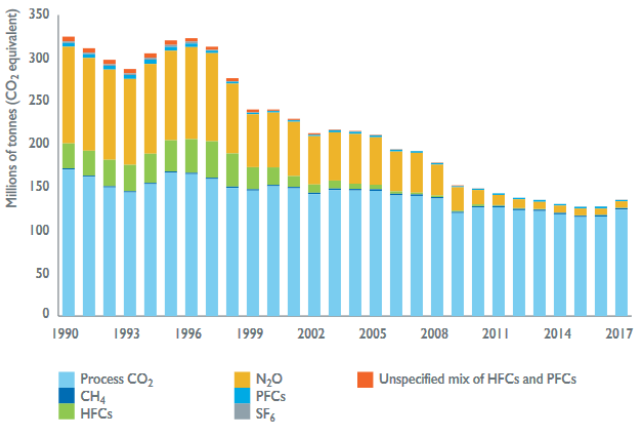


FIGURE 4: HISTORIC OF EMISSIONS FOR ALL GHG FOR THE EU28 CHEMICAL SECTOR. SOURCE: CEFIC[8]

3.2.2. EMISSION ALLOCATION AMONG CHEMICALS

Inspired by the JRC work (JRC, 2017) it was chosen for a chemical process which produces several chemicals that the scope 1&2 emissions due to the process should be allocated to the different individual chemical products as follow:

- If all chemicals produced are type B chemicals: no need for mass allocation as there is no intensity pathway but absolute emission pathways for emissions related to type B products
- If all chemicals produced are type A chemicals (e.g. chlorine & hydrogen): the scope 1 & 2 emissions should be allocated though a mass-allocation. For instance, if a process generates 5 tons of products split among 1 ton of primary chemical A1 and 4 tons of primary chemicals A2 and is responsible for the scope 1&2 emission of 1 ton of CO_2: product A1 will be allocated 1/5 of the emissions (hence 1000 x 1/5 = 200 $kgCO_2$/t of A1) and A2 will be allocated 4/5 of the emissions (hence 1000 x 4 / 5 = 800 $kgCO_2$ for 4 tons of A2, hence 200 $kgCO_2$/t of A2)
- If the process yields both primary (type A) and non-primary (type B) chemicals: all emissions should be split among the primary chemicals only – which leads to no emissions associated with type B chemicals. (Note that efforts to use these type B coproducts are rewarded thanks to module 9)

3.2.3. DESCRIPTION OF THE EMISSIONS

[8] https://www.francechimie.fr/media/52b/the-european-chemical-industry-facts-and-figures-2020.pdf

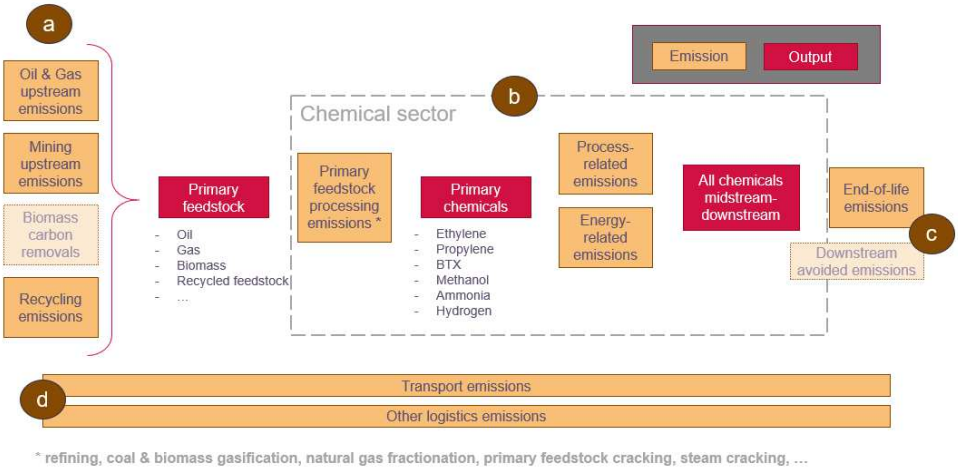


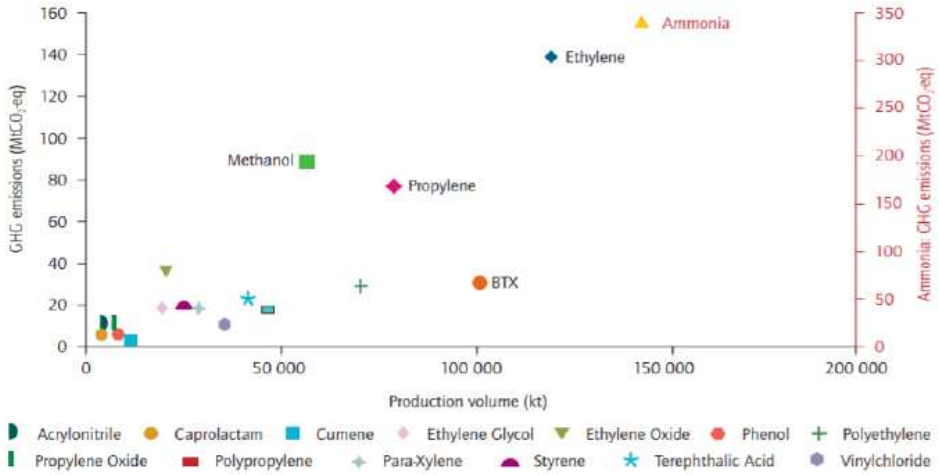
FIGURE 5: EMISSIONS WITHIN THE CHEMICAL SECTOR

Four broad categories of emissions can be distinguished:

- **a. Upstream**: the upstream emissions from feedstock production result from the production of the primary feedstocks that enter the chemical sector: oil, gas, coal, biomass or secondary raw material. Those upstream emissions are very different depending on the type of primary feedstock and the technical route selected to produce it:
    - *Oil & Gas upstream emissions* cover the emissions resulting from exploration, production and supply of fossil hydrocarbons, including the methane leakage associated.
    - *Mining upstream emissions* cover the emissions due to the mining sector to generate and possibly already partially process the raw materials it supplies. The mining subsectors considered here relate, but are not limited, to coal mining and mining of basic components of inorganic chemistry (such as sodium chloride).
    - *Biomass carbon removals* relate to the negative emissions the bio-sourced carbon sinks can foster. As the biomass grows, it contributes to capture and stock carbon from the atmosphere into the biomass. The rate of carbon absorption depends on complex processes that evolve over time, but also whether the biomass is sustainably grown or not.
    - *Recycling emissions* are the direct emissions related to the mechanical or chemical processes that transform end-use products or intermediary products into secondary raw materials that can be fed as feedstock for the chemical sector.

- **b. Within the chemical sector**, there are three types of scope 1+2 emissions:
    - *Energy-related emissions* come from fuel combustion for heat, steam and cooling generation as well as electricity consumption throughout the company activity.
    - *Process-related emissions* are specific to the chemical sector as they emerge from the very chemical reactions the company carries out throughout its activities. For instance, in steam methane reforming followed by water-gas shift, CO_2 is naturally formed from the overall chemical reaction: $CH_4 + 2\ H_2O \rightarrow CO_2 + 4\ H_2$. Note that chemical processes may also use CO_2 as a feedstock triggering negative emissions.
    - *Primary feedstock processing emissions*: For downstream activities within the chemical sector, there is a consumption of chemical inputs. The most common ones are the several primary chemical building blocks produced upstream (in refineries, crackers, coal or biomass gasification units, etc.) and they are responsible for a high share of the chemical sector GHG emissions.

Figure 2: Global Greenhouse Gas Emissions versus Production Volumes of Top 18 Chemicals, 2010



Notes: GHG = Greenhouse gas; Mt CO_2e = Megatons carbon dioxide equivalent; BTX = Benzene, toluene, xylene; Kt = kilotonne. GHG emissions for olefins in this figure represent that of steam cracking process. Ammonia is presented on a different axis on the right. Figure is based on CO_2 emissions only and does not include other greenhouse gases.
Source: IEA, ICCA, and DECHEMA 2013.

FIGURE 6: GLOBAL GREENHOUSE GAS EMISSIONS VERSUS PRODUCTION VOLUME OF TOP 18 CHEMICALS, 2010 [9]

The emissions related to the consumption of chemical inputs in the early stages of the value chain are scope 3 upstream emissions for midstream/downstream activities, and are referred here as Primary feedstock processing emissions.

- **c. Downstream**
  - *End-of-life emissions:* When end-use products are manufactured and delivered at the end of the value chain, they can cause direct or indirect *End-of-life emissions*. For instance, nitrogenous fertilizers, derived from ammonia, are responsible for nitrous oxide (N_2O, a greenhouse gas exhibiting a high Global Warming Potential) emissions once used in agriculture.
  - *Avoided emissions*[10]: The chemical sector can also enable *Avoided emissions* further down the value chain. Those are not emissions *per se* but they represent a "positive" climate impact. Avoided emissions are related to the use-phase of a product (good or service) and are estimated by comparison to a baseline. For instance, a new additive in tires can decrease the fuel consumption of a vehicle: compared to the case where it does not exist, the additive allows to save fuel (thus reduce GHG emissions) while the car is used.

- **d. Logistics**
  - *Transport emissions* are scope 3 emissions occurring all along the value chain from the freight emissions to transport the feedstock, chemicals and end-use products from one place to another.
  - *Other logistics emissions* cover all other kind of logistics emissions that can occur within the value chain, such as refrigeration needs (e.g. for the transport of ammonia).

[9] IEA, ICCA and DECHEMA 2013

[10] WRI - Estimating and reporting the comparative emissions impacts of products – 2019: "The greenhouse gas (GHG) emissions impact of a product (good or service), relative to the situation where that product does not exist. The differences may be either negative or positive. Positive differences are frequently called avoided emissions…"

3.2.4. SETTING THE BOUNDARIES

Two different cases are to be differentiated:

- Emissions that are **included** in the boundaries of ACT Chemicals methodology
- Emissions that are **excluded** from the boundaries of ACT Chemicals methodology.

To assess a company in the ACT methodology for the chemical sector, the next table summarizes the categories of emissions that will be taken into account:

TABLE 3: EMISSION BOUNDARIES OF THE ACT CHEMICALS METHODOLOGY

		Type A company	Type B company	Integrated company
Feedstock production upstream emissions		Included (2)	Included (2)	Included (2)
Chemical sector scope 1 & 2 emissions	Primary feedstock processing emissions	N/A (these emissions are the energy & process-related emissions of the company)	Included (1)	Included (1)
	Energy-related emissions	Included (1)	Included (1)	Included (1)
	Process-related emissions	Included (1)	Included (1)	Included (1)
Logistics emissions	Transport emissions	Excluded	Included (1)	Included (1)
	Other logistic emissions	Excluded	Excluded	Excluded
Downstream emissions	End-of-life emissions	Included (2)	Included (1)	Included (1)
	Avoided emissions	Included (2)	Included (2)	Included (2)

(1): The emissions can be assessed and compared with a quantitative emission reduction pathway (see Section 5.1 for more details).

(2): These emissions will be assessed directly or indirectly, but will not be compared to a quantitative emission reduction pathway.

3.2.5. RATIONALE FOR BOUNDARY SETTINGS

a. Inclusion of the feedstock production upstream emissions

Low-carbon feedstock alternative was identified as a powerful lever to reduce the overall footprint of the chemical sector, by substituting carbon-intensive fossil feedstock (oil, gas and coal) with bio-sourced and recycled feedstock. The choice of feedstock is considered in the ACT assessment.

However, the emission factor of the bio-sourced feedstock largely depends on the carbon removal potential of the biomass. International standards recommend to account for carbon sinks separately, and exclude emissions from bio-sourced feedstock from carbon inventories (ISO 14064-1 standard, GHG Protocol, BEGES, etc.). Furthermore, there is currently no unanimously recognized point of reference for biogenic emissions. As a result, carbon removals from biomass will be considered separately from other emission sources, and will be assessed in separate indicators.

For a fair and scientifically sound treatment of all feedstocks, the other non-biomass feedstocks (recycled feedstock, fossil feedstock and inorganic feedstock) cannot be included in the comparison with the company's carbon emission reduction pathway. Nevertheless, all the feedstock production emissions will be considered within the ACT assessment through various indicators assessing the share of the different feedstock used.

b. Inclusion of the chemical sector scope 1+2 emissions

Emissions resulting from the players' own processes shall obviously be included, as the company has direct levers to reduce them. These emissions are:

- The process-based emissions (from chemical reactions, other emissions ensuing from the processes, etc.); and
- The energy-related emissions:
    - o direct energy-related emissions with heat, cooling and steam generation
    - o indirect with electricity consumption or other energy consumption.

Most of the emissions for the chemical sector come from the production of primary chemicals: the sole production of ammonia, ethylene, propylene, BTX and methanol account for 60% of the whole sector emissions (IEA, The Future of Petrochemicals, 2018). With the addition of chlorine and hydrogen generation, almost 70% of the sector's emissions that come from chemical upstream activities, processing primary feedstock into chemical building blocks, are covered.

The emissions related to primary chemicals production shall be taken into account not only for the players operating primary feedstock processing, but also for the downstream activities that are supplied with those building blocks to generate a variety of intermediate and specialty chemicals.

A company's scope 1+2 emissions will be used to compute a carbon intensity per product which will be compared either to a specific carbon intensity reduction benchmark or an absolute contraction benchmark (see Section 5.1 for more details).

c. Inclusion of the downstream emissions

From a methodology perspective, avoided emissions cannot be added to "real" emissions. Because there is currently no internationally recognized standard addressing calculation of avoided emissions, these are not directly taken into account in the ACT assessment[11]. However, 'enabling activities'[12] are acknowledged within the module *Business model*. Besides, the narrative score will assess the motivation and credibility of communications and claims from companies regarding avoided emissions (but not the performance itself).

End-of-life emissions highly depend on the chemicals and end-use products considered. Some products may have significant end-of-life emissions (such as nitrous fertilizers generating nitrous monoxide while used in agriculture), while some others do not emit any GHG emissions during their end-of-life. It is then relevant to consider these emissions qualitatively or quantitatively at some point in the ACT assessment. This may be challenging as a wide typology of products and usages exist.

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[11] See ACT technical note on this topic (publication end of April 2021)

[12] Definition of **enabling activities** from the EU taxonomy: "Economic activities that, by provision of their products or services, enable a substantial contribution to be made in other activities. For example, an economic activity that manufactures a component that improves the environmental performance of another activity."

For type A companies, the emissions reduction pathway is obtained thanks to scenarios that do not cover these scope 3 emissions (downstream emissions), hence those downstream emissions will not be quantitatively calculated; note that for a type A company, the downstream emissions are not a significant part of the overall emissions. However, for integrated and downstream companies being assessed against a global scenario, scope 3 emissions are to be considered, thus those end-of-life emissions will be taken into account.

d. Partial exclusion of the logistics emissions

- *Upstream*

Emissions from the transport and logistics emissions are insignificant compared to the feedstock and process emissions in the Chemical sector. A literature review carried out for the ACT Chemicals methodology highlighted that the emissions from transport and logistics are usually not taken into account in this sector. LCA studies about primary chemicals for which the emissions resulting from transport are quantified indicate that they represent less than 1% of the whole emissions for chlorine and ammonia (PlasticsEurope, 2005) and less than 5% for ethylene (Madhav Ghanta, 2014), which backs the assumption that the share of emissions from transport is negligible and can be excluded from the boundaries.

Some transport emissions of the initial feedstocks (oil, gas, coal, biomass, secondary raw material) are often not distinguished from the upstream emissions in LCA studies. In the case of biomass, the transport distance and weight involved can be quite significant. However, this information will be taken into account through indicators looking at upstream emissions (all emissions required to bring the primary feedstock to the chemical sector).

Considering these low emission levels and the limited levers a chemical company may have on the transport and logistics emissions all along the value chain, these emissions will not be covered in the ACT assessment boundaries for upstream companies.

- *Downstream / Integrated*

However, for many downstream companies (type B or integrated), transport emissions can represent a high share of the emissions within direct grasp of the company (typically tier 1 supplier and customer), on which there is a direct lever through engagement with the transport service provider, or own fleet management if the company operates its freight directly. For these downstream and integrated companies, transport emissions will be considered within the boundaries.

4. Construction of the data infrastructure

4.1.DATA SOURCES

In order to carry out a company level assessment, many data points need to be gathered by sourcing from various locations. Principally, ACT relies on the voluntary provision of data by the participating companies. Besides, external data sources are consulted where this would streamline the process, ensure fairness, and provide additional value for checking, validation and preparation of the assessment narrative.

The low-carbon scenarios used as benchmark for the quantitative indicators come from external sources and are detailed in the section 5.1. They may need to be updated in the future, according to the latest methodological developments of the scenarios.

4.2. COMPANY DATA REQUEST

The data request will be presented to companies in a comprehensive data collection format. The following data will be requested:

Data requested to the company
GHG emissions (on scopes defined in the quantitative indicators from the modules 1, 2 and 4)
Activity data
Reduction targets (absolute and intensity)
Low-Carbon CAPEX
R&D spending in low-carbon technologies
Low-carbon Patenting Activity
Environmental policy and details regarding governance
Management incentives
Scenario testing
List of environmental/CSR contract clauses in purchasing & suppliers' selection process

List of initiatives implemented to influence suppliers to reduce their GHG emissions, green purchase policy or track record, supplier code of conduct
Client policy
List of initiatives implemented to influence client behaviour to reduce their GHG emissions
Company policy on engagement with trade associations
Position of the company on significant climate policies (public statements, etc.)
List and turnover or invested capital (or other financial KPI) of activities in new businesses related to low-carbon business models
Current position and action plan of the company towards the identified low-carbon business models

4.3. PERFORMANCE INDICATORS.

The performance indicators have been conceived following the main principles described in Table 1 from the Principles section of the methodology.

The following table gives an overview of the Key Performance Indicators used in the ACT Chemicals methodology. For further information (weight and rationale) for each indicator, see 5.3.

TABLE 4A : KEY PERFORMANCE INDICATORS OF ACT CHEMICAL SECTOR ASSESSMENT

Module	Indicator
Targets	*1.1 Alignment of scope 1+2 emissions reduction targets*
	1.2 Alignment of scope 1+2+3 emissions reduction targets
	1.3 Time horizon of targets
	1.4 Achievement of past and current targets
Material investment	*2.1 Past performance – Scope 1+2 emissions*
	2.2 Trend in future Scope 1+2 emissions
	2.3 Locked-in emissions induced by company assets
	2.4 Low carbon and mitigation technologies & Carbon removal technologies CAPEX share
	2.5 Energy management
Intangible investment	*3.1 R&D spending in low-carbon, mitigation and carbon removal technologies*
	3.2 Company Low-carbon Patenting Activity
Sold Product Performance	*4.1 Past performance – Scope 1+2+3 emissions*
	4.2 Trend in future product specific performance
	4.3 Ammonia feedstock
	4.4 Methanol feedstock
	4.5 HVC feedstock
	4.6 Recycled content of products (including CO_2)
	4.7 Bio-based Type B products

Module	Indicator
Management	*5.1 Oversight of climate change issues*
	5.2 Climate change oversight capability
	5.3 Low-carbon transition plan
	5.4 Management incentives on climate change
	5.5 Climate change scenario testing
	5.6 Internal carbon pricing integration
Supplier engagement	*6.1 Strategy to influence suppliers to reduce their GHG emissions*
	6.2 Activities to influence suppliers to reduce their GHG emissions
Client engagement	*7.1 Strategy to influence customer behaviour to reduce their GHG emissions*
	7.2 Activities to influence customer behaviour to reduce their GHG emissions
Policy	*8.1 Company policy on engagement with trade associations*
	8.2 Trade associations supported do not have climate negative activities or positions
	8.3 Position on significant climate policies
Business model	*9.1 Business activities that develop low-carbon, mitigation and carbon removal technologies*
	9.2 Business activities that develop products enabling energy transition

TABLE 5: KEY PERFORMANCE INDICATORS OF ACT CHEMICAL SECTOR ASSESSMENT

		CHEMICALS		
		Past	Present	Future
Core business performance	1.TARGETS	CH 1.4 Historic ambition and company performance		
			CH 1.1 & CH 1.2 Alignment of scope 1+2 and scope 1+2+3 emission reduction targets CH 1.3 Time horizon of targets	
	Investment: 2. MATERIAL INVESTMENT	CH 2.1 Past performance – Scope 1+2 emissions	CH 2.3 Trend in future Scope 1&2 emissions CH 2.3 Locked-in emissions	
		CH 2.4 Low carbon, mitigation and carbon removal technologies CAPEX share CH 2.5 Energy management		
	Investment: 3. INTANGIBLE INVESTMENT	CH 3.1 R&D spending in low-carbon, mitigation and carbon removal technologies CH 3.2 Company low-carbon patenting activity		
	4 SOLD PRODUCT PERFORMANCE	CH 4.1 Past performance – Scope 1+2+3 emissions	CH 4.3 & CH 4.4 & CH 4.5 Ammonia, methanol & HVC feedstock CH 4.6 Recycled content of products (including CO_2) CH 4.7 Bio-based Type B products	CH 4.2 Trend in future Scope 1+2+3 emissions
	5. MANAGEMENT		CH 5.1 Oversight of climate change issues CH 5.2 Climate change oversight capability CH 5.4 Climate change management incentives CH 5.6 Carbon pricing integration	CH 5.3 Low-carbon transition plan CH 5.5 Climate change scenario testing
Influence	6. SUPPLIER	CH 6.2 Activities to influence suppliers to reduce their GHG emissions	CH 6.1 Strategy to influence suppliers to reduce their GHG emissions	
	7. CLIENT	CH 7.2 Activities to influence customer behavior to reduce their GHG emissions	CH 7.1 Strategy to influence customer behavior to reduce their GHG emissions	
	8. POLICY ENGAGEMENT		CH 8.1 Company policy on engagement with trade associations CH 8.2 Trade associations supported do not have climate-negative activities or positions CH 8.3 Position on significant climate policies	
	9. BUSINESS MODEL	CH 9.1 Business activities that develop low-carbon, mitigation and carbon removal technologies CH 9.2 Business activities that develop products enabling energy transition CH 9.3 Business activities that promote circular economy		

TARGETS (WEIGHTING: 15%)

- **CH 1.1 ALIGNMENT OF SCOPE 1+2 EMISSIONS REDUCTION TARGETS**

DESCRIPTION & REQUIREMENTS

CH 1.1 ALIGNMENT OF SCOPE 1+2 EMISSIONS REDUCTION TARGETS

SHORT DESCRIPTION OF INDICATOR

A measure of the alignment of the company's scope 1+2 GHG emissions reduction targets with their low-carbon benchmark pathway. The indicator will compare the trend of company's target pathway to the trend of company's benchmark and thus identify the gap between both pathways at the target year, which is expressed as the company's commitment gap.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- Targets information for each relevant scope 1+2 GHG emissions sources (target year, emission reduction between reporting year and target year, target coverage)
- Base year, emissions at base year

CDP Questionnaire 2021 mapping to this indicator:

- C4.1a (absolute target)
- C4.1b (intensity target)

External sources of data used for the analysis of this indicator are:

- Low-carbon scenario - background scenario data (IEA ETP 2020)

The benchmark indicators involved are:

TARGET TYPE	VALUE CHAIN	METRIC	BENCHMARK
Scope 1+2 intensity emissions	Type A	tCO_2 / t primary chemical	IEA ETP 2020
Scope 1+2 absolute emissions	Type B	tCO_2e	IPCC 1.5DS

Scope 1+2 intensity and absolute emissions	Integrated	Both tCO_2e / t primary chemical and tCO_2e	IEA ETP 2020 and IPCC 1.5DS

- "tCO_2" corresponds to the emission of CO_2 related to the scope 1+2 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the emissions released to the atmosphere.
- 'tCO_2e" corresponds to the emission of CO_2 equivalent related to the Scope 1+2 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the CO_2 emissions released to the atmosphere.
- "t primary chemical" corresponds to the mass of chemicals produced in tons.

If the CO_2 emissions from operated Joint-Ventures (JVs) are reported in the Scope 1+2 by the company, they should be reported in this indicator as well.

How the assessment will be done

The analysis is based on a trend ratio between the company's direct emissions target and the company benchmark. Trends are computed between reporting year and the longest time horizon of the target.

The company's target pathway is the decarbonization over time, defined by the company's scope 1+2 emissions reduction target. To compute it, a straight line is drawn between the starting point of the analysis and the company's target endpoint. The company benchmark pathway is the company specific scope 1+2 emissions low-carbon benchmark pathway.

The company achieves the maximum score if the company's target pathway and the company benchmark pathway are aligned (commitment gap = 0) and also if the targets are covering most of the company's direct emissions at reporting year.

Please note that CCS or CCU projects are accounted for also if performed by another actor than the company assessed. As a consequence, the scope 1+2 emissions intensities of the company can be reduced from the GHG emissions that are captured and stored in a permanent way.

Calculation of score:

1) **Trend ratio**

The score is calculated by dividing the company engagement of reduction by the specific benchmark emission reduction between the reporting year and the target year through the trend ratio:

$$Trend\ ratio = \frac{Company's\ target\ trend}{Benchmark\ pathway\ trend} = \frac{E_C(Y_T) - E_C(Y_R)}{E_B(Y_T) - E_B(Y_R)}$$

Where:

- $E_C(Y_T)$ is the company Scope 1+2 emissions (absolute and intensity) at target year
- $E_C(Y_R)$ is the company Scope 1+2 emissions (absolute and intensity) at reporting year
- $E_B(Y_T)$ is the benchmark Scope 1+2 emissions (absolute and intensity) at target year
- $E_B(Y_R)$ is the benchmark Scope 1+2 emissions (absolute and intensity) at reporting year

The commitment gap of the company is equal to (1- trend ratio). Thus, when the company's target pathway is aligned on the company's benchmark, the trend ratio is equal to 1 and the commitment gap is 0 (see Figure 7).

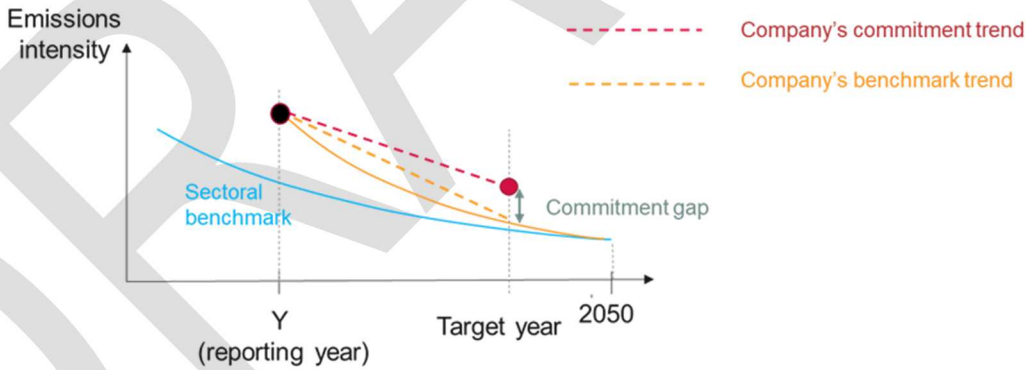


FIGURE 7: TREND RATIO AND COMMITMENT GAP (EXAMPLE WHERE SECTORAL PATHWAY IS AVAILABLE)

2) Final Score

The final score assigned to the indicator is calculated as follows:

Conditions	Score
$Company's\ target\ trend > 0$ Increase in company emissions (absolute or intensity)	0%
$Company's\ target\ trend \leq 0$ $0 \leq trend\ ratio \leq 1$ Decrease in company emissions (absolute r intensity) but company's commitment does not go beyond the company's benchmark ambition	$Trend\ ratio \times 100\%$
$Company's\ target\ trend < 0$ $trend\ ratio > 1$ Decrease in company emissions (absolute or intensity) and company's commitment equals or exceeds the company's benchmark ambition	100%
$Company's\ target\ trend \leq 0\ and\ E_C(Y_R) < E_B(Y_T)$ No increase in company emissions (absolute or intensity) and company's emissions (absolute or intensity) is already below the company's benchmark ambition for the target year	100%

Targets that do not cover > 95% of direct emissions are not preferred in the calculations. If only such targets are available, then the score will be adjusted downwards in proportion with % coverage. If the target coverage of total company emissions at reporting year (C_{Yr}) represents less than 95%, the final score is equal to:

Final Score = Score x Target coverage of total company emissions (C_{Yr}))

If the company has set several targets, the consolidation of the scores assigned to each target will be based on the share of emissions covered by the targets

RATIONALE

CH 1.1 ALIGNMENT OF SCOPE 1+2 EMISSIONS REDUCTION TARGETS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

Emissions reduction targets related to the Scope 1+2 are included in the ACT Chemicals assessment for the following reasons:

1. Targets are an indicator of corporate commitment to reduce emissions, and are a meaningful metric of the company's internal planning towards the transition.

2. Targets are one of the few metrics that can predict a company's long-term plan beyond that which can be projected in the short-term, satisfying ACT's need for indicators that can provide information on the long-term future of a company.

3. For the upstream part of the sector, direct emissions represent the highest share of emissions (1,4 $GtCO_2$ from direct emissions in the chemical industry in 2019).

SCORING RATIONALE:

Targets are quantitatively interpreted and directly compared to a low-carbon emissions reduction pathway built from the company's current level of emissions at reporting year and converging toward the 2050 value, in the case where sectoral or sub-sectoral benchmark is available. Contraction of absolute emissions might be used to plot the emissions reduction pathway otherwise (leading to a time horizon that might differ from 2050).

Comparing the trends gives a direct measure of the commitment gap of the company. It was chosen for its relative simplicity in interpretation and powerful message.

NB: In previous ACT methodologies, the calculation was based on the difference between the company's target and the company benchmark 5 years after the reporting year. The analysis is now based on the difference between the company's target and the company benchmark at the target year (also in line with the SBT approach). The previous version assumed that the emission reduction would be linear between reporting year and reporting year + 5, which could affect the result as the low-carbon pathway is not linear, the new version avoids this assumption by using directly data at target year.

DESCRIPTION & REQUIREMENTS

CH 1.2 ALIGNMENT OF SCOPE 1+2+3 EMISSIONS REDUCTION TARGETS

SHORT DESCRIPTION OF INDICATOR

A measure of the alignment of the company's scope 1+2+3 GHG emissions reduction targets with their low-carbon benchmark pathway. The indicator will compare the trend of company's target pathway to the trend of company's benchmark and thus identify the gap between both pathways at the target year, which is expressed as the company's commitment gap.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- Targets information for each relevant scope 1+2+3 GHG emissions sources (target year, emission reduction between reporting year and target year, coverage)
- Base year, emissions at base year

CDP Questionnaire 2021 mapping to this indicator:

- C4.1a (absolute target)
- C4.1b (intensity target)

External sources of data used for the analysis of this indicator are:

- Low-carbon scenario - background scenario data (IEA ETP 2020)

Note that only Type B products are evaluated by this indicator here (which means no evaluation for Type A companies as there is a 0% weighting on this indicator, and assessment on the volume of type B products for integrated companies).

The benchmark indicators involved are:

TARGET TYPE	VALUE CHAIN	METRIC	BENCHMARK
Scope 1+2+3 absolute emissions	Type B	tCO_2e	IPCC 1.5DS
Scope 1+2+3 absolute emissions on type B products only	Integrated	tCO_2e	IPCC 1.5DS

- ‘tCO_2e” corresponds to the emission of CO_2 equivalent related to the Scope 1+2+3 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the CO_2 emissions released to the atmosphere.

If the CO_2 emissions from operated Joint-Ventures (JVs) are reported in the Scope 1+2+3 by the company, they should be reported in this indicator as well.

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on a trend ratio between the company’s scope 1+2+3 emissions target and the company benchmark. Trends are computed between reporting year and the longest time horizon of the target.

Same computation as indicator 1.1 Alignment of scope 1+2 emissions reduction targets

RATIONALE

CH 1.2 ALIGNMENT OF SCOPE 1+2+3 EMISSIONS REDUCTION TARGETS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

Emissions reduction targets related to the Scope 1+2+3 are included in the ACT Chemicals assessment for the following reasons:

1. Targets are an indicator of corporate commitment to reduce emissions, and are a meaningful metric of the company’s internal planning towards the transition.

2. Targets are one of the few metrics that can predict a company’s long-term plans beyond that which can be projected in the short-term, satisfying ACT’s need for indicators that can provide information on the long-term future of a company.

3. The Chemical companies cover a large range of activities in the sector, they take responsibility of the climate impact of Chemical products at several points in the economic chain. The Life Cycle Analysis of the Chemical products, on all the GHG scopes, is therefore a relevant tool to be used in order to embrace the diverse sources of emissions caused by the Chemical business models.

4. For the downstream part of the sector, indirect emissions represent the highest share of emissions (1,4 $GtCO_2$ from direct emissions in the chemical industry in 2019). A GHG emissions reduction target should be assigned to them.

SCORING RATIONALE:

Targets are quantitatively interpreted and directly compared to a low-carbon emissions reduction pathway built from the company's current level of emissions at reporting year and converging toward the 2050 value, in the case where sectoral or sub-sectoral benchmark is available. Contraction of absolute emissions might be used to plot the emissions reduction pathway otherwise (leading to a time horizon that might differ from 2050).

Comparing the trends gives a direct measure of the commitment gap of the company. It was chosen for its relative simplicity in interpretation and powerful message.

NB: In previous ACT methodologies, the calculation was based on the difference between the company's target and the company benchmark 5 years after the reporting year. The analysis is now based on the difference between the company's target and the company benchmark at the target year. The previous version assumed that the emission reduction would be linear between reporting year and reporting year + 5, which could affect the result as the low-carbon pathway is not linear, the new version avoids this assumption by using directly data at target year.

- **CH 1.3 TIME HORIZON OF TARGETS**

DESCRIPTION & REQUIREMENTS

CH 1.3 TIME HORIZON OF TARGETS

SHORT DESCRIPTION OF INDICATOR

A measure of the time horizon of company targets. The ideal set of targets is forward looking enough to include a long-time horizon that includes the majority of a company's asset lifetimes, but also includes short-term targets that incentivize action in the present.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Per target: Target year, and scopes or emissions sources covered by the target. Please include all company targets (target with the longest time horizon and all intermediate targets).

CDP Questionnaire 2021 mapping to this indicator:

- C4.1a (absolute target)
- C4.1b (intensity target)

HOW THE ASSESSMENT WILL BE DONE

The analysis has two dimensions:

- A comparison of: (a) the longest time horizon of the company's targets, and (b) the long-term point fixed by ACT assessment methodology.
- The company has interval targets that ensure both short and long-term targets are in place to incentivize short-term action and communicate long-term commitments.

DIMENSION 1 - TARGET ENDPOINT: The company's target endpoint (T_e) is compared to a relevant time horizon for the sector (LT) defined as 30 years after the reporting year which corresponds to a typical lifetime of assets in the chemical sector[13].

The company's target endpoint (T_e) is equal to the longest time horizon among the company's targets, minus the reporting year:

$$T_e = Longest\ target\ time\ horizon - reporting\ year$$

The analysis compares T_e to LT. This analysis measures the horizon gap:

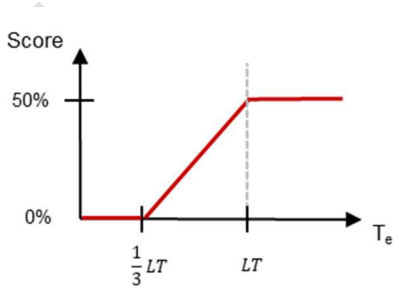
$$Horizon\ gap = LT - T_e$$

The company's target endpoint is scored according to the following scoring table:

HORIZON GAP	SCORE
$\boldsymbol{T_e} > LT$	50%
$\mathbf{33\%} * \boldsymbol{LT} < \boldsymbol{T_e}$ <Lt	$75\% * \frac{T_e}{LT}$-25%

[13] IEA – Energy Technology Perspectives 2020

$T_e \leq 33\% * LT$	0%



DIMENSION 2 - INTERMEDIATE HORIZONS: All company targets and their endpoints are calculated and plotted. The ideal scoring company does not have intervals between target endpoints larger than 5 years from the reporting year. Measurements are done in five-year intervals between the reporting year and LT.

The company's targets are compared according the following scoring table:

Intermediate target gap length	Score
All the gaps until T_e are equal or less than 5 years	50%
All the gaps until 80% of T_e are equal or less than 5 years	40%
All the gaps until 60% of T_e are equal or less than 5 years	30%
All the gaps until 40% of T_e are equal or less than 5 years	20%
All the gaps until 20% of T_e are equal or less than 5 years	10%
All the gaps of 5 years or less do not reach 20% of T_e or there is no such gaps disclosed by the company	0%

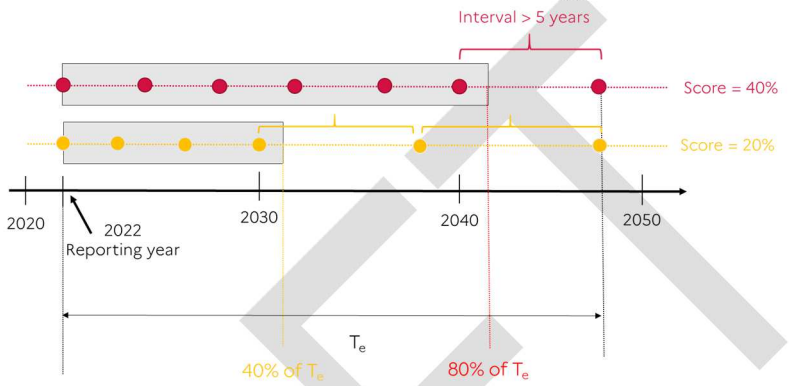


FIGURE 8 : EXAMPLES OF HORIZONS OF INTERMEDIATE TARGETS SET BY THE COMPANY AND CORRESPONDING SCORES ON DIMENSION 2 OF THE INDICATOR 1.4

AGGREGATED SCORE: DIMENSION 1: 50%, DIMENSION 2: 50%

FOR ALL CALCULATIONS:

- Targets that do not cover > 95% of emissions are not preferred in the calculations. If only such targets are available, then the score will be adjusted downwards in proportion with % coverage.

RATIONALE

CH 1.3 TIME HORIZONS OF TARGETS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

The time horizon of targets is included in this ACT methodology for the following reasons:

- The target endpoint is an indicator of how forward-looking the company's transition strategy is.
- Aside from communicating long-term commitments, short-term action needs to be incentivized. This is why short time intervals between targets are needed. A 5-year interval is seen as a suitable interval to ensure company is taking enough action, holding itself accountable by measuring progress every 5 years.
- The very long expected lifetime of Chemicals infrastructure means that Chemical companies 'commit' a large amount of carbon emissions into the future through the assets owned today, which requires targets that have time horizons which align with this reality.

• CH 1.4 ACHIEVEMENT OF PAST AND CURRENT TARGETS

DESCRIPTION & REQUIREMENTS

CH 1.4 ACHIEVEMENT OF PAST AND CURRENT TARGETS

SHORT DESCRIPTION OF INDICATOR

A measure of the company's historic target achievements and current progress towards active emission reduction targets. All the scopes of the company are considered. The ambition of the target is qualitatively assessed and is not included in the performance indicators.

DATA REQUIREMENTS

The relevant data for this indicator are:

For each target set in the past 10 years:

- Base year
- Start year
- Target year
- Percentage of reduction target from base year in absolute emissions
- Percentage of reduction target achieved in absolute emissions
- Percentage of reduction target from base year in emissions intensity
- Percentage of reduction target achieved in emissions intensity
- Percentage of emissions covered by the targets

- Emissions of the company on the year the target was set

CDP Questionnaire 2021 mapping to this indicator:

- C4.1a (absolute target)
- C4.1b (intensity target)

HOW THE ASSESSMENT WILL BE DONE

For the performance score, this indicator is assessed on two dimensions, whereby companies achieve the maximum score if:

DIMENSION 1: The company has achieved all previous emissions reduction targets with a target year in the past 10 years. If all past targets are indeed achieved, the highest score is obtained. If not, the achievement ratio a is computed as follows:

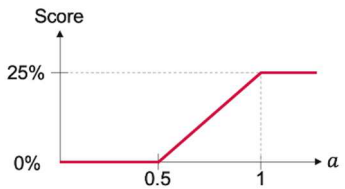
$$a = \frac{E(t_{ref}) - E(t_{horizon})}{E(t_{ref}) - T(t_{horizon})}$$

Where:

- $E(t_{ref})$ is the level of emissions of the company on the year the target was set
- $T(t_{horizon})$ is the target the company set (a given level of emission at a given horizon year, now past)
- $E(t_{horizon})$ is the effective level of emission reached by the company on the year of horizon of the target

A threshold is set for scoring at 0.5: if the company has achieved less than 50% of its own past target, it shall receive a zero score.

If the company has several past targets over the last 10 years, the ratio a shall be computed for each target, and the average of all a ratio shall be kept for scoring. Below you can find a table summarizing the scoring for the first dimension of the indicator.

Achievement ratio	Score	
$a \geq 1$	25%	
0.5 < a< 1	25%*(2*a-1)	
$a \leq 0.5$	0%	

DIMENSION 2: The company is currently on track to meet an existing emissions reduction target. The assessment is based on the progress ratio p:

$$\mathrm{p} = \frac{a}{\%\ time}$$

a being defined in dimension 1 and the past time ratio $\%time$ defined as follows:

$$\%time = \frac{t_{ref} - t_{reporting}}{t_{ref} - t_{horizon}}$$

Where

- t_{ref} is the year during which the target was set
- $t_{reporting}$ is the reporting year
- $t_{horizon}$ is the year of horizon of the target

The highest score is attained if $p \geq 1$. A percentage score is assigned for any value between 0 and 1.

Progress ratio	Score
$p \geq 1$	100%
$p < 1$	p (%)

AGGREGATED SCORE - DIMENSION 1: 25%, DIMENSION 2: 75%

The two dimensions' scores are added to form the indicator score. Below you can find an example of an emission intensity curve compared to the targets set by the company for this specific intensity. The indicator is also applicable for absolute emissions targets set.

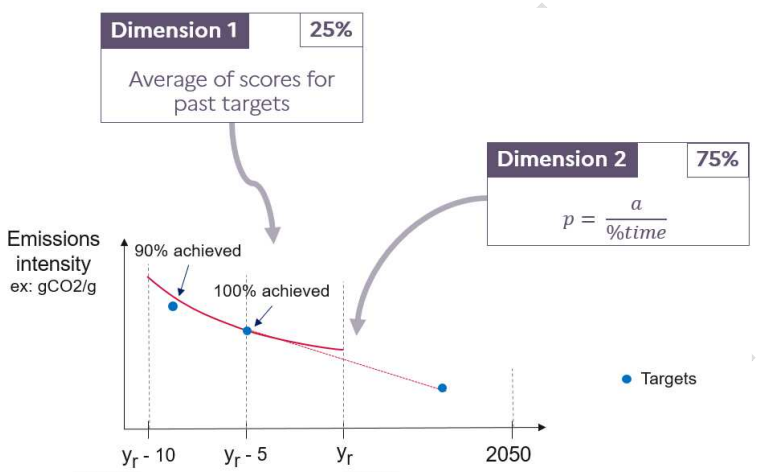


FIGURE 9: CALCULATION OF THE ACHIEVEMENT OF PREVIOUS TARGET INDICATOR

FOR ALL CALCULATIONS:

- Companies which do not have targets with target years in the past but only with target years in the future are not assessed on dimension 1, but only on dimension 2. Their score for this indicator is based on dimension 2.
- Targets that do not cover >95% of the company's GHG emissions scope are not preferred in the calculation of dimension 2, but are not penalized, as other indicators already penalize for not having a large coverage in the target.
- If the company has multiple targets in different scopes that can be assessed according to the above criteria, then the score is an average score based on the progress ratios of all targets assessed.

The performance score does not assess the ambition level of previous targets, and therefore dimension 1 has only a low weight in the final performance score. This information is also qualitatively assessed in the narrative analysis, which will take another look at the following dimensions:

- Achievement level: To what degree has the company achieved its previously set emissions reduction targets.
- Progress level: To what degree is the company on track to meet its currently active emissions reduction targets.
- Ambition level: What level of ambition do the previously achieved emissions reduction targets represent.

RATIONALE

CH 1.4 ACHIEVEMENT OF PAST AND CURRENT TARGETS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

The historic target ambition and company performance is included in this ACT methodology for the following reasons:

- The ACT assessment looks only to the past to the extent where it can inform on the future. This indicator is future-relevant by providing information on the organizational capability to set and meet emission reduction targets. Dimension 1 of this indicator adds credibility to any company claim to commit to a science-based reduction pathway.
- Dimension 2 of this indicator adds value to the assessment of comparison to the company's performance with respect to their targets in the reporting year.

SCORING RATIONALE:

Previous target achievement is not straightforward to interpret quantitatively. Therefore, the performance score makes no judgement of past target ambition and leaves it to the assessment narrative for a meaningful judgement on the ambition level of past targets.

- Dimension 1 of the performance score will penalize companies who have not met past targets in the past 10 years, as this means the company has lower credibility when setting ambitious science-based targets
- Dimension 2 uses a simple ratio, which reflects how well or not the company is currently on track to reach its existing emissions reduction target. As far as the degree of completion is equal or higher than expected, the maximum score is obtained. If the degree of completion is lower than expected, then the score is as impacted as the gap between reality and expectancies is high too. This way, staying on track of initial objectives is rewarded.

MATERIAL INVESTMENT (WEIGHTING: 8-32%)

Maturity matrix contains five levels of evaluation that are associated with scores given to the company for each indicator. Depending on the indicator, it might be possible to obtain only some score. Some of the indicators might be divided into sub-dimensions that are evaluated individually before the score is aggregated to obtain the indicator score.

Evaluation level	Basic	Standard	Advanced	Next practice	Low-carbon aligned
Score	0	0,25	0,5	0,75	1

- **CH 2.1 PAST PERFORMANCE - SCOPE 1+2 EMISSIONS**

DESCRIPTION & REQUIREMENTS

CH 2.1 PAST PERFORMANCE - SCOPE 1+2 EMISSIONS

SHORT DESCRIPTION OF INDICATOR

A measure of the alignment of the company's recent emissions for scope 1+2, with that of their decarbonization pathway. The indicator will compare the gradient of this trend over a 5-year period to the reporting year (reporting year minus 5 years) with the decarbonization pathway trend over a 5-year period after the reporting year.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Carbon intensity and activity at reporting year and Y-5 and other information if necessary (geography, …) regarding material investment

  OR
- Total direct emissions and activity at reporting year and Y-5.

CDP Questionnaire 2021 mapping to this indicator:

- C6.1: Gross scope 1 CO_2e emissions for reporting year and over the past 3 years
- C6.3: Gross scope 2 CO_2e emissions for reporting year and over the past 3 years

The benchmark indicators involved are:

TRENDS	VALUE CHAIN	METRIC	BENCHMARK
Scope 1+2 intensity emissions	Type A	tCO_2 / t primary chemical	IEA ETP 2020
Scope 1+2 absolute emissions	Type B	tCO_2e	IPCC 1.5DS
Scope 1+2 intensity and absolute emissions	Integrated	Both tCO_2e / t primary chemical and tCO_2e	IEA ETP 2020 and IPCC 1.5DS

- "tCO_2" corresponds to the emission of CO_2 related to the scope 1+2 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the emissions released to the atmosphere.
- 'tCO_2e" corresponds to the emission of CO_2 equivalent related to the Scope 1+2 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the CO_2 emissions released to the atmosphere.
- "t primary chemical" corresponds to the mass of chemicals supplied in tons.

If the CO_2 emissions from operated Joint-Ventures (JVs) are reported in the Scope 1+2 by the company, they should be reported in this indicator as well.

How the assessment will be done

This indicator is assessed on two dimensions:

Dimension 1: Trend in past emissions (50% for type A companies, 100% for type B companies)

1/ Type A products:

The analysis is based on the comparison between the company's recent (reporting year minus 5 years) emissions intensity trend gradient (CR'_{S12}) and the company's decarbonization pathway trend gradient (CB'_{S12}) in the short-term (reporting year plus 5 years). The emissions intensity of the company at the reporting year (CEI_Y) and the sectoral benchmark value of emissions intensity in 2050 (SB_{2050}) are also considered to calculate the company's score.

CR'_{S12} is the gradient of the linear trend-line of the company's recent scope 1+2 emissions intensity ($kgCO_2$/ton) over time (CR_{S12}).

CB'_{S12} is the gradient of the linear trend-line of the company benchmark pathway for emissions intensity ($kgCO_2$/ton) (CB_{S12}). See section **Erreur ! Source du renvoi introuvable.** Quantitative benchmarks used for the indicators for details on the computation of the company specific decarbonization pathway.

The difference between CR'_{S12} and CB'_{S12} will be measured by their ratio (r_{S12}). This is the scope 1+2 emissions Transition ratio, which is calculated by the following equation, with the symbol ' used to denote gradients:

$$R_{S12} = \frac{CR'_{S12}}{CB'_{S12}}$$

2/ Type B products:

No sectoral benchmark is available. The rules are the same than for Type A products except that there is no SB_{2050} point to refer to.

CALCULATION OF SCORE:

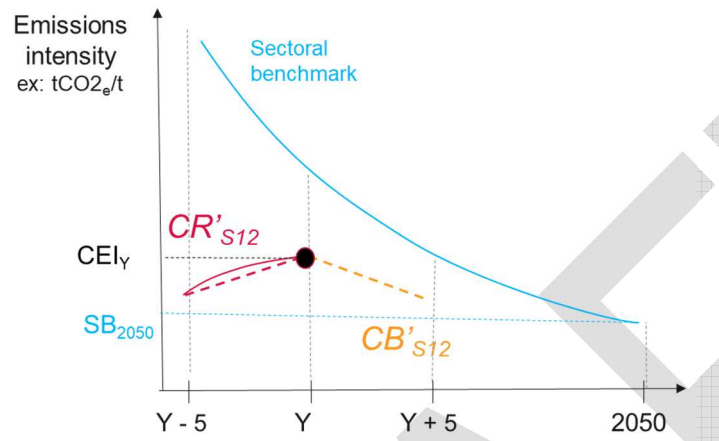
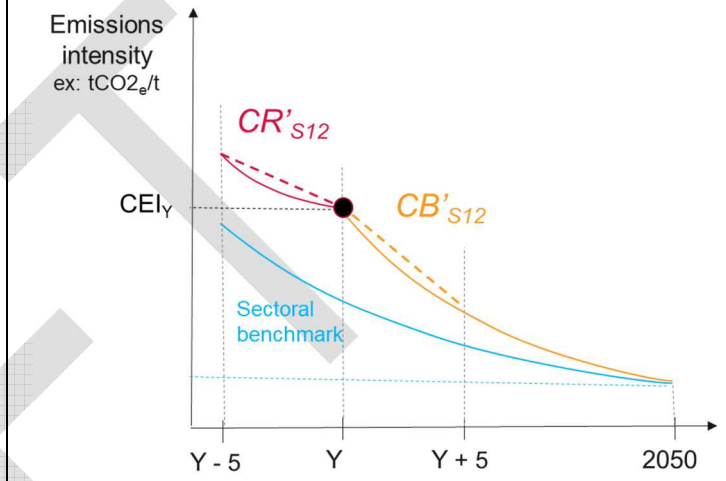
1/ Type A products:

The Sectoral Decarbonization Approach (SDA, see section 5.1) is used.

Four different cases are to be taken into consideration:

- Case #1: CR'_{SC1+2} is positive → Score = 0 (whatever the r_{SC1+2} and CEI_Y values)
- Case #2: CR'_{SC1+2} is negative and $0 < r_{SC1+2} < 1$ and CEI_Y is higher than SB_{2050} → Score = r_{SC1+2} (expressed as a percentage)
- Case #3: CR'_{SC1+2} is negative and $r_{SC1+2} \geq 1$ and CEI_Y is higher than SB_{2050} → Score = 100 %
- Case #4: CR'_{SC1+2} is negative and CEI_Y is lower than SB_{2050} → Score = 100 % (whatever the r_{SC1+2} value)

Case #1	Case #2

	
$CR'_{S12} > 0$ Whatever the r_{S12} value Whatever the CEI_Y value	$CR'_{S12} < 0$ $0 < r_{S12} < 1$ $CEI_Y > SB_{2050}$
Score = 0	**Score = r_{S12} (%)**
Case #3	Case #4

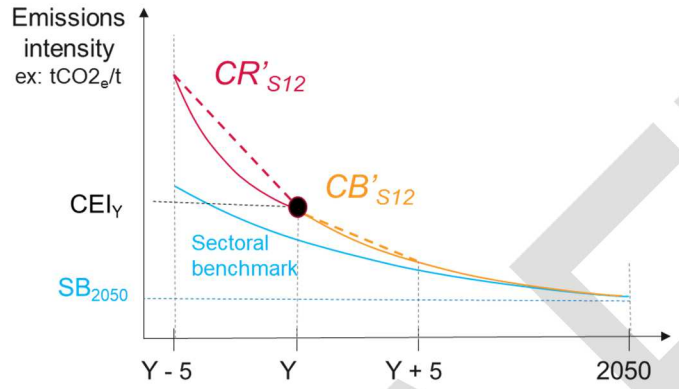
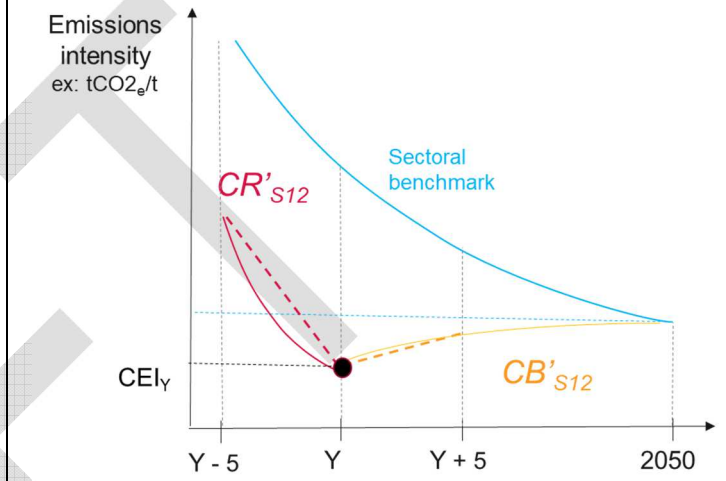
	
$CR'_{S12} < 0$ $r_{S12} \geq 1$ $CEI_Y > SB_{2050}$	$CR'_{S12} < 0$ $CEI_Y < SB_{2050}$ whatever the r_{S12} value
Score = 100 %	**Score = 100 %**

FIGURE 10: CASES ENCOUNTERED FOR THE TRANSITION RATIO

2/ Type B products:

The Absolute Contraction Approach (ACA, see section 5.1) is used.

- Case #1: CR'_{SC1+2} is positive → Score = 0
- Case #2: CR'_{SC1+2} is negative and $0 < r_{SC1+2} < 1$ → Score = r_{SC1+2} (expressed as a percentage)
- Case #3: CR'_{SC1+2} is negative and $r_{SC1+2} \geq 1$ → Score = 100 %

DIMENSION 2: ALIGNMENT OF PAST PERFORMANCE WITH SECTORAL CARBON BUDGET (50% FOR TYPE A COMPANIES / TYPE A ACTIVITIES FOR INTEGRATED COMPANIES)

Use past data on emissions for the assessed company and compare it to the sector benchmark.

This dimension assesses the alignment of the company's recent absolute emissions with the past sectoral carbon budget. The recent emissions and carbon budget are measured over a 5-year period to the reporting year (reporting year minus 5 years).

Basically, one should calculate the blue area of the graph in Figure 11, multiplied by the company's activity during the corresponding years. Then, compare this area to the sectoral carbon budget during the same period.

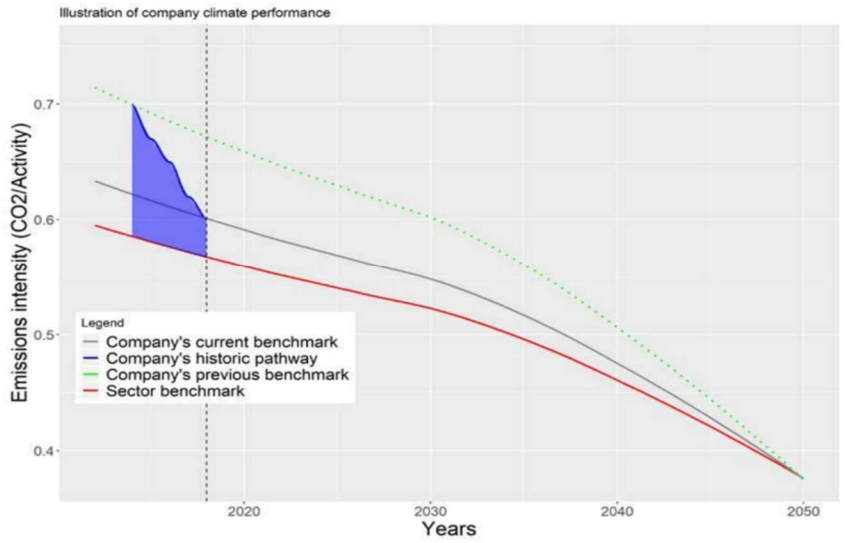


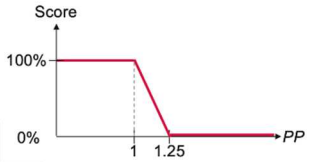
FIGURE 11: COMPARISON OF PAST PERFORMANCE AND CARBON BUDGET DEFINED BY SECTOR BENCHMARK

The past performance ratio PP is computed:

$$PP = \frac{\int_{y_r-5}^{y_r}(E_C \times A)}{\int_{y_r-5}^{y_r}(E_{SB} \times A)}$$

Where:

- E_C is the past emissions (absolute or intensity) of the company
- E_{SB} is the sectoral emissions (absolute or intensity) benchmark
- A is the activity

Past performance ratio	Score	
PP ≤ 1	100%	
1 < *PP* ≤ 1.25	(-4*PP + 5) * 100%	
PP > 1.25	0%	

AGGREGATED SCORE - DIMENSION 1: 50%, DIMENSION 2: 50%

RATIONALE

CH 2.1 PAST PERFORMANCE – SCOPE 1+2 EMISSIONS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

Past performance indicator is included in this ACT methodology for the following reasons:

- Dimension 1 (Trend in past emissions intensity) shows the speed at which the company has been reducing its emissions intensity over the recent past. Comparing this to the decarbonization pathway gives an indication of the scale of the change that needs to be made within the company to bring it onto a low-carbon pathway.
- Dimension 2 (Alignment of past performance with sectoral carbon budget) helps the company having an overview of its emissions exceedance in the recent past. This dimension also intends to remind that the carbon budget is set for the global economy and that each sector and each company has a defined carbon budget that cannot be exceeded to reach the overall long-term objective

of limiting global warming. The sector benchmark is defined for the next years, assuming it was respected for the past years where it was already defined. The emissions overshooting the benchmark in the past correspond to accumulated CO_2 that will remain in the atmosphere for decades. Hence, a company having already exceeded the benchmark should further its efforts to decrease its emissions in the near and remote future. This dimension is a ratio of the values of the emissions over a period of time in the past, as companies are very unlikely to provide data for the same period. What is considered here is the emission excess compared to the sectoral carbon budget, proportionally to the period of time.

- While ACT aims to be as future-oriented as possible, it nevertheless does not want to solely rely on projections of the future, in a way that would make the analysis too vulnerable to the uncertainty of those projections. Therefore, this measure, along with projected emissions intensity and absolute emissions, forms part of a holistic view of company emissions performance in the past, present, and future.
- This indicator is future-relevant by providing information on the organizational capability to meet emission reduction that is aligned with the benchmark. This indicator adds credibility to any company whose past emissions intensity were aligned with their historic benchmark and whose past carbon budget did not exceed the sectoral carbon budget.

SCORING RATIONALE

While 'gap type' scoring is preferred for any indicator where possible, the dimension 1 of this indicator looks at past emissions and would therefore require a different baseline in order to generate a gap method. Consequently, 'trend type' scoring is preferred here. Another advantage of the trend analysis is that it does not require the use of a 'business as usual' pathway to anchor the data points and aid interpretation, as trends can be compared directly, and a score can be generated from the resulting ratio.

- **CH 2.2 TREND IN FUTURE SCOPE 1+2 EMISSIONS**

DESCRIPTION & REQUIREMENTS

CH 2.2 TREND IN FUTURE SCOPE 1+2 EMISSIONS

SHORT DESCRIPTION OF INDICATOR

A measure of the alignment of the company's future emissions for scope 1+2, with that of their decarbonization pathway. The indicator will compare the gradient of this trend over a 5-year period following the reporting year (reporting year plus 5 years) with the decarbonization pathway trend over a 5-year period after the reporting year.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Carbon intensity at reporting year and Y+5, other information if necessary (geography, …), regarding material investment
  OR
- Total direct emissions at reporting year and Y+5

CDP Questionnaire 2021 mapping to this indicator:

- C6.1: Gross scope 1 CO_2e emissions for reporting year
- C6.3: Gross scope 2 CO_2e emissions for reporting year
- Future emissions data is not collected by CDP

Future emission should be estimated from company assets and their expected produced activity. If future emissions cannot be estimated from company assets, expected trend in future emissions should be estimated by extrapolating the trend from the last 5 years before the reporting year.

The benchmark indicators involved are:

TRENDS	VALUE CHAIN	METRIC	BENCHMARK
Scope 1+2 intensity emissions	Type A	tCO_2 / t primary chemical	IEA ETP 2020
Scope 1+2 absolute emissions	Type B	tCO_2	IPCC 1.5DS
Scope 1+2 intensity and absolute emissions	Integrated	Both tCO_2 / t primary chemical and tCO_2	IEA ETP 2020 and IPCC 1.5DS

- "tCO_2" corresponds to the emission of CO_2 related to the scope 1+2 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the emissions released to the atmosphere.

- "t primary chemical" corresponds to the mass of chemicals supplied in tons.

If the CO_2 emissions from operated Joint-Ventures (JVs) are reported in the Scope 1+2 by the company, they should be reported in this indicator as well.

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on the Future Action ratio (A_{future}) which represents the ratio between the company's future (reporting year plus 5 years) emissions from material investment trend gradient and the company's future benchmark (reporting year plus 5 year) emission trend gradient. Below you can find a figure illustrating the case for Type A companies in emissions intensity.

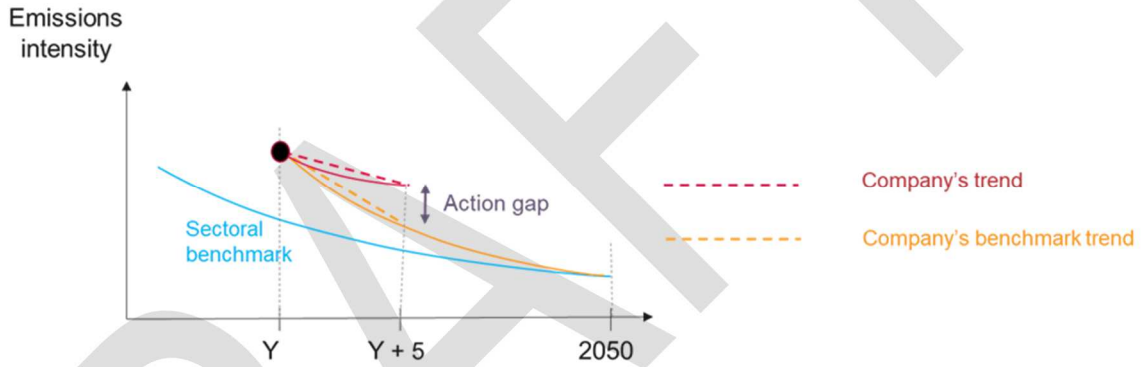


FIGURE 12: COMPARISON OF TREND IN FUTURE EMISSIONS AND TREND IN COMPANY'S BENCHMARK (EXAMPLE WHERE SECTORAL PATHWAY IS AVAILABLE)

CALCULATION OF SCORE:

Future Action ratio (A_{future}) is calculated by dividing the company's future emission from material investment trend (between reporting year and reporting year plus 5 years) and the future benchmark emission (between reporting year and reporting year plus 5 years):

$$A_{future} = \frac{E_c(Y_R) - E_c(Y_{R+5})}{E_B(Y_R) - E_B(Y_{R+5})}$$

where $E_c(Y_R)$ is the company emission at reporting year, $E_c(Y_{R+5})$ is the company emission at reporting year plus 5 years, $E_B(Y_R)$ is the benchmark emission at reporting year and $E_B(Y_{R+5})$ is the benchmark emission at reporting year plus 5 years.

The action gap of the company is equal to $(1 - A_{future})$. Thus, when the company's future emissions pathway is aligned on the company's benchmark, the Future Action ratio is equal to 1 and the action gap is 0.

The final score assigned to the indicator is calculated as follows (see 10.3 for a graphic illustration of the different cases):

Conditions	Score
$Company's\ future\ trend > 0$ Increase in company emissions	0%
$Company's\ future\ trend \leq 0$ et $E_C(Y_R) > E_B(Y_{R+5})$ $0 \leq A_{future} \leq 1$ Decrease in company emissions but company's pathway does not go beyond the company's benchmark ambition	$A_{future} \times 100\%$
$Company's\ future\ trend < 0$ $A_{future} > 1$ Decrease in company emissions and company's pathway equals or exceeds the company's benchmark ambition	100%
$Company's\ future\ trend \leq 0\ and\ E_C(Y_R) \leq E_B(Y_{R+5})$ No increase in company emissions and company's emissions is already below the company's benchmark ambition for year+5.	100%

If the company has several types of assets, the consolidation of the scores assigned to each type of assets will be based on the share of emissions covered by the assets.

RATIONALE

CH 2.2 TREND IN FUTURE SCOPE 1+2 EMISSIONS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

Trends in future emissions from material investment are included in this ACT methodology for the following reasons:

- The trend shows the speed at which the company needs to reduce its emissions for the coming years. Comparing this to the low-carbon benchmark pathway gives an indication of the scale of the change that needs to be made within the company to bring it onto a low-carbon pathway.
- ACT aims to be future-oriented. Therefore, this particular indicator, with projected emissions, forms part of a holistic view of company emissions performance in the past, present, and future.

SCORING RATIONALE

Comparing the trends gives a direct measure of the future action gap of the company. It was chosen for its relative simplicity in interpretation; it is aligned with most of the other forward-looking indicators. Indeed, the indicator looks at a fix point in the future and assesses the capacity of the company to deploy a range of low-carbon assets in the short term.

- **CH 2.3 EMISSIONS LOCKED-IN FROM MATERIAL INVESTMENT**

DESCRIPTION & REQUIREMENTS

CH 2.3 EMISSIONS LOCKED-IN FROM MATERIAL INVESTMENT

SHORT DESCRIPTION OF INDICATOR

Measure of the company's cumulative GHG emissions implied by the company's installed and planned assets over a 15-years period from the reporting year. These locked-in emissions are compared to a theoretical portfolio with a similar locked activity per year and benchmark emissions

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- For all existing and planned assets (for the next 15 years): Asset name, Geographic Location (country level), Plant type, Technology, Fuel mix, Status, Total capacity (ton), Active capacity (ton), Emissions factor (metric tonnes CO_2e/t chemical), Year of commissioning, Expected lifetime (years), Decommissioning or modernization year, if planned, Ownership stake (%), Attributable to reporting boundary (%)

CDP Questionnaire 2021 mapping to this indicator:

- C7.3b (scope 1 asset-level data)
- C7.6b (scope 2 asset-level data)

In case of difficulties for the company to provide these pieces of information, the ACT framework may mobilize 3rd party databases to provide an estimate of these production data series, aggregated by chemicals and company.

Company Assets

1. Production plants at the date of reporting
2. Under development plants at the date of reporting

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on the ratio between the company's installed and planned emissions for the 15 years after the reporting year $LE_F(y_r + 15)$, and the emissions budget entailed by the company's carbon budget B(t) over the same period of time.

$LE_F(t)$ is calculated as the total cumulative emissions implied by the lifetimes of currently active and confirmed planned assets that are going to be commissioned soon. If unknown, the commissioning year of projects is estimated from the project status (e.g. bidding process, construction, etc.) and data on typical project periods by plant type.

$LE_F(y_r + 15)$ is calculated as the company's locked-in carbon emissions, up to reporting year + 15 years, which is derived by taking the area under the company's future locked-in emissions curve. This curve in turn is derived from the company's intensity pathway CA_G, multiplied by activity A_G:

$$LE_F(t) = \int_{from\ the\ reporting\ ear}^{t} A_G * CA_G$$

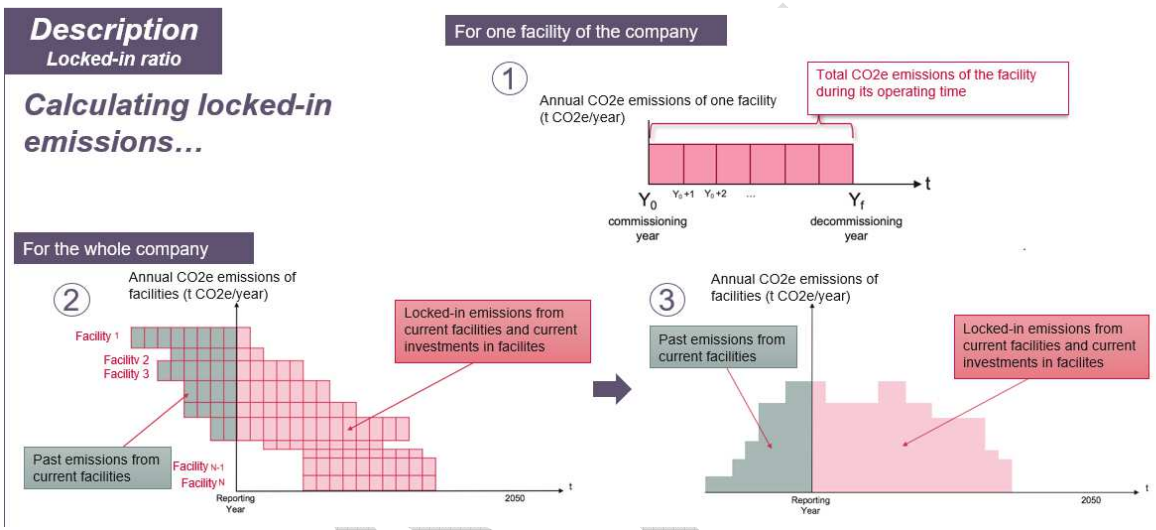


FIGURE 13 : COMPUTING LOCKED-IN EMISSIONS FROM FACILITY

$B(y_r + 15)$ is calculated as the company's carbon budget up to reporting year + 15 years, which is derived by taking the area under the absolute emissions reduction curve. This curve is derived from the company benchmark pathway ($CB_{Scopes12}$) by multiplying it by the projected activity A_P for the company:

$$B(t) = \int_{the\ reporting\ year}^{t} A_P * CB_{Scope12}$$

The company's benchmark is computed from the company's current emissions at reporting year and the level of carbon emissions defined by the sectoral benchmark presented in section. The carbon budget is illustrated in Figure 14 below.

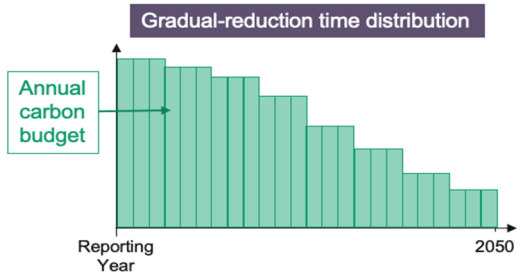


FIGURE 14 : CARBON BUDGET DERIVED FROM THE COMPANY'S BENCHMARK

Depending on the data availability, the computation of these areas may not be as straightforward as the equations shown and will be done by approximation, but the principles will hold.

The locked-in ratio (r_{LB}) is illustrated in Figure 15 and calculated as follows:

$$r_{LB}(t) = \frac{LE_F(t)}{B(t)}$$

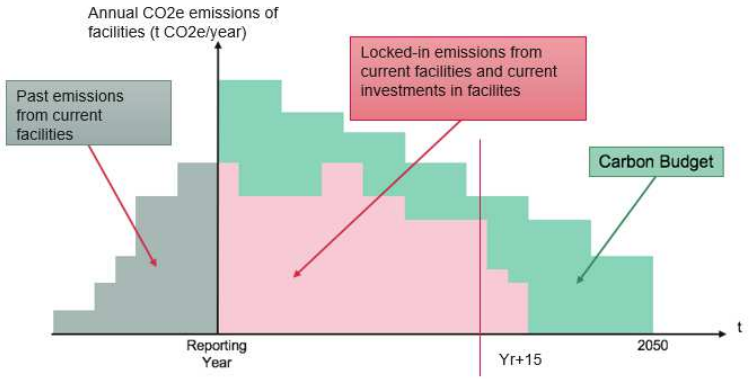


FIGURE 15 : ILLUSTRATION OF THE LOCKED-IN RATIO

To be able to give a score regarding the amount of carbon budget consumed, the level of activity performed with the existing and planned assets needs to be taken into account. Therefore, in a similar way to locked-in emissions, the level of activity that the company is able to perform thanks to the existing and planned assets, per year. It is called the secured activity and is illustrated in Figure 16.

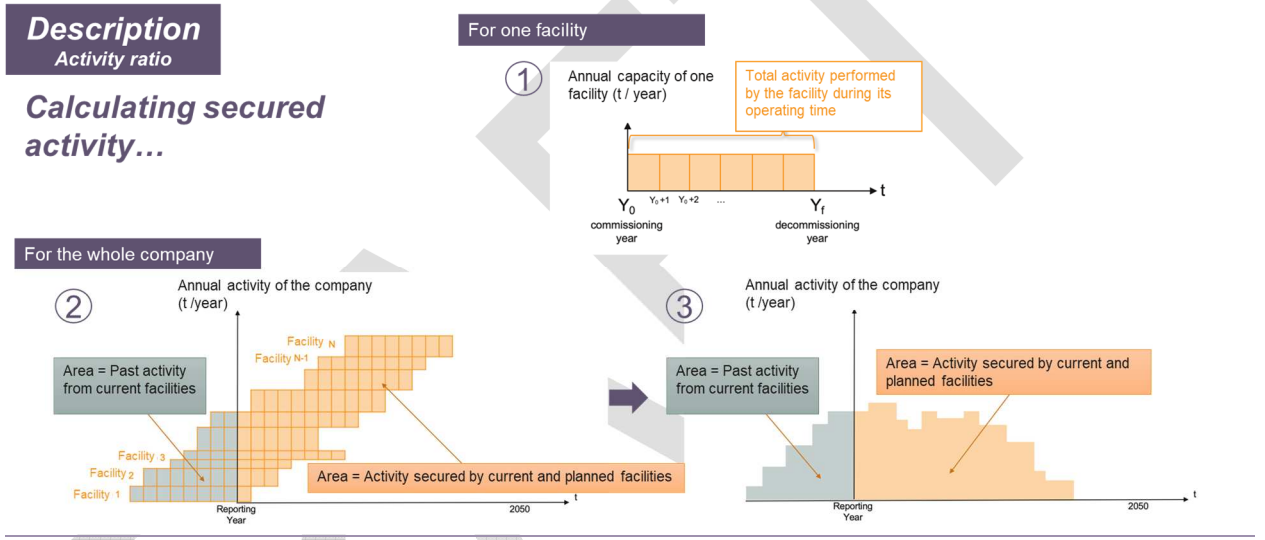


FIGURE 16 : SECURED ACTIVITY BY THE COMPANY

The secured activity is compared to the level of activity projected by the company up to reporting year + 15 years. If the company does not have any projections or not up to reporting year + 15 years, it will be considered that its market share will remain constant and its activity will evolve at the same rate as the sector and sectoral projection of activity are used. The company's projected activity is illustrated in Figure 17**Erreur ! Source du renvoi introuvable.**.

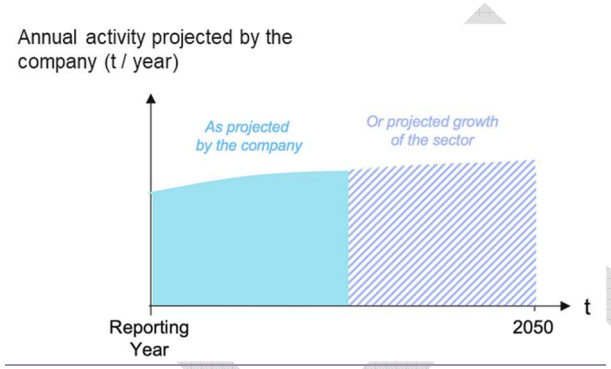


FIGURE 17 : PROJECTED ACTIVITY

The secured activity ratio $r_{SA}(y_r + 15)$ compares the secured activity up to $(y_r + 15)$ with the projected activity up to $(y_r + 15)$. It is illustrated in Figure 18.

$$r_{SA}(y_r + 15) = \frac{A_S(y_r + 15)}{A_P(y_r + 15)}$$

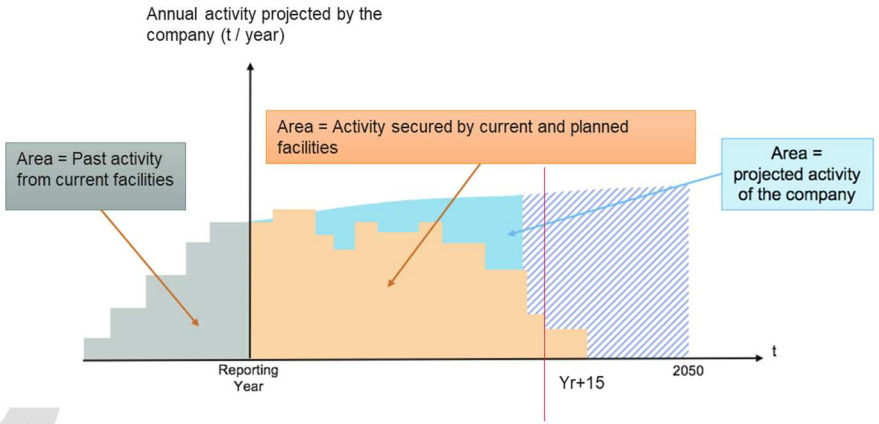


FIGURE 18 : SECURED ACTIVITY RATIO

CALCULATION OF THE SCORE:

r_{SA} is used as a threshold value for the scoring:

$r_{SA} < 1$: More investments will be needed	
Value of r_{LB}	**Score**
$r_{LB} \leq r_{SA}$	100%
$r_{SA} < r_{LB} < 1.5$	$\frac{r_{LB} - 1.5}{r_{SA} - 1.5}$
$r_{LB} \geq 1.5$	0%

This means that if the company has planned its activity and its locked-in emissions are lower than the carbon budget, it gets 100%, but if the locked-in emissions exceed by more than 50% its carbon budget, it gets 0%.

The case $r_{SA} > 1$ is unlikely to happen as the company is unlikely to have existing or planned assets able to meet or exceed the projection of activity until $(y_r + 15)$.

RATIONALE

CH 2.3 EMISSIONS LOCKED-IN FROM MATERIAL INVESTMENT

RELEVANCE OF THE INDICATOR:

RATIONALE OF THE INDICATOR

Locked-in emissions are included in this ACT methodology for the following reasons:

- Absolute GHG emissions over time are the most relevant measure of emissions performance for assessing a company's contribution to global warming. Furthermore, the concept of locked-in emissions allows a judgement to be made about the company's outlook in more distant time periods than ones of the investment plans.
- Analysing a company's locked-in emissions alongside science-based budgets also introduces the means to scrutinise the potential cost of inaction, including the possibility of stranded assets.

- Examining absolute emissions, along with recent and short-term emissions intensity trends, forms part of a holistic view of a company's emissions performance in the past, present, and future.

- The approach using the secured-activity ratio is a coherence check between the company's ambition for emissions reduction, and its investments (and the inevitable emissions associated). It allows showing the leeway for future investments and alerts for the cost of inaction and the risk of stranded assets.

SCORING RATIONALE

The only data coming in is provided by the asset dataset: currently active plants, new plants and modernization / retrofit plans that are 'in the pipeline' (which can be estimated to become active in the short-term).

When a plant reaches the end of its estimated lifetime, no replacement is assumed because those decisions have not been made yet. In fact, chemical plants are not often decommissioned but more modernized with new important equipment, so the lifetime of the asset is assumed to be the average lifetime of the process equipment, which is around 30 years.

Hence, the locked-in emissions calculated are the locked-in emissions of committed (existing and under development) plants only. The indicator describes the proportion of their budget (computed from the reporting year for 15 years ahead) that will be used up by committed activity.

Unlike the 'gap' and 'trend' comparisons done in all other quantitative indicators, this indicator compares two areas: that of the carbon budget until t and the locked-in emissions until t. It is expected that companies will exceed their budget when it is in the short-term future but will not when it is in the long-term future. However, any short-term exceedance will have to be compensated for in later time periods. This is called carbon budget displacement, which makes the company's actual decarbonization pathway steeper than the original benchmark. There is a dimension of risk from inaction here.

When the company exceeds its full carbon budget up to (yr+15), it will not be able to displace enough carbon from later time periods to nearer ones and will be faced with stranded assets when the current lifetime estimates are held up. This is a major problem, and this situation will certainly result in a zero score.

When companies are closer to their carbon budget than others, they will be less flexible in their future strategy as there is more pressure to change their equipment on a plant (modernization of a kiln for example). There is also less room for refurbishment to extend the lifetimes of existing assets as this carries the risk of exceeding the carbon budget. Therefore, there is rationale for intermediate scoring levels that magnify this level of risk due of future flexibility in the future.

NOTE ON CALCULATING LE_F AND B:

Where data on plant emissions intensity is unavailable at the asset level (requested in CH 2A), default factors are applied and are the median of the range of values published in annex A.III. 4.2.1 of IPCC. Data on typical project periods by plant type is also obtained from this source. Where plant lifetime information is unavailable (requested in CH 2A), the median of known lifetimes in Chemicals will be applied. The rationale for using these sources is that the medians are built on comprehensive samples of data.

- **CH 2.4 LOW CARBON, MITIGATION CARBON REMOVAL TECHNOLOGIES CAPEX SHARE**

DESCRIPTION & REQUIREMENTS	**CH 2.4 LOW CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES CAPEX SHARE**
SHORT DESCRIPTION OF INDICATOR	A measure of the alignment of the company's planned CAPEX, i.e. investment by the company, for the next five years in low carbon, mitigation and carbon removal technologies with their pathway required in the low-carbon scenario.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Share of CAPEX in low carbon and mitigation technologies (M$/M$) planned for the next 5 years ♦ Share of CAPEX set on investments in carbon removal technologies (CCS, CCU, CDR) (in M$/M$) planned for the next 5 years CDP Questionnaire 2021 mapping to this indicator: ♦ N/A (no data on CAPEX investment is collected by CDP)
HOW THE ASSESSMENT WILL BE DONE	The assessment will assign a maturity score based on the company's share of planned low-carbon, carbon removal and mitigation technologies CAPEX, expressed in a maturity matrix. A company that is placed in the 'aligned' category will receive the maximum score. Companies who are at lower levels will receive a partial score, with 0 points awarded for having no engagement at all. The maturity matrix will be confronted to the road-test to be further calibrated.

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned
Associated score	*0%*	*25%*	*50%*	*75%*	*100%*
What is the sum of the shares of CAPEX invested in Low-Carbon & Mitigation technologies and CCS/CCU technologies (% of CAPEX)?	*Below 5%*	*Between 5% and 10%*	*Between 10% and 20%*	*Between 20% and 50%*	*Above 50%*

This maturity matrix is indicative but does not show all possible options that can result in a particular score. Companies' responses will be scrutinized by the analyst and then placed on the level in the matrix where the analyst deems it most appropriate.

DEFINING 'LOW-CARBON TECHNOLOGIES':

Low-carbon technologies are technologies that produce final product with a lower carbon content. They encompass:

- Technologies enabling the incorporation of secondary raw material or bio-based feedstock in the chemical products.
- Technologies substantially reducing the carbon content of the chemical product
- Technologies that substantially reduce the energy consumption or GHG emissions of the clients

To be considered a low-carbon technology, the technology must meet the criteria defined by the EU Green Taxonomy, which defines low carbon technologies as resulting in substantial GHG emission reductions in other sectors of the economy, provided that product related emissions are at least the level of best available techniques[14].

DEFINING 'MITIGATION TECHNOLOGIES':

Mitigation technologies are technologies that reduce the carbon footprint of the operations of the Chemical activities. This includes:

- Energy efficiency technologies

[14] EU Taxonomy – Technical Annex (2017) p162-166

- Technologies to prevent methane, CFC and HFC leakage during the process
- Any other technology that helps reduce the carbon footprint of operations – to be checked by the analyst.

To be considered a mitigation technology, the technology must meet the criteria defined by the EU Green Taxonomy, which defines:

"An economic activity shall be considered to contribute substantially to climate change mitigation where that activity substantially contributes to the stabilization of greenhouse gas concentrations in the atmosphere at a level which prevents dangerous anthropogenic interference with the climate system by avoiding or reducing greenhouse gas emissions or enhancing greenhouse gas removals through any of the following means, including through process or product innovation, consistent with the long term temperature goal of the Paris Agreement."[15]

DEFINING 'CARBON REMOVAL TECHNOLOGIES':

Carbon removal technologies are technologies able to capture in a non-reversible way the carbon dioxide for storage or usage.

For further inputs on technologies that can be considered low-carbon and mitigation ones see the Best Available Techniques (BATs) from the "Energy efficiency and GHG emissions : Prospective scenarios for the Chemical and Petrochemical Industry" document by the JRC and the "Low carbon energy and feedstock for the European chemical industry" by DECHEMA.

RATIONALE

CH 2.4 LOW CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES CAPEX SHARE

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

Investments planning related to the company's low-carbon and mitigation technologies and carbon removal technologies CAPEX are included in this ACT methodology as CAPEX planification is an indicator of corporate commitment to a low-carbon transition, and is a meaningful metric of the company's internal planning towards the transition.

Although this indicator may be based on a specific ratio in other ACT methodologies, no benchmarks are available for this sector. Therefore, thresholds have been defined accordingly.

[15] EU Taxonomy – Technical Annex (2017) p15

- **CH 2.5 ENERGY MANAGEMENT**

DESCRIPTION & REQUIREMENTS

CH 2.5 ENERGY MANAGEMENT

SHORT DESCRIPTION OF INDICATOR

A measure of the company's energy management actions at the reporting year. The indicator will evaluate the implementation of global recommendations to decarbonize the assets consuming energy.

DATA REQUIREMENTS

The question comprising the information request that are relevant to this indicator is:

- Energy demand in Coal, Oil, Natural gas, Electricity, Imported heat, Hydrogen, Bioenergy and other renewable energy for the last five years and the coming five ones.
- For all existing and planned assets: Asset name, Geographic Location (country level), Plant type, Technology, Fuel mix, Status, Total capacity (ton), Active capacity (ton), Emissions factor (metric tons CO_2e/t chemical), Year of commissioning, Expected lifetime (years), Decommissioning or modernization year, if planned, Ownership stake (%), Attributable to reporting boundary (%)
- Energy consumption targets
- Action plan regarding energy management
- Share of certified renewable energy (Renewable Energy Certificate, Power Purchase Agreement …)

CDP Questionnaire 2021 mapping to this indicator:

- C8.2: Energy-related activities undertaken by organization
- C8.2a: Organization's energy consumption totals
- C-CH8.2a: Organization's energy consumption totals (sectoral question)
- C8.2e: Amounts of electricity that were accounted for at a zero-emission factor in scope 2

HOW THE ASSESSMENT WILL BE DONE

CALCULATION OF SCORE:

To be ready for the transition to a low-carbon economy, chemical companies need to plan and carry out energy management to reduce GHG emissions of their assets (especially chlorine and hydrogen producers regarding electricity management).
The maturity matrix used for the assessment is the following:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub-score
Associated score	0%	25%	50%	75%	100%	
Has the company taken actions to reduce energy consumption during the past 5 years?	There are no reported actions	Actions have been taken to reduce 5% of the energy consumption so far	Actions have been taken to reduce 10% of the energy consumption so far	Actions have been taken to reduce 20 % of the energy consumption so far	Actions have been taken to reduce 30% of the energy consumption so far	20%
Does the company plan to take actions to reduce energy consumption in the next five years?	There are no reported actions planned	Actions are planned to reduce the energy consumption by 5%	Actions are planned to reduce the energy consumption by 10%	Actions are planned to reduce the energy consumption by 20%	Actions are planned to reduce the energy consumption by 30%	20%
Is the action plan robust enough?	No roadmap and resources affected to this objective		Roadmap set		Public target, financial resources and detailed roadmap set	10%
Does the company source its energy from low-carbon sources?	No knowledge of carbon content of energy used	25% of energy consumption used is low-carbon as defined by the EU taxonomy	50% of energy consumption used is low-carbon as defined by the EU taxonomy	75% of energy consumption used is low-carbon as defined by the EU taxonomy	90% of energy consumption used is low-carbon as defined by the EU taxonomy	20%
Does the company take actions to use low-carbon electricity?	No knowledge of carbon content of electricity used or less than 30%	30% of electricity consumption used is low-carbon as defined by the EU taxonomy for on-site generation 30% of electricity is low-carbon	45% of electricity consumption used is low-carbon as defined by the EU taxonomy for on-site generation 45% of electricity is low-carbon	60% of electricity consumption used is low-carbon as defined by the EU taxonomy for on-site generation 60% of electricity is low-carbon	At least 80% of electricity consumption used is low-carbon as defined by the EU taxonomy for on-site generation At least 80% of electricity is low-carbon	15%

What is the policy of the company regarding the development of green electricity?	No certification for electricity (grid)	GO or REC	PPA	PPA that guarantees the development of a new renewable electricity source without public funding	PPA that guarantees the development of a new renewable electricity source without public funding And on-site production of renewable electricity that covers at least 10% of the electricity consumption of the company	15%

A company that is placed in the 'Low-carbon aligned' category receives the maximum score. Companies that are at lower levels receive a partial score, with 0 points awarded for having no engagement at all. If the company use several types of energy for the production of heat, steam or power, the consolidation of the scores assigned to each type of energy will be based on the share of energy consumption.

RATIONALE

CH 2.5 ENERGY MANAGEMENT

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

The first goal of this indicator was to integrate the specificity of electrolysis-based productions which are very electric-intensive. The scope was extended to the overall energy demand of companies. Indeed, various processes within the chemical sector are based on a consumption of energy sources other than electricity.

SCORING RATIONALE

The scoring aims at assessing past reduction in energy consumption implemented by the company during the last five years, actions planned in the near future and the integration of low-carbon energy in the overall energy consumption of the company.

INTANGIBLE INVESTMENT (WEIGHTING: 5-10%)

- **CH 3.1 R&D SPENDING IN LOW-CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES**

DESCRIPTION & REQUIREMENTS

CH 3.1 R&D SPENDING IN LOW-CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES

SHORT DESCRIPTION OF INDICATOR

A measure of the ratio of R&D costs/investments in low-carbon, mitigation and carbon removal technologies. The indicator identifies the ratio between the company's R&D investment in low-carbon, mitigation and carbon removal technologies and total R&D investments.

DATA REQUIREMENTS

Relevant and external sources of data used for the assessment of this indicator:

- R&D costs/investments in low-carbon, mitigation and carbon removal technologies of the company.
- Total R&D costs/investments of the company

CDP Questionnaire 2021 mapping to this indicator:

- C C-CH9.6a: Organization's investments in low-carbon R&D

HOW THE ASSESSMENT WILL BE DONE

R&D INVESTMENT SHARE

The assessment is based on the ratio of the company's 'average annual R&D expenditure on low-carbon, mitigation and carbon removal technologies' to the company's 'average total annual capital expenditure in R&D'. The average expenditures are computed over the three years prior to the ACT assessment.

See module 2.4 for the definition of low-carbon, mitigation and carbon removal technologies.

FINAL SCORE

The ratio will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for companies indicating a higher level of maturity, which means a higher share in R&D costs/investments in these technologies.

The matrix is provided below:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned
Associated score	0%	25%	50%	75%	100%
What is the share of R&D costs/investments in low-carbon, mitigation and carbon removal technologies compared to the total R&D costs/investments?	The share of low-carbon R&D is below 20% of total R&D investments	The share of low-carbon R&D is between 21% and 40% of total R&D investments	The share of low-carbon R&D is between 41% and 60% of total R&D investments	The share of low-carbon R&D is between 61% and 80% of total R&D investments	The share of low-carbon R&D is above 80% of total R&D investments.

RATIONALE

CH 3.1 R&D SPENDING IN LOW-CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

R&D spending in low-carbon technologies is included in the ACT Chemicals assessment for the following reasons:

- To enable the transition, the sector where there are technological stakes relies heavily on the development of low-carbon solutions to replace its currently high emitting systems
- R&D is one of the main proactive action to develop these technologies.
- R&D is also one of the main tools to reduce the costs of a technology in order to increase its market penetration.
- Aside from technology, companies can also invest into R&D on operational practices to optimize the carbon impact where they have direct responsibility.
- Lastly, the R&D investment of a company into non-mature technologies and practices allows for direct insight in the company's commitment to alternative technologies that may not currently be part of its main business model.

Although this indicator may be based on a specific ratio in other ACT methodologies, no benchmarks are available for this sector. Therefore, thresholds have been defined accordingly.

RELEVANCE OF THE INDICATOR'S 3-YEAR TIME HORIZON

In order to prevent the calculated score from being too dependent on the conjuncture in the year of the ACT assessment, the average annual expenditure over the previous three years is adopted.

- **CH 3.2 Company Low-carbon Patenting Activity**

Description & Requirements

CH 3.2 Company low-carbon patenting activity

Short description of indicator

A measure of the company patenting activity related to low-carbon technologies. The indicator identifies the ratio between the company's patent activity for the last 5 years and average patenting activity linked to climate change of the sector.

Data requirements

Relevant and external sources of data used for the assessment of this indicator:

- Patenting activity in climate change mitigation technologies of the company over the last 5 years.
- Total patenting activity of the company over the last 5 years

CDP Questionnaire 2021 mapping to this indicator:

- N/A (no data on patenting activity is collected by CDP)

How the assessment will be done

Past low-carbon patents activity ratio

The assessment is based on the ratio of the company's patenting activity dedicated to climate change mitigation technologies over the last 5 years to the company's total patenting activity over the same span of time. If the company is developing open-source patents or makes them publicly available, this should be positively reflected in the narrative score.

Defining Climate Change Mitigation Technologies Patents:

The indicator focuses on patents that mitigate climate change. The European Patent Office (EPO) and the US Patent and Trademark Office (USPTO) have developed a dedicated patent classification scheme (Cooperative Patent Classification - CPC) which details patents for climate change mitigation or technologies:

Y02B – CCMTs related to buildings
Y02C – Capture, storage, sequestration or disposal of greenhouse gases
Y02E – Reduction of greenhouse gas emissions, related to energy generation, transmission or distribution
Y02P – CCMTs relating to production in energy intensive industries
Y02T – CCMTs related to transportation
Y02W – CCMTs related to wastewater treatment or waste management

(EPO, 2017)

Final Score

The ratio will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for companies indicating a higher level of maturity, which means a higher share in Climate Change Mitigation Technologies (CCMTs) patenting activity.

The matrix is provided below:

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Subscore
Associated score	0%	25%	50%	75%	100%	
What is the share of patents in climate change mitigation technologies (CCMTs) compared to the total patent activity over the last 5 years?	The share of CCMTs patents is below 20% of total patents	The share of CCMTs patents is between 21% and 40% of total patents	The share of CCMTs patents is between 41% and 60% of total patents	The share of CCMTs patents is between 61% and 80% of total patents	The share of CCMTs patents is above 80% of total patents	***80%***
Are the technologies patented in open source?	No, they are not		Yes, some are		Yes, 100% are	***20%***

RATIONALE

CH 3.2 COMPANY LOW-CARBON PATENTING ACTIVITY

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

The indicator on CCMTs patenting activity is complementary to the one dedicated to R&D in low-carbon technologies, as it monitors the technology diffusion whereas R&D expenditures monitor the technology development. It is included in this ACT Chemicals methodology for the following reasons:

- To enable the transition, the sector where there are technological stakes relies heavily on the development of low-carbon solutions to replace its currently high emitting systems
- Patent data are commensurable because patents are based on an objective standard (OECD 2015)
- Patent data measure intermediate outputs of an inventive process, where R&D data expenditures measure the input (OECD 2015)
- Patent data can be disaggregated into specific technological fields (OECD 2015)

RELEVANCE OF THE INDICATOR'S 5-YEAR TIME HORIZON

Patents applications are typically disclosed 18 months after their filing date (OECD 2015). To avoid the effects of this "publication lag" and smooth the ratio used for the assessment, the indicator monitors the last 5 years of the company's patenting activity.

SOLD PRODUCT PERFORMANCE (WEIGHTING 2-25%)

- **CH 4.1 PAST PERFORMANCE - SCOPE 1+2+3 EMISSIONS**

DESCRIPTION & REQUIREMENTS

CH 4.1 PAST PERFORMANCE – SCOPE 1+2+3 EMISSIONS

SHORT DESCRIPTION OF INDICATOR

A measure of the alignment of the company's past sold or purchased product absolute emissions trend with its low-carbon benchmark pathway. The indicator will compare the gradient of this trend over a 5-year period to the reporting year (reporting year minus 5 years) with the low-carbon benchmark pathway trend over a 5-year period after the reporting year.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Sold product absolute emissions and activity at reporting year and Y-5. Absolute emissions shall encompass at least:
  - Process- and energy-related emissions (scope 1 & 2)
  - Raw material emissions (scope 3 upstream)
  - Transport-related emissions (scope 3 upstream and downstream)

When not directly available, emissions can be estimated from secondary data and default modelling parameters (such as the ADEME Base Carbone)
CDP Questionnaire 2021 mapping to this indicator:

- C6.1: Gross scope 1 CO_2e emissions for reporting year and over the past 3 years
- C6.3: Gross scope 2 CO_2e emissions for reporting year and over the past 3 years
- C6.5: Gross Scope 3 CO_2e emissions for reporting year

Note that only Type B products are evaluated by this indicator here (which means no evaluation for Type A companies as there is a 0% weighting on this indicator, and assessment on the volume of type B products for integrated companies).

The benchmark indicators involved are:

TRENDS	VALUE CHAIN	METRIC	BENCHMARK

Scope 1+2+3 absolute emissions	Type B	tCO_2e	IPCC 1.5DS
Scope 1+2+3 absolute emissions on type B products only	Integrated	tCO_2e	IPCC 1.5DS

- tCO_2e" corresponds to the emission of CO_2 equivalent related to the Scope 1+2+3 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the CO_2 emissions released to the atmosphere.

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on the Past Action ratio (A_{past}) which represents the ratio between the company's recent (reporting year minus 5 years) absolute emissions from product performance trend gradient and the company's benchmark recent (reporting year minus 5 years) absolute emission from product performance trend gradient.

Same computation as indicator 2.1 Past performance / dimension 1 (Type B products).

RATIONALE

CH 4.1 PAST PERFORMANCE – SCOPE 1+2+3 EMISSIONS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

Past performance is included in this ACT methodology for the following reasons:

- The trend shows the speed at which the company has been reducing its absolute emissions over the recent past. Comparing this to the low-carbon transition pathway gives an indication of the scale of the change that needs to be made within the company to bring it onto a low-carbon pathway.
- While ACT aims to be as future-oriented, it nevertheless does not want to solely rely on projections of the future, in a way that would make the analysis too vulnerable to the uncertainty of those projections. Therefore, this measure, along with projected absolute emissions intensity and absolute emissions, forms part of a holistic view of company emissions performance in the past, present, and future.

SCORING RATIONALE

While ‘gap type’ scoring is preferred for any indicator where possible, this indicator looks at past emissions and would therefore require a different baseline in order to generate a gap method. Consequently, ‘trend type’ scoring is preferred here. Another advantage of the trend analysis is that it does not require the use of a ‘business as usual’ pathway to anchor the data points and aid interpretation, as trends can be compared directly, and a score can be generated from the resulting ratio.

- **CH 4.2 Trend in future Scope 1+2+3 product specific performance**

Description & Requirements

CH 4.2 Trend in future Scope 1+2+3 product specific performance

Short description of indicator

A measure of the alignment of the company’s future sold or purchased product absolute emissions trend with its low-carbon benchmark pathway. The indicator will compare the gradient of this trend with the low-carbon benchmark pathway trend over a 5-year period after the reporting year.

Data requirements

The relevant data for this indicator are:

- Sold product absolute emissions and activity at reporting year and projected for Y+5. Absolute emissions shall encompass at least:
  - Process- and energy-related emissions (scope 1 & 2)
  - Raw material emissions (scope 3 upstream)
  - Transport-related emissions (scope 3 upstream and downstream)

When not directly available, emissions can be estimated from secondary data and default modelling parameters (such as the ADEME Base Carbone)

CDP Questionnaire 2021 mapping to this indicator:

- C6.1: Gross scope 1 CO_2e emissions for reporting year
- C6.3: Gross scope 2 CO_2e emissions for reporting year
- C6.5: Gross Scope 3 CO_2e emissions for reporting year
- Future emissions data is not collected by CDP

Note that only Type B products are evaluated by this indicator here (which means no evaluation for Type A companies as there is a 0% weighting on this indicator, and assessment on the volume of type B products for integrated companies).

The benchmark indicators involved are:

TRENDS	VALUE CHAIN	METRIC	BENCHMARK
Scope 1+2+3 absolute emissions	Type B	tCO_2e	IPCC 1.5DS
Scope 1+2+3 absolute emissions on type B products only	Integrated	tCO_2e	IPCC 1.5DS

- 'tCO_2e" corresponds to the emission of CO_2 equivalent related to the Scope 1+2+3 of the company. The emissions are gross emissions, except for the case where CCS or CCU is implemented within operational scope and thus reduces the CO_2 emissions released to the atmosphere.

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on the Future Action ratio (A_{future}) which represents the ratio between the company's future (reporting year plus 5 years) sold or purchased product absolute emissions trend gradient and the company's future benchmark (reporting year plus 5 year) product absolute emission trend gradient.

Same computation as indicator 2.2 Trend in future emissions

RATIONALE

CH 4.2 TREND IN FUTURE SCOPE 1+2+3 PRODUCT SPECIFIC PERFORMANCE

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

Trends in future products specific performance are included in this ACT methodology for the following reasons:

- The trend shows the speed at which the company needs to reduce its absolute emissions for the coming years. Comparing this to the low-carbon benchmark pathway gives an indication of the scale of the change that needs to be made within the company to bring it onto a low-carbon pathway.

- ACT aims to be future-oriented. Therefore, this particular indicator, with projected absolute emissions, forms part of a holistic view of company emissions performance in the past, present, and future.

Scoring rationale

Comparing the trends gives a direct measure of the future action gap of the company. It was chosen for its relative simplicity in interpretation; it is aligned with most of the other forward-looking indicators. Indeed, the indicator looks at a fix point in the future and assesses the capacity of the company to deploy a range of low-carbon products in the short term.

CH 4.3 Ammonia Feedstock

Description & Requirements

CH 4.3 Ammonia feedstock

Short description of indicator

The indicator aims at assessing alignment of the feedstock used for ammonia production to a below 2°C scenario.

Data requirements

The relevant data for this indicator is the share of ammonia produced from electrolysis-based hydrogen.

CDP Questionnaire 2021 mapping to this indicator:

- C C-CH8.3b: Feedstock source (sectoral question)

How the assessment will be done

The share of low-carbon feedstock will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for companies indicating a higher level of maturity, which means a higher share of electrolysis-based hydrogen as feedstock for the production of ammonia.

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Subscore
Associated score	0%	25%	50%	75%	100%	

What is the share of ammonia produced with electrolysis-based hydrogen?	The share of ammonia produced with electrolysis-based hydrogen is below 5% of total weight of ammonia sold	The share of ammonia produced with electrolysis-based hydrogen is below 15% of total weight of ammonia sold	The share of ammonia produced with electrolysis-based hydrogen is below 30% of total weight of ammonia sold	The share of ammonia produced with electrolysis-based hydrogen is below 50% of total weight of ammonia sold	The share of ammonia produced with electrolysis-based hydrogen is above 50% of total weight of ammonia sold	**50%**
Out of the hydrogen produced through electrolysis, what is the share that comes from low-carbon electricity sources?	**Less than 25% or unknown**	**25% to 49%**	**50% to 70%**	**71% to 90%**	More than 91%	**50%**

RATIONALE

CH 4.3 AMMONIA FEEDSTOCK

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

The indicator aims at addressing the specificities of ammonia production. Almost 100%[16] of hydrogen used as an input for the production of ammonia through the Haber-Bosch process today comes from fossil fuels. As decarbonizing the ammonia production cannot be performed without defossilizing its feedstock, this indicator accounts for the share of feedstock derived from electrolysis for its lower carbon content.

Note that other feedstocks are possible to reduce the carbon footprint of the chemical production – these will be recognized under other indicators (such as CH 2.2, 4.1, 4.2, etc.)

SCORING RATIONALE

[16] https://www.lelementarium.fr/product/ammoniac/

The Clean Technology Scenario for Europe (IEA, The Future of Petrochemicals, 2018) was used as a benchmark to provide the low-carbon aligned threshold of the maturity matrix.

• CH 4.4 Methanol Feedstock

Description & Requirements

CH 4.4 Methanol feedstock

Short description of indicator

The indicator aims at assessing alignment of the feedstock used for methanol production to a below 2°C scenario.

Data requirements

The relevant data for this indicator is the share of methanol produced from electrolysis-based hydrogen.

CDP Questionnaire 2021 mapping to this indicator:

- C C-CH8.3b: Feedstock source (sectoral question)

How the assessment will be done

The share of low-carbon feedstock will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for companies indicating a higher level of maturity, which means a higher share of electrolysis-based hydrogen as feedstock for the production of methanol.

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Subscore
Associated score	0%	25%	50%	75%	100%	
What is the share of methanol produced with electrolysis-based hydrogen ?	The share of methanol produced with electrolysis-based hydrogen is below 10% of	The share of methanol produced with electrolysis-based hydrogen is below 25% of	The share of methanol produced with electrolysis-based hydrogen is below 45% of	The share of methanol produced with electrolysis-based hydrogen is below 75% of	The share of methanol produced with electrolysis-based hydrogen is above 75% of total weight of methanol sold	**50%**

	total weight of methanol sold	total weight of methanol sold	total weight of methanol sold	total weight of methanol sold		
Out of the hydrogen produced through electrolysis, what is the share that comes from low-carbon electricity sources?	Less than 25% or unknown	25% to 49%	50% to 70%	71% to 90%	More than 91%	**50%**

RATIONALE

CH 4.4 METHANOL FEEDSTOCK

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

The indicator aims at addressing the specificities of methanol production. Almost all of hydrogen used as an input for the production of methanol today comes from fossil fuels[17]. As decarbonizing the methanol production cannot be performed without defossilizing its feedstock, this indicator accounts for the share of feedstock derived from electrolysis for its lower carbon content.

Note that other feedstocks are possible to reduce the carbon footprint of the chemical production – these will be recognized under other indicators (such as CH 2.2, 4.1, 4.2, etc.)

SCORING RATIONALE

The Clean Technology Scenario for Europe (IEA, The Future of Petrochemicals, 2018) was used as a benchmark to provide the low-carbon aligned threshold of the maturity matrix.

[17] https://www.lelementarium.fr/product/methanol/

- **CH 4.5 High Value Chemicals (HVC) Feedstock**

Description & Requirements	**CH 4.5 HVC feedstock**
Short description of indicator	The indicator aims at assessing alignment of the feedstock used for HVC production to a below 2°C scenario.
Data requirements	The relevant data for this indicator is the share of bio-based HVC produced within HVC sold (by weight). CDP Questionnaire 2021 mapping to this indicator: ♦ C C-CH8.3b: Feedstock source (sectoral question)
How the assessment will be done	The assessment is based on the share of bio-based content (by weight). **Calculation of score:** The share of low-carbon products/services will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for companies indicating a higher level of maturity, which means a higher share of bio-based HVC production. **Defining Bio-based content:** ♦ Bio-based feedstock is eligible if it is produced from the advanced feedstock listed in Part A of Annex IX of Directive (EU) 2018/2001. ♦ The company assessed shall provide elements of proof regarding the provenance of its bio-sourced feedstock (including if the company purchases intermediate chemical product with a percentage of bio-based content incorporated upstream in the value chain) ♦ The analyst will check the robustness of the certifications provided

DEFINING STANDARDS CERTIFYING THE SUSTAINABLE SOURCING OF BIO-BASED FEEDSTOCK:

- A list of international certification schemes that demonstrate compliance with the sustainability criteria for biofuels and biomass as set by Renewable Energy Directive (EU) 2018/2001 are available at the following link: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en.
- The analyst will check the robustness of the certifications provided.

The matrix is provided below:

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Subscore
Associated score	0%	25%	50%	75%	100%	
What is the share of HVC production from bio-based feedstock (% of weight)?	The share of HVC production from bio-based feedstock is below 1% of total weight of products sold	The share of HVC production from bio-based feedstock is below 2% of total weight of products sold	The share of HVC production from bio-based feedstock is below 3% of total weight of products sold	The share of HVC production from bio-based feedstock is below 4% of total weight of products sold	The share of HVC production from bio-based feedstock is above 4% of total weight of products sold	***50%***
Is the sustainable sourcing of the bio-based feedstock purchased by the company certified?	No certification of the sustainable sourcing of the feedstock	The sustainable sourcing of **25% to 49%** of bio-based feedstock purchased by the company is certified by an international standard	The sustainable sourcing of **50% to 70%** of bio-based feedstock purchased by the company is certified by an international standard	The sustainable sourcing of **71% to 90%** of bio-based feedstock purchased by the company is certified by an international standard	The sustainable sourcing of **91% to 100%** of bio-based feedstock purchased by the company is certified by an international standard	***50%***

RATIONALE

CH 4.5 HVC FEEDSTOCK

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

Share of bio-based content in the HVC production of the company is included in this ACT methodology for the following reasons:

- Switching feedstock from fossil-based to bio-sourced material is key to engage the decarbonation of the chemical sector. Incorporation of bio-based content can be measured with the share by weight of the overall material constituting the products sold by the company assessed.
- Sourcing in a sustainable way and incorporating bio-based material within products can prove more energy-intensive than the conventional fossil-based technological route. This increase of energy consumption and associated GHG emissions, whether within the company's perimeter or upstream, will not be captured by this indicator – it will however be reflected in the scope 1-2-3 emissions of indicators 1.2, 4.1 and 4.2 and in the scope 1-2 emissions of indicators 1.1, 2.1 and 2.2.

Note that other feedstocks are possible to reduce the carbon footprint of the chemical production – these will be recognized under other indicators (such as CH 2.2, 4.1, 4.2, etc.)

SCORING RATIONALE

The Clean Technology Scenario for Europe (IEA, The Future of Petrochemicals, 2018) was used as a benchmark to provide the low-carbon aligned threshold of the maturity matrix.

• CH 4.6 RECYCLED CONTENT OF PRODUCTS SOLD

DESCRIPTION & REQUIREMENTS

CH 4.6 RECYCLED CONTENT OF PRODUCTS SOLD

SHORT DESCRIPTION OF INDICATOR

An analysis of the company's share of recycled content within the products sold.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Share of recycled content within the products sold (by weight) at Y

CDP Questionnaire 2021 mapping to this indicator:

- N/A (no data on the recycled content of chemical products is collected by CDP)

How the assessment will be done

The assessment is based on the share of recycled content (by weight).

Calculation of score:

The share of recycled content will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for companies indicating a higher level of maturity, which means a higher share of recycled content in their product.

Defining 'Recycled content':

- Material that has been reprocessed from recovered (reclaimed) material by means of a manufacturing process and made into a final product or into a component for incorporation into a product[18].Both pre-consumer and post-consumer recycling are considered in this indicator.
- CO_2 captured and incorporated back into a chemical product is also considered as recycled content.

Note that a recycled material incorporated at the beginning of the chain continues to be counted as recycled further down the chain. For instance, if company C purchases 1 ton of Input1 which is made of recycled content at 10%, and mixes is with 1 ton of Input2 (no-recycled content), the 2 tons of Output that are obtained are considered to be made of 5% recycled content.

The matrix is provided below:

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned
Associated score	0%	25%	50%	75%	100%
What is the share of recycled content within the products (% of weight)?	The share of recycled content is below 1% of total weight of products sold	The share of recycled content is below 3% of total weight of products sold	The share of recycled content is below 5% of total weight of products sold	The share of recycled content is below 7% of total weight of products sold	The share of recycled content is above 7% of total weight of products sold

[18] Source: https://www.ul.com/insights/interpreting-pre-consumer-recycled-content-claims

RATIONALE

CH 4.6 RECYCLED CONTENT OF PRODUCTS SOLD

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

Share of recycled content in the total product portfolio of the company is included in this ACT methodology for the following reasons:

- Switching feedstock from fossil-based to e.g. secondary raw material is key to engage the decarbonation of the chemical sector. Incorporation of recycled content can be measured with the share by weight of the overall material constituting the products sold by the company assessed.
- Recycling and incorporating secondary raw material within products can prove more energy-intensive than the conventional fossil-based technological route. This increase of energy consumption and associated GHG emissions, whether within the company's perimeter or upstream, will not be captured by this indicator – it will however be reflected in the scope 1-2-3 emissions of indicators 4.1 and 4.2.

Note that other feedstocks are possible to reduce the carbon footprint of the chemical production – these will be recognized under other indicators (such as CH 2.2, 4.1, 4.2, etc.)

- **SCORING RATIONALE**

As there is no quantitative definition available regarding the share of recycled content in the total chemical production, the best way to assess the performance in this indicator is to compare the share of recycled content to a maturity matrix.

With the further development of recycling content in chemicals, quantitative benchmarks are likely to be built. The methodology may be updated to integrate such benchmarks as soon as they are available.

- **CH 4.7 BIO-BASED CONTENT OF TYPE B PRODUCTS SOLD**

DESCRIPTION & REQUIREMENTS

CH 4.7 BIO-BASED CONTENT OF TYPE B PRODUCTS SOLD

SHORT DESCRIPTION OF INDICATOR

An analysis of the company's share of bio-based content within the products sold. The indicator is specific to type B companies

DATA REQUIREMENTS

The relevant data for this indicator are:

- Share of bio-based content within the products sold (by weight) at Y

CDP Questionnaire 2021 mapping to this indicator:

- C C-CH8.3b: Feedstock source (sectoral question)

HOW THE ASSESSMENT WILL BE DONE

The assessment is based on the share of bio-based content (by weight).

CALCULATION OF SCORE:

The share of bio-based feedstock will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for companies indicating a higher level of maturity, which means a higher share of bio-based content in their product.

DEFINING BIO-BASED CONTENT:

- Bio-based feedstock is eligible if it is produced from the advanced feedstock listed in Part A of Annex IX of Directive (EU) 2018/2001.
- The company assessed shall provide elements of proof regarding the provenance of its bio-sourced feedstock (including if the company purchases intermediate chemical product with a percentage of bio-based content incorporated upstream in the value chain)
- The analyst will check the robustness of the certifications provided

DEFINING STANDARDS CERTIFYING THE SUSTAINABLE SOURCING OF BIO-BASED FEEDSTOCK:

- A list of international certification schemes that demonstrate compliance with the sustainability criteria for biofuels and biomass as set by Renewable Energy Directive (EU) 2018/2001 are available at the following link: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en.
- The analyst will check the robustness of the certifications provided.

The matrix is provided below:

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Subscore
Associated score	0%	25%	50%	75%	100%	
What is the share of bio-based content within the products (% of weight)?	The share of bio-based content is below 1% of total weight of products sold	The share of bio-based content is below 3% of total weight of products sold	The share of bio-based content is below 5% of total weight of products sold	The share of bio-based content is below 7% of total weight of products sold	The share of bio-based content is above 7% of total weight of products sold	***50%***
Is the sustainable sourcing of the bio-based feedstock purchased by the company certified?	No certification of the sustainable sourcing of the feedstock	The sustainable sourcing of **25% to 49%** of bio-based feedstock purchased by the company is certified by an international standard	The sustainable sourcing of **50% to 70%** of bio-based feedstock purchased by the company is certified by an international standard	The sustainable sourcing of **71% to 90%** of bio-based feedstock purchased by the company is certified by an international standard	The sustainable sourcing of **91% to 100%** of bio-based feedstock purchased by the company is certified by an international standard	***50%***

RATIONALE

CH 4.7 BIO-BASED CONTENT OF TYPE B PRODUCTS SOLD

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR

Share of bio-based content in the total product portfolio of the company is included in this ACT methodology for the following reasons:

- Switching feedstock from fossil-based to bio-sourced material is key to engage the decarbonation of the chemical sector. Incorporation of bio-based content can be measured with the share by weight of the overall material constituting the products sold by the company assessed.
- Sourcing in a sustainable way and incorporating bio-based material within products can prove more energy-intensive than the conventional fossil-based technological route. This increase of energy consumption and associated GHG emissions, whether within the company's perimeter or upstream, will not be captured by this indicator – it will however be reflected in the scope 1-2-3 emissions of indicators 1.2, 4.1 and 4.2 and in the scope 1-2 emissions of indicators 1.1, 2.1 and 2.2.

Note that other feedstocks are possible to reduce the carbon footprint of the chemical production – these will be recognized under other indicators (such as CH 2.2, 4.1, 4.2, etc.)

SCORING RATIONALE

As there is no quantitative definition available regarding the share of bio-based content in the total chemical production, the best way to assess the performance in this indicator is to compare the share of bio-based content to a maturity matrix. In the ETP2020 scenario, bioenergy accounts for over 7% of the whole chemical sector energy demand. As biomass can be used as feedstock or as energy source in the chemical sector, this figure was selected to set the threshold for low-carbon aligned category of the maturity matrix.

MANAGEMENT (WEIGHTING: 12%)

- **CH 5.1 OVERSIGHT OF CLIMATE CHANGE ISSUES**

DESCRIPTION & REQUIREMENTS

CH 5.1 OVERSIGHT OF CLIMATE CHANGE ISSUES

SHORT DESCRIPTION OF INDICATOR

The company discloses that responsibility for climate change within the company lies at the highest level of decision making within the company structure.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Details on where is the highest level of direct responsibility for climate change within the organization
- Position of the individual or name of the committee with this responsibility and outline their expertise regarding climate change and the low-carbon transition

CDP 2021 Questionnaire mapping to this indicator:

- C1.1
- C1.1a
- C1.2
- C1.2a

External sources of data may also be used for the analysis of this indicator.

HOW THE ASSESSMENT WILL BE DONE

The benchmark case is that climate change is managed within the highest decision-making structure within the company. The company situation will be compared to the benchmark case, if it is similar then points will be awarded.

The position at which climate change is managed within the company structure will be determined from the company data submission and accompanying evidence.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
What is the position of the employee/ committee with highest responsibility for climate change?	No one in charge of climate change issues	Manager /officer	Senior Manager/ Officer	Senior Manager/Officer closely related to decision-making structure within the company	Board or individual/sub-set of the board or other committee appointed by the board (CEO, other chief etc.)	100%

RATIONALE

CH 5.1 OVERSIGHT OF CLIMATE CHANGE ISSUES

RATIONALE OF THE INDICATOR

Successful change within companies, such as the transition to a low-carbon economy, requires strategic oversight and buy-in from the highest levels of decision-making within the company. For the Chemical sector, a change in strategy and potentially business model will be required and this cannot be achieved at lower levels within an organization. Evidence of how climate change is addressed within the top decision-making structures is a proxy for how seriously the company takes climate change, and how well integrated it is at a strategic level. High-level ownership also increases the likelihood of effective action to address low-carbon transition.

- **CH 5.2 CLIMATE CHANGE OVERSIGHT CAPABILITY**

DESCRIPTION & REQUIREMENTS

CH 5.2 CLIMATE CHANGE OVERSIGHT CAPABILITY

SHORT DESCRIPTION OF INDICATOR

Company board or executive management has expertise on the science and economics of climate change, including an understanding of policy, technology and consumer drivers which can disrupt current business.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

Position of the individual or name of the committee with this responsibility and outline their expertise regarding climate change and the low-carbon transition CDP Questionnaire mapping to this indicator:

- C1.1
- C1.1a
- C1.1b

- C1.1c
- C1.2
- C1.2a

External sources of data may also be used for the analysis of this indicator.

How the assessment will be done

The presence of expertise on relevant topics to climate change and low carbon transition within the individual or committee with overall responsibility for it within the company will be assessed. The presence of expertise is the condition that must be fulfilled for points to be awarded in the scoring.

The analyst will determine if the company has expertise as evidenced through a named expert biography outlining capabilities. A cross check will be performed against 5.1 on the highest responsibility for climate change, the expertise should exist at the level identified or the relationship between the structures/experts identified should also be evident.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
Does this employee/committee have a proven expertise regarding climate change topics	The employee/committee does not meet the following characteristics: - academic background/professional training related to energy & climate change, - former experiences on climate issues, - technical knowledges on climate (based on statements, published reports, …). Therefore, expertise is not evident.	The employee/committee meets several of the following characteristics: - academic background/professional training related to energy & climate change, - former experiences on climate issues, - technical knowledges on climate (based on statements, published reports, …).	The employee/committee meets all the following characteristics: - academic background/professional training related to energy & climate change, - former experiences on climate issues, - technical knowledges on climate (based on statements, published reports, …).	The employee/committee meets all the following characteristics: - academic background/professional training related to energy & climate change, - former experiences on climate issues, - technical knowledges on climate (based on statements, published reports, …). Expertise is closely related to decision-making	The employee/committee meets all the following characteristics: - academic background/professional training related to energy & climate change, - former experiences on climate issues, - technical knowledges on climate (based on statements, published reports, …). Expertise is completely integrated in decision-making	100%

RATIONALE	**CH 5.2 CLIMATE CHANGE OVERSIGHT CAPABILITY**
RATIONALE OF THE INDICATOR	Effective management of low-carbon transition requires specific expertise related to climate change and its impacts, and their likely direct and indirect effects on the business. Presence of this capability within or closely related to the decision-making bodies that will implement low-carbon transition indicates both company commitment to that transition and also increases the chances of success. Even if companies are managing climate change at board or equivalent level, a lack of expertise could be a barrier to successful management of low-carbon transition.

- **CH 5.3 LOW-CARBON TRANSITION PLAN**

DESCRIPTION & REQUIREMENTS	**CH 5.3 LOW CARBON TRANSITION PLAN**
SHORT DESCRIPTION OF INDICATOR	The company has a plan on how to transition the company to a business model compatible with a low-carbon economy.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Details on the organization's low-carbon transition plan CDP 2021 Questionnaire mapping to this indicator: - C3.1 - C3.1a - C3.1b External sources of data may also be used for the analysis of this indicator.
HOW THE ASSESSMENT WILL BE DONE	The analyst will evaluate the description and evidence of the low carbon transition plan for the presence of best practice elements and consistency with the other reported management indicators. The company description and evidence will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for elements indicating a higher level of maturity.

Best practice elements identified to date include:

- Plan includes financial projections
- Plan should include cost estimates or other assessment of financial viability as part of its preparation
- Description of the major changes to the business is comprehensive, consistent, aligned with other indicators
- Quantitative estimations of how the business will change in the future are included
- Costs associated with the plan (e.g. write-downs, site remediation, contract penalties, regulatory costs) are included
- Consideration of potential “shocks” or stressors (sudden adverse changes) has been made
- Relevant region-specific considerations are included
- Plan’s measure of success is SMART - contains targets or commitments with timescales to implement them, is time-constrained or the actions anticipated are time-constrained
- Plan’s measure of success is quantitative
- Description of relevant testing/analysis that influenced the transition plan is included
- Plan is consistent with reporting against other ACT indicators
- Scope – should cover entire business, and is specific to that business
- Should cover the short, medium and long term. From now or near future <5 years, until at least 2035 and preferably beyond (2050)
- Contains details of actions the company realistically expects to implement (and these actions are relevant and realistic)
- Approved at the strategic level within the organization
- Contains discussion of the potential impacts of a low-carbon transition on the current business
- The company has a publicly-acknowledged low carbon science-based target (SBT).
- Maximum points will be awarded if all of these elements are demonstrated.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
What is the highest-level approval of low carbon transition plan?	Not known	Operational level (CSR level)	Upper management level	Board/strategic level	Matches highest level of responsibility as previously reported	100%/7
How the success of the plan is measured?	No measure of success	Measure of success is mainly qualitative	SMART KPI: specific, measurable, acceptable, realistic, time bound.	Measure of success is SMART. Measure of success contains both qualitative and quantitative targets.	Measure of success is quantitative	100%/7

Does the plan comprise financial content? If it does, what type of content?	No financial content	Financial projections, cost estimates or other estimates of financial viability are described but not quantified	Financial projections, cost estimates or other estimates of financial viability are laid out OR short-term actions to start implementing plan are quantified in more detail	Quantitative estimations of how the business will change in the future are included Costs associated with the plan (e.g. write-downs, site remediation, contract penalties, regulatory costs) are included	Description of the major changes to the business is comprehensive, consistent, aligned with other indicators	100%/7
To what extent business future considerations are integrated in the plan?	Implications to future business noted but not discussed properly	Contains actions the company expects to implement to make the transition a reality without any details	Contains discussion certain current company elements that need to be changed to make the transition a reality	Contains discussion of the potential portfolio of a future, low-carbon ready company	Contains one or more elaborate outlines of how the far-future company could look like in terms of physical assets and business model	100%/7
To what extent short term considerations and remedial actions are integrated in the plan?	Short-term considerations and remedial actions can be discussed but are not integrated in the plan	List of short-term considerations and remedial actions integrated in the plan	Contains discussion of the potential impacts of a low-carbon transition on the current business Relevant region-specific considerations are included	Contains details of actions the company realistically expects to implement (and these actions are relevant and realistic)	Consideration of potential short-term “shocks” or stressors (sudden adverse changes) has been made	100%/7

What is the scope of the plan?	No clear scope to the plan, no consistency among sections and no analysis presented	The scope covers the entire business.	The scope covers the entire business. Plan is consistent with reporting against other ACT indicators Contains a description of relevant testing/analysis	The scope covers the entire business and is specific to it. Plan is consistent with reporting against other ACT indicators. Contains a description of relevant testing/analysis	Transition covers entire business and is specific to it, with proper scoping, consistency and proper analysis	100%/7
What is the time horizon of the plan?	Covers only short-term (< Y_R+3 years)	Covers only medium term (< 5 years)	Should cover the short, medium and long term. From now or near future <5 years, until at least 10 years and preferably beyond	Covers the short, medium and long term. From now until at least 20 years	Covers the short, medium and long term. From now and beyond 2050	100%/7

RATIONALE **CH 5.3 LOW CARBON TRANSITION PLAN**

RATIONALE OF THE INDICATOR

The Chemical sector will require substantial changes to their business to align to a low-carbon economy, over the short, medium and long term, whether it is voluntarily following a strategy to do so or is forced to change by regulations and structural changes to the market. It is better for the success of its business and of its transition that these changes occur in a planned and controlled manner.

- **CH 5.4 CLIMATE CHANGE MANAGEMENT INCENTIVES**

DESCRIPTION & REQUIREMENTS **CH 5.4 CLIMATE CHANGE MANAGEMENT INCENTIVES**

SHORT DESCRIPTION OF INDICATOR

The Board's Compensation Committee has included metrics for the reduction of GHG emissions in the annual and/or long-term compensation plans of senior executives; the Company provides monetary incentives for the management of climate change issues as defined by a series of relevant indicators.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- IS5.D: Whether the company provides incentives for the management of climate change issues, including the attainment of targets?
- IS5.E: Details on the incentives provided for the management of climate change issues

CDP 2021 Questionnaire mapping to this indicator:

- C1.3
- C1.3a

External sources of data may also be used for the analysis of this indicator.

HOW THE ASSESSMENT WILL BE DONE

The analyst will verify if the company has compensation incentives set for senior executive compensation and/or bonuses, that directly and routinely rewards specific, measurable reductions of tons of carbon emitted by the company in the preceding year and/or to the future attainment of emissions reduction targets, or other metric related to the company's low carbon transition plan.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
Who is entitled to benefit?	Any other answer		Executive	Senior executive	Board chairman - Board/Executive board - Director on board - Corporate executive team - Chief Executive Officer (CEO) - Chief Operating Officer (COO) - Chief Financial Officer (CFO) - All employees	33%
What is the type of incentives (non-monetary/ monetary)?	No incentive	Recognition (non-monetary)	Other non-monetary reward		Monetary reward	33%

What are the targets related to CC incentives?	No targets incentivized	Behavior change related indicator or other specification	Qualitative targets, such as: Efficiency project, Efficiency target, Environmental criteria included in purchases, Supply chain engagement, or other specification		Quantitative targets, such as: Emissions reduction target, Energy reduction target, or other specification	33%

RATIONALE

CH 5.4 CLIMATE CHANGE MANAGEMENT INCENTIVES

RATIONALE OF THE INDICATOR

Executive compensation should be aligned with overall business strategy and priorities. As well as commitments to action the company should ensure that incentives, especially at the executive level, are in place to reward progress towards low-carbon transition. This will improve the likelihood of successful low carbon transition.

Monetary incentives at the executive level are an indication of commitment to successful implementation of a strategy for low carbon transition.

- **CH 5.5 CLIMATE CHANGE SCENARIO TESTING**

DESCRIPTION & REQUIREMENTS

CH 5.5 CLIMATE CHANGE SCENARIO TESTING

SHORT DESCRIPTION OF INDICATOR

Testing or analysis relevant to determining the impact of transition to a low-carbon economy on the current and projected business model and/or business strategy that has been completed, with the results reported to the board or c-suite, the business strategy revised where necessary, and the results publicly reported.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- Details on the organization's climate change scenario testing
- Consideration of risk types in organization's climate-related risk assessments

- ♦ Details of risks identified with the potential to have a substantive financial or strategic impact on business

CDP 2021 Questionnaire mapping to this indicator:

- C3.2
- C3.2a
- C3.2b

External sources of data may also be used for the analysis of this indicator.

HOW THE ASSESSMENT WILL BE DONE

The analyst evaluates the description and evidence of the low-carbon economy scenario testing for the presence of best-practice elements and consistency with the other reported management indicators. The company description and evidence are compared to the maturity matrix developed to guide the scoring and a greater number of points are allocated for elements indicating a higher level of maturity.

Best-practice elements to be identified in the test/analysis include:

- Entire coverage of the company's boundaries
- Timescale from present to long-term (2035 - 2050)
- Translation of results into value-at-risk or other financial terms
- Multivariate: a range of different changes in conditions are considered together
- Changes in conditions that are specific to a low carbon climate scenario
- Climate change conditions are combined with other likely future changes in operating conditions over the timescale chosen.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
What is the scope of the scenario testing?	Large element[19] not included	Large element included	All elements included except small elements	Almost elements included (majority of small elements included)	Covers entire boundary of the company	35%
What is the time horizon of the scenario testing?	With future date not defined	From present to Y+5	From present to Y+10	From present to Y+15	From present to 2050	20%

[19] Large elements are defined as business segments that generate more that 30% of the company's total revenues.

Are the results in qualitative/ quantitative/ financial terms?	Expressed in qualitative terms	Expressed in quantitative terms	Expressed in financial terms	Expressed in financial terms and results are translated into value-at-risk	Expressed as value-at-risk	10%
What is the type of changing conditions considered?	Considers no particular changing conditions	Considers a narrow range of different changes in conditions.	Considers a range of changing conditions together (multivariate)	Considers changing climate conditions in combination with changes in operating conditions	Considers changing conditions specific for a low carbon scenario	35%

RATIONALE

CH 5.5 CLIMATE CHANGE SCENARIO TESTING

RATIONALE OF THE INDICATOR

Economical changes predicted to occur due to climate change could have a number of consequences for the chemical sector, including increased costs, a dramatically changed operating environment and major disruptions to the business. There are a variety of ways of analyzing the potential impacts of climate-related changes on the business, whether these are slow and gradual developments or one-off "shocks". Investors are increasingly calling for techniques such as scenario analysis and stress testing to be implemented to enable companies to calculate the value-at-risk that such changes could pose to the business. As this practice is emergent at this time there is currently no comprehensive survey or guidance on specific techniques or tools recommended for the sector. The ACT methodology thus provides a broad definition of types of testing and analysis which can be relevant to this information requirement, to identify both current and best practices and consider them in the analysis.

Scenario stress testing is an important management tool for preparing for low-carbon transition. For businesses likely to be strongly affected by climate change impacts (both direct and indirect), it has even greater importance.

- **CH 5.6 INTERNAL CARBON PRICING INTEGRATION**

DESCRIPTION & REQUIREMENTS

CH 5.6 INTERNAL CARBON PRICING INTEGRATION

SHORT DESCRIPTION OF INDICATOR

Setting an internal carbon price to evaluate the impact of transition to a low-carbon economy on the current and projected business model and/or business strategy that has been completed, with the results reported to the board or c-suite, the business strategy revised where necessary, and the results publicly reported.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- Existence and coverage of an internal carbon price

- Reviewing process of the internal carbon price
- Value of the internal carbon price

CDP 2021 Questionnaire mapping to this indicator:

- C11.1
- C11.1a
- C11.1b
- C11.1c
- C11.1d

HOW THE ASSESSMENT WILL BE DONE

The analyst evaluates the evidence of the integration of an internal carbon price. The company description and evidence are compared to the maturity matrix developed to guide the scoring and a greater number of points are allocated for elements indicating a higher level of maturity.

Best-practice elements to be identified in the test/analysis include:

- The carbon price value is aligned with a low-carbon scenario
- The Internal Carbon Price (ITC) covers direct and indirect emissions of the company
- The ITC is regularly reviewed
- The ITC is integrated in all strategic decisions

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
What is the role of the ITC (Internal Carbon Price) in the plan?	No ITC	A carbon price has been considered to elaborate the plan but is not actually considered for the decisions	A carbon price is integrated in the financial scenario proposed for key decisions	The carbon price is integrated in financial scenario proposed regarding all strategic decisions	The carbon price value is aligned with a low carbon scenario used in the methodology and is integrated in financial scenario proposed regarding all strategic decisions	25%
What is the coverage of the Internal Carbon Price (ITC)?	No ITC	ITC partially covers CO_2 scope 1+2 emissions	ITC covers the totality of CO_2 scope 1+2 emissions	ITC covers CO_2 scope 1+2 emissions, and scope 3 emissions that are relevant to the sector or company	ITC covers all relevant greenhouse gas (GHG) scope 1+2 emissions, and scope 3 emissions that are relevant to the sector or company	25%

What is the value of the ITC?	No ITC	ITC value is lower than external carbon pricing (set by government in which the company is located)	ITC value is equal to external carbon pricing (set by government in which the company is located)	ITC value is higher than external carbon pricing (set by government in which the company is located)	ITC value is higher than external carbon pricing (set by government in which the company is located) AND arise from or is aligned with a low carbon scenario	25%
How is the monitoring and evaluation done?	No ITC	ITC has been established but it never is reviewed	The company has a plan to regularly review the ITC		The company has a plan to regularly review the ITC against quantified key performance indicators	25%

RATIONALE **CH 5.6 INTERNAL CARBON PRICING INTEGRATION**

RATIONALE OF THE INDICATOR

Carbon pricing is a way to analyze the potential impacts of climate-related changes on the business, both risks and opportunities. Investors are increasingly calling for the setting of an internal price on carbon to enable companies to calculate the value-at-risk that climate change changes could pose to the business. The maturity matrix was developed based on recommendations from the "HOW-TO GUIDE TO CORPORATE INTERNAL CARBON PRICING"[20] document.

[20] How to guide to corporate internal carbon pricing – Four dimensions to best practice approaches – Carbon Pricing Unlocked

SUPPLIER ENGAGEMENT (WEIGHTING: 10-22%)

- **CH 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS**

DESCRIPTION & REQUIREMENTS

CH 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

SHORT DESCRIPTION OF INDICATOR

This indicator assesses the strategic policy and the process which are formalized and implemented by the company in order to engage its suppliers.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- Details of the methods of supplier engagement, strategy for prioritizing supplier engagements and measures of success
- Number of suppliers with whom the company is engaging, the proportion of the total spend that they represent, part of the inclusive Scope 1+2 carbon emissions
- If data on suppliers' GHG emissions and climate change strategies are available, explain how the company makes use of that data

OR/AND

List of environmental contract clauses in purchasing & suppliers' selection process

CDP 2021 Questionnaire mapping to this indicator:

- C12.1
- C12.1a

External sources of data may also be used for the analysis of this indicator.

HOW THE ASSESSMENT WILL BE DONE

The analyst will assign a maturity score based on the company's formalized strategy with their suppliers, expressed in a maturity matrix.

A company that is placed in the 'aligned' category will receive the maximum score. Companies who are at lower levels will receive a partial score, with 0 points awarded for having no engagement at all.

This maturity matrix is indicative but does not show all possible options that can result in a particular score. Companies' responses will be scrutinized by the analyst and then placed on the level in the matrix where the analyst deems it most appropriate.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
To what extent GHG emissions reduction issues are integrated in engagement with suppliers?	No consideration	CSR clause included in engagements with suppliers. Means commitment included in contracts	CSR clause with GHG emissions reduction included in engagements with suppliers. Results-driven commitment in contracts	CSR clause with quantified GHG emissions reduction included in engagements with suppliers. Results commitment in contracts. Regular reporting	CSR clause with GHG emissions reduction included as priority in engagements with suppliers. Results-driven commitment in contracts. Regular reporting.	20%
What action levers are used by the company to encourage suppliers to develop a low carbon offer?	No action levers used	Passive approach (suppliers may offer low-carbon product but no specific requirements from the company)	Use of one action lever (awareness campaign, compensation, purchasing rule, etc.)	Use of several action levers (awareness campaign, compensation, purchasing rule, sectoral workshops/initiatives)	Use of several action levers (awareness campaign, compensation, purchasing rule, etc.). Regular audits of the supplier by the purchaser or a representative	30%
What is the scope of the action levers used?	No strategy applied to any suppliers		Strategy applied to few large suppliers (represent more than 20% of purchases)	Strategy applied to majority of suppliers (more than 60% of purchases)	Strategy applied to all of suppliers (more than 90% of purchases)	20%
To what extent carbon issues are integrated in the selection process of suppliers?	No selection of suppliers based on environmental criteria		Criteria on environmental policy (qualitative) integrated in the suppliers selection process	Criteria on environmental performance of the products (quantitative) integrated in the suppliers selection process	Criteria on environmental performance of the products (quantitative) aligned with low-carbon scenario integrated in the suppliers' selection process	30%

RATIONALE

CH 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

RATIONALE OF THE INDICATOR

Relevance of the indicator:

Supplier engagement is included in the ACT Chemicals assessment for the following reasons:

1. Given their size and their decision-making power in the value chain, integrated companies have the ability to influence the strategy and performance of suppliers regarding climate.
2. The upstream segment represents a high source of emissions throughout the value chain (>60% of the total GHG emissions[21] of the Chemicals value chain) and should be engaged. The weight of this indicator depends on the position of the company in the value chain and whether it has influence on its suppliers.
3. Engaging suppliers through contract clauses and sales incentives is necessary to take them on board.

Scoring the indicator

Because of data availability and complexity, a direct measure of the outcome of such engagement is not very feasible at this time. It is often challenging to quantify the emissions reduction potential and outcome of collaborative activities within the supply chain. Therefore, the approach of a maturity matrix allows the analyst to consider multiple dimensions of supplier engagement and assess them together towards a single score for Supplier Engagement.

- **CH 6.2 Activities to influence suppliers to reduce their GHG emissions**

Description & Requirements

CH 6.2 Activities to influence suppliers to reduce their GHG emissions

Short description of indicator

This indicator assesses initiatives and the partnerships launched by the company in order to engage its suppliers.

Data requirements

The questions comprising the information request that are relevant to this indicator are:

- List of initiatives implemented to influence suppliers to reduce their GHG emissions, green purchase policy or track record, supplier code of conduct

CDP 2021 Questionnaire mapping to this indicator:

- C12.1
- C12.1a

[21] ARC Energy Research Institute, using input data from the US Department of Energy National Energy Technology Laboratory to define the US Refined Average (2014))

External sources of data may also be used for the analysis of this indicator.

How the assessment will be done

The analyst will assign a maturity score based on the company's formalized strategy with their suppliers, expressed in a maturity matrix.

A company that is placed in the 'aligned' category will receive the maximum score. Companies who are at lower levels will receive a partial score, with 0 points awarded for having no engagement at all.

This maturity matrix is indicative but does not show all possible options that can result in a particular score. Companies' responses will be scrutinized by the analyst and then placed on the level in the matrix where the analyst deems it most appropriate.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
How the company encourage suppliers to reduce their GHG emissions?	No activity	Company requires suppliers to sign a code of conduct (or similar) and/or to provide data regarding their environmental performance (for audited suppliers). Means-driven commitment	Company assists suppliers to reduce their GHG emissions Company monitors GHG emissions along its value chain Provision of documents and tools by the lessor	Company partners with large suppliers to define common GHG emissions reduction plan Provision of documents and tools Multi-party working group with annual meeting at least	Company contributes in GHG emissions reduction along its value chain through close partnerships with suppliers	50%
Does the company develop a low-carbon demand?	No green purchase		Company purchases low-carbon products/equipment to reduce its production phase emissions	Company purchases low-carbon products/equipment to reduce its production phase emissions Company partners with suppliers to develop low-carbon products	Company purchases low-carbon products/equipment to reduce its production phase emissions Company partners with suppliers to develop low-carbon products	30%

Does the company finance low-carbon innovation in the supply chain?	No financing activities		Finances companies that develop innovative low-carbon equipment/products	Finances companies that develop innovative low-carbon equipment/products. Provides non-financial supports through close partnerships	Finances companies that develop innovative low-carbon equipment/products. Provides non-financial supports through close partnerships. Purchases or guarantees future purchases the companies produce in the pilot/road test phase.	20%

RATIONALE

CH 6.2 ACTIVITIES TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

RATIONALE OF THE INDICATOR

Relevance of the indicator

Activities to influence suppliers are included in the ACT Chemicals assessment for the following reasons:

1. Given their size and their decision-making power in the value chain, integrated companies have the ability to influence the strategy and performance of suppliers regarding climate.
2. The upstream segment represents a high source of emissions throughout the value chain (>60% GHG emissions of the Chemicals value chain) and should be engaged. However, the weight of this indicator depends on the position of the company in the value chain and whether it has influence on its suppliers.
3. Engaging suppliers through contract clauses and sales incentives is necessary to take them on board.

Scoring the indicator

Because of data availability and complexity, a direct measure of the outcome of such engagement is not very feasible at this time. It is often challenging to quantify the emission reduction potential and outcome of collaborative activities with the supply chain. Therefore, the approach of a maturity matrix allows the analyst to consider multiple dimensions of supplier engagement and assess them together towards a single score for all the activities related to Supplier Engagement.

CLIENTS ENGAGEMENT (WEIGHTING: 4-8%)

- **CH 7.1 STRATEGY TO INFLUENCE CUSTOMER BEHAVIOUR TO REDUCE THEIR GHG EMISSIONS**

DESCRIPTION & REQUIREMENTS	**CH 7.1 STRATEGY TO INFLUENCE CUSTOMERS TO REDUCE THEIR GHG EMISSION**
SHORT DESCRIPTION OF INDICATOR	This indicator assesses the level of engagement that the company has with its clients, based on an assessment of the client policy formalized and implemented by the company.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Methods of client engagement ♦ % of customers CDP 2021 Questionnaire mapping to this indicator: - C12.1 - C12.1b External sources of data may also be used for the analysis of this indicator.
HOW THE ASSESSMENT WILL BE DONE	The analyst will assign a maturity score based on the company's formalized strategy with their clients, expressed in a maturity matrix. A company that is placed in the 'aligned' category will receive the maximum score. Companies who are at lower levels will receive a partial score, with 0 points awarded for having no engagement at all. This maturity matrix is indicative but does not show all possible options that can result in a particular score. Company responses will be scrutinized by the analyst and then placed on the level in the matrix where the analyst deems it most appropriate.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
To what extent GHG emissions reduction issues are integrated in engagement with clients?	No strategy	GHG emissions reduction included in engagement with clients Means-driven commitment	Quantified GHG emissions reduction included in engagement with clients		Quantified GHG emissions reduction included as priority in engagements with clients	40%
What action levers are used by the company to encourage clients to buy low carbon products?	No strategy	Passive approach	Use of one action lever (awareness campaign, compensation, purchasing rule, etc.) Provision of documents and tools by the lessor	Use of several action levers (awareness campaign, compensation, purchasing rule, etc.) Provision of documents and tools Multi-party working group with annual meeting at least	Use of several action levers (awareness campaign, compensation, purchasing rule, etc.) Contribution to shift demand towards low-carbon products	40%
What is the scope of the action levers used?	No clients in the scope		Only large clients (represent 20% of revenues in total)	Majority of clients (represent more than 60% of total revenues)	All clients (represent more than 90% of total revenues)	20%

RATIONALE

CH 7.1 STRATEGY TO INFLUENCE CUSTOMERS TO REDUCE THEIR GHG EMISSION

RATIONALE OF THE INDICATOR

Relevance of the indicator

Strategy to influence customers are included in the ACT Chemicals assessment for the following reasons:

1. Given their size and their decision-making power in the value chain, integrated companies have the ability to influence the strategy and performance of clients regarding climate.
2. The downstream segment represents less emissions but is not to be neglected and should be engaged. The weight of this indicator depends on the position of the company in the value chain and whether it has influence on its clients.

Scoring the indicator

Because of data availability and complexity, a direct measure of the outcome of such engagement is not very feasible at this time. It is often challenging to quantify the emission reduction potential and outcome of collaborative activities with the supply chain. Therefore, the approach of

a maturity matrix allows the analyst to consider multiple dimensions of supplier engagement and assess them together towards a single score for all the activities related to Client Engagement.

- **CH 7.2 Activities to influence customer behaviour to reduce their GHG emissions**

Description & Requirements

CH 7.2 Activities to influence customers to reduce their GHG emissions

Short description of indicator

This indicator assesses the level of engagement that the company has with its clients, based on an assessment of previous initiatives that show whether or not the company engages with clients in various ways.

Data requirements

The questions comprising the information request that are relevant to this indicator are:

- reported activities or interventions

CDP 2021 Questionnaire mapping to this indicator:

- C12.1
- C12.1b

External sources of data may also be used for the analysis of this indicator.

How the assessment will be done

The analyst will assign a maturity score based on the company's formalized strategy with their clients, expressed in a maturity matrix.

A company that is placed in the 'aligned' category will receive the maximum score. Companies who are at lower levels will receive a partial score, with 0 points awarded for having no engagement at all.

This maturity matrix is indicative but does not show all possible options that can result in a particular score. Companies' responses will be scrutinized by the analyst and then placed on the level in the matrix where the analyst deems it most appropriate.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
How the company encourage clients to reduce their GHG emissions?	No engagement	Company promotes products with lower carbon footprint but no data reported Company defines means-driven commitment	Company assists clients to reduce their GHG emissions	Company partners with large clients to define common GHG emissions reduction plan Provision of documents and tools Multi-party working group with annual meeting at least	Company contributes in GHG emissions reduction along its value chain through close partnerships with clients	30%
Does the company promote low-carbon solutions to its clients?	No offer	The company does offer low-carbon/energy efficient products but no promotion strategy developed	The company promotes its low-carbon offer through marketing and communication channels	The company promotes its low-carbon offer through marketing and communication channels. The company offers buying incentives regarding low-carbon products	The company promotes its low-carbon offer through marketing and communication channels. The company offers buying incentives regarding low-carbon products. The brand identity of the company is based only on its range of low-carbon solutions.	40%
Does the company provide support to clients in order to help them reduce their GHG emissions?	No support provided		The company provides support (consulting services, premium customer service) to a small part of its clients (represent more than 20% of total revenues) in order to help them reduce their GHG emissions		The company provides support (consulting services, premium customer service) to a large part of its clients (represent more than 60% of total revenues) in order to help them reduce their GHG emissions	30%

RATIONALE

CH 7.2 ACTIVITIES TO INFLUENCE CUSTOMERS TO REDUCE THEIR GHG EMISSIONS

RATIONALE OF THE INDICATOR

Relevance of the indicator

Activities to influence customers are included in the ACT Chemicals assessment for the following reasons:

1. Given their size and their decision-making power in the value chain, integrated companies have the ability to influence the strategy and performance of clients regarding climate.
2. The downstream segment represents less emissions but is not to be neglected and should be engaged. The weight of this indicator depends on the position of the company in the value chain and whether it has influence on its clients.

Scoring the indicator

Because of data availability and complexity, a direct measure of the outcome of such engagement is not very feasible at this time. It is often challenging to quantify the emission reduction potential and outcome of collaborative activities with the supply chain. Therefore, the approach of a maturity matrix allows the analyst to consider multiple dimensions of supplier engagement and assess them together towards a single score for all the activities related to Client Engagement.

POLICY ENGAGEMENT (WEIGHTING: 5%)

- **CH 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS**

DESCRIPTION & REQUIREMENTS

CH 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS

SHORT DESCRIPTION OF INDICATOR

The company has a policy on what action to take when industry organizations to which it belongs are found to be opposing “climate-friendly” policies.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- The company shall disclose if it has a policy to govern action when trade associations supported take positions on legislation that could hinder progress on transition to a low-carbon economy, and if this policy is public
- If it has a policy as outlined at first point, the company shall describe this policy
- The company should attach supporting documentation, if this exists, giving evidence

CDP 2021 Questionnaire mapping to this indicator:

- C12.3
- C12.3a
- C12.3c
- C12.3f

External sources of data may also be used for the analysis of this indicator.

How the assessment will be done

The analyst will evaluate the description and evidence of the policy on trade associations and climate change for the presence of best practice elements and consistency with the other reported management indicators. The company description and evidence will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for elements indicating a higher level of maturity.

Best practice elements to be identified in the test/analysis include:

- A publicly available policy is in place
- The scope of the policy covers the entire company and its activities, and all group memberships and associations
- The policy sets out what action is to be taken in the case of inconsistencies
- Action includes option to terminate membership of the association
- Action includes option of publicly opposing or actively countering the association position
- Responsibility for oversight of the policy lies at top level of the organization
- There is a process to monitor and review trade association positions

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
What is the scope covered by the engagement policy? Is the policy publicly available?	Does not cover entire company or all group memberships. Is not publicly available.	Does not cover entire company or all group memberships. Is publicly available.	Covers the entire company and its activities, and all group memberships and associations, but not publicly available		Covers the entire company and its activities, and all group memberships and associations. Public policy is publicly available	40%
Does the company have a review process of trade associations?	No process to review trade associations positions	A process to monitor and review trade association positions exists but is not necessarily implemented	A process to monitor and review trade association positions exists and is well implemented	A process to monitor and review trade association positions exists and is well implemented at a high level of the organization	A process to monitor and review trade associations positions exists. Responsibility for oversight of the policy lies at top level of the organization	40%
Does the plan have an action plan regarding engagement with trade associations?	No mention of this element		Sets out what action is to be taken in the case of inconsistencies	Option to terminate membership of the association	Option of publicly opposing or actively countering the association position	20%

RATIONALE

CH 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS

RATIONALE OF THE INDICATOR

Trade associations are a key instrument by which companies can indirectly influence policy on climate. Thus, when trade associations take positions, which are negative for climate, companies need to take action to ensure that this negative influence is countered or minimized.

This indicator is consistent with ACT philosophy and common to the other sectoral methodologies.

- **CH 8.2 TRADE ASSOCIATIONS SUPPORTED DO NOT HAVE CLIMATE-NEGATIVE ACTIVITIES OR POSITIONS**

DESCRIPTION & REQUIREMENTS

CH 8.2 TRADE ASSOCIATIONS SUPPORTED DO NOT HAVE CLIMATE-NEGATIVE ACTIVITIES OR POSITIONS

SHORT DESCRIPTION OF INDICATOR

The company is not on the board or providing funding beyond membership of any trade associations that have climate-negative activities or positions. It should also be considered if the company is supporting trade associations with climate-positive activities and/or positions.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- The company shall disclose if (yes or no) it is on the board of any trade associations or provides funding beyond membership
- If yes, the reporter shall provide details of those trade associations that are likely to take a position on climate change legislation
- The company should attach supporting documentation, if this exists, giving evidence

CDP 2021 Questionnaire mapping to this indicator:

- C12.3
- C12.3a
- C12.3c
- C12.3f

External sources of data may also be used for the analysis of this indicator:

- InfluenceMap
- RepRisk database,
- Climate Action 100+
- Ellen Macarthur Foundation (21)
- Press news
- EP100 – Climate Group www.theclimategroup.org/project/ep100
- Low-carbon Technology Partnerships initiative www.wbcsd.org/Programs/Climate-and-Energy/Climate/Low-Carbon-Technology-Partnershipsinitiative

How the assessment will be done

The list of trade associations declared in the CDP data and other external source entries relating to the company (e.g. RepRisk database), is assessed against a list of associations that have climate-negative activities or positions. The results are compared to any policy described in 5.1.

If the company is part of trade associations that have climate-positive activities and/or positions, this should be considered for the analysis.

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
Does the company support trade associations that have climate negative activities/positions?	Company is on the board or provides funding beyond membership to trade associations that have climate-negative activities or positions.		The company is not on the board or providing funding beyond membership of any trade associations that have climate-negative activities or positions. Company can be member.		Company is not a member of any trade associations that have climate negative activities or positions	100%

Rationale

CH 8.2 Trade associations supported do not have climate-negative activities or positions

Rationale of the indicator

Trade associations are a key instrument by which companies can indirectly influence policy on climate. Participating in trade associations which actively lobby against climate-positive legislation is hence, a negative indicator and likely to obstruct low-carbon transition. However, membership in association that supports climate positive policies should also be considered in the analysis.

- **CH 8.3 Position on significant climate policies**

Description & Requirements	**CH 8.3 Position on significant climate policies**
Short description of indicator	The company is not opposed to any significant climate relevant policy and/or supports climate friendly policies.
Data requirements	The questions comprising the information request that are relevant to this indicator are: ♦ The company should attach supporting documentation, if this exists, giving evidence ♦ The company shall disclose details of the issues on which it has been directly engaging with policy makers and its proposed legislative solution CDP 2021 Questionnaire mapping to this indicator: - C12.3 - C12.3a - C12.3c - C12.3f External sources of data may also be used for the analysis of this indicator: ♦ InfluenceMap ♦ RepRisk database ♦ Climate Action 100+ ♦ Ellen Macarthur Foundation (21) ♦ press news ♦ EP100 – Climate Group www.theclimategroup.org/project/ep100 Low-carbon Technology Partnerships initiative www.wbcsd.org/Programs/Climate-and-Energy/Climate/Low-Carbon-Technology-Partnershipsinitiative

HOW THE ASSESSMENT WILL BE DONE

The analyst will evaluate the description and evidence on company position on relevant climate policies for the presence of best practice elements, negative indicators and consistency with the other reported management indicators. The company description and evidence will be compared to the maturity matrix developed to guide the scoring and a greater number of points will be allocated for elements indicating a higher level of maturity.

Maturity matrix contents could include (decreasing maturity)

1. Publicly supports relevant significant climate policies
2. No reports of any opposition to climate policy
3. Reported indirect opposition to climate policy (e.g. via trade association)
4. Reported direct opposition to climate policy (third-party claims are found)
5. Company publicizes direct opposition to climate policy (direct statement issues or given by a company representative in e.g. speech or interview)

Question	Basic	Standard	Advanced	Next practice	Low carbon aligned	Subscore
	0%	*25%*	*50%*	*75%*	*100%*	
What is the position of the company on significant climate policies?	No reported direct opposition to climate policy	No reports of any opposition to climate policy	Publicly supports significant climate policies	Publicly commits to international low-carbon commitments Engages in sectoral/cross-sectoral initiatives against climate change*	Publicly commits to international low-carbon commitments Leads sectoral/cross-sectoral initiatives against climate change* (founding member/main sponsor/spokeperson of the initiative)	100%

Non-exhaustive list of sectoral initiatives on the low-carbon transition of Chemical sector:

- IEA, The Future of Petrochemicals
- IEA, The Future of Hydrogen
- IEA, Energy Technology Perspectives
- DECHEMA, Roadmap Chemie 2050

Non-exhaustive list of cross-sectoral initiatives on the low-carbon transition of the economy:

- Paris Agreement

- SBT Initiative (validated targets)
- ACT initiative

RATIONALE

CH 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES

RATIONALE OF THE INDICATOR

Private and public stakeholders of the Chemical sectors have been developing initiatives about sustainable practices that contribute to the transition to a low-carbon economy. Companies should not oppose effective and well-designed regulation in these areas, but should support it. Assessing the position of the company regarding the evolution of the context is thus key to understand the corporate vision in these matters.

BUSINESS MODEL (WEIGHTING: 10%)

The analysis is based on the business activities proposed by the company. The analyst evaluates the implementation of the future business model pathways through a maturity matrix and the highest level achieved determines the current level of the company.

CCS and CCU technologies are accounted for whether they are direct air capture project or services to clients.

In order for companies to align with a low-carbon future and meet the future mobility needs, it is expected that they pursue at least one of these future business model pathways and integrate them in their strategic plans. The analyst evaluates the description and evidence of the company's degree of activity in one of the future business model areas for the presence of best practice elements and consistency with the other reported management indicators. The company description and evidence are compared to the maturity matrix developed to guide the scoring and a greater number of points are allocated for elements indicating a higher level of maturity.

	Basic	Advanced	Low carbon aligned	Weight of the indicator in business model score
Associated score	0%	50%	100%	**100%**
Profitability of business model	Non- estimated or in a very early stage of development (research or conception stage)	Mature business model but non- profitable or in a development stage (prototype / demonstration or test)	Mature and profitable business model	25%
Size of business model	Non- estimated	Limited size of business for the company (few FTE or time dedicated, small turnover, few revenues expected, etc.)	Substantial size of market for the company (significant number or FTE or dedicated hours, great turnover, great anticipated profitability, etc.)	25%
Growth potential of business model	Non- estimated or exploration of the business model interrupted	Scheduling next development steps	Scheduling the expansion of the target or size of the business model	25%

Deployment schedule of business model	Non- scheduled	Deployment scheduled with a 2 years horizon or less	Deployment scheduled with a 2 years horizon or more	25%

The minimum requirement for points to be awarded is that some level of exploration of one or more of these relevant business areas has started. This could include participation in collaborations, pilot projects, or research funding.

Best-practice elements to be identified in the test/analysis include:

- the company has developed a mature business model that integrates one or many of the above elements
- the business activity is profitable
- the business activity is of a substantial size
- the company is planning to expand the business activity
- expansion will occur on a defined timescale

Maximum points are awarded if all of these elements are demonstrated.

The final score will be equal to the maximum of all the scores of the (maximum) five business models. The minimum requirement for points to be awarded is that some level of exploration of one or more of these relevant business areas has started. This could include participation in collaborations, pilot projects, or research funding.

Best-practice elements to be identified in the test/analysis include:

- the company has developed a mature business model that integrates one or many of the above elements
- the business activity is profitable
- the business activity is of a substantial size
- the company is planning to expand the business activity
- expansion will occur on a defined timescale

Maximum points are awarded if all of these elements are demonstrated.

The scores of the (maximum) five business models will be equally weighted for the final score.

- **CH 9.1 BUSINESS ACTIVITIES THAT DEVELOP LOW-CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES**

DESCRIPTION & REQUIREMENTS

CH 9.1 BUSINESS ACTIVITIES THAT DEVELOP LOW-CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES

SHORT DESCRIPTION OF INDICATOR

The company is actively developing business models for a low-carbon future by demonstrating its application of low-carbon business model pathways. The innovative business models that have been identified as being strategic for the company's low-carbon transition are the ones that develop low-carbon, mitigation and carbon removal technologies.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- Description of business activity, Stage of development, Activity timeframe, Indicator of business size (over activity timeframe), Business size, What are your future plans for this activity? What is your deployment timeframe?, How do you manage this business plan deployment ?

Regarding financial KPIs, which might be highly strategic and confidential, the company may be asked to indicate ranges of numbers instead of specific data.

CDP 2021 Questionnaire mapping to this indicator:

- C2.4a
- C3.3
- C4.3
- C-CH9.6
- C-CH9.6a

External sources of data may also be used for the analysis of this indicator.

HOW THE ASSESSMENT WILL BE DONE

The integration of CCS/CCU/CDR in the activity of the company or as a proposition to clients is accounted for in this indicator.

Defining low-carbon technologies, mitigation technologies and carbon removal technologies

To define these three types of technologies, the definition set by the European Taxonomy on Sustainable Activities[22] is considered. See Article 10 which is copied below. For specific criteria linked to each type of activity, please refer to the EU Taxonomy Delegated Act[23] which determines the criteria under which the manufacture of various chemical products qualifies or not as contributing substantially to climate change mitigation.

[22] EU Taxonomy on Sustainable Activities (Regulation (EU) 2020/852) available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852.

[23] EU Taxonomy Delegated Act (2021) available at https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf

In cases where the activity is not covered by the EU taxonomy, the analyst should determine using other existing international standards or certifications whether the technology falls into the category of a low-carbon technology, mitigation technology or carbon removal technology.

EU Taxonomy on Sustainable Activities, Article 10:

An economic activity shall qualify as contributing substantially to climate change mitigation where that activity contributes substantially to the stabilisation of greenhouse gas concentrations in the atmosphere at a level which prevents dangerous anthropogenic interference with the climate system consistent with the long-term temperature goal of the Paris Agreement through the avoidance or reduction of greenhouse gas emissions or the increase of greenhouse gas removals, including through process innovations or product innovations, by:

(a) generating, transmitting, storing, distributing or using renewable energy in line with Directive (EU) 2018/2001, including through using innovative technology with a potential for significant future savings or through necessary reinforcement or extension of the grid;

(b) improving energy efficiency, except for power generation activities as referred to in Article 19(3);

(c) increasing clean or climate-neutral mobility;

(d) switching to the use of sustainably sourced renewable materials;

(e) increasing the use of environmentally safe carbon capture and utilisation (CCU) and carbon capture and storage (CCS) technologies that deliver a net reduction in greenhouse gas emissions;

(f) strengthening land carbon sinks, including through avoiding deforestation and forest degradation, restoration of forests, sustainable management and restoration of croplands, grasslands and wetlands, afforestation, and regenerative agriculture;

(g) establishing energy infrastructure required for enabling the decarbonization of energy systems;

(h) producing clean and efficient fuels from renewable or carbon-neutral sources; or

(i) enabling any of the activities listed in points (a) to (h) of this paragraph in accordance with Article 16.

See module introduction to know more on how the assessment is done.

RATIONALE

CH 9.1 BUSINESS ACTIVITIES THAT DEVELOP LOW-CARBON, MITIGATION AND CARBON REMOVAL TECHNOLOGIES

RATIONALE OF THE INDICATOR

In addition to developing sustainable practices, a company may transition its business model to other areas to remain profitable in a low-carbon economy. The company's future business model should enable it to decouple financial results from GHG emissions, in order to meet the constraints of low-carbon transition while continuing to generate value. The business model shifts identified do not conflict with the changes that are implied by decarbonizing the company's Integrated Chemicals business model.

This indicator aims to identify both relevant current business activities, and those still at a burgeoning stage. It is recognized that promoting CCS/CCU, with associated change in business models, is a high level of CO_2 emissions reduction in the chemical sector. The assessment will thus seek to identify and reward projects at an early stage as well as more mature business activities, although the latter (i.e. substantially sized, profitable, and/or expanding) business activities will be better rewarded.

- **CH 9.2 BUSINESS ACTIVITIES THAT DEVELOP PRODUCTS ENABLING ENERGY TRANSITION**

DESCRIPTION & REQUIREMENTS

CH 9.2 BUSINESS ACTIVITIES THAT DEVELOP PRODUCTS ENABLING ENERGY TRANSITION

SHORT DESCRIPTION OF INDICATOR

The indicator aims at valuing companies whose chemicals manufactured are key for the transition of the economy to a low carbon one. Indeed, the chemical sector can be a contributor of the energy transition by providing critical elements required for such transition – this is what this indicator aims at capturing.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

- Share of end-products (by revenue) that are key components of taxonomy-aligned activities
- Share of end-products that are effectively sold to taxonomy-aligned companies

CDP 2021 Questionnaire mapping to this indicator:

- C2.4a
- C3.3
- C4.3
- C-CH9.6
- C-CH9.6a

External sources of data may also be used for the analysis of this indicator.

How the assessment will be done

Chemicals and chemical products sold by the company are considered as enabling the low carbon economy transition if they are key components to an eligible activity as defined by the delegated acts operationalizing the European taxonomy for sustainable activities[24].

In cases where the activity – for which the chemical product is a key component - is not covered by the EU taxonomy, the analyst should determine using other existing international standards or certifications whether the technology falls into the category of a low-carbon technology, mitigation technology or carbon removal technology with a level of environmental stringency at least as demanding as the technical criteria set in the delegated acts of the EU taxonomy.

See module introduction to know more on how the assessment is done and for the maturity matrix.

Rationale

CH 9.2 Business activities that develop products enabling energy transition

Rationale of the indicator

See first paragraph of the rationale for 9.1.

The chemical industry as a major industry in terms of capital and emissions share in the global total needs to reduce its own emissions but should also support other industries to decarbonize. Some chemicals are indeed key components for some low carbon transition activities to occur. The assessment will thus seek to identify and reward companies which products sold are essential to activities enabling the transition.

- **CH 9.3 Business activities that promote circular economy**

Description & Requirements

CH 9.3 Business activities that promote circular economy

[24] EU Taxonomy Delegated Act for Climate Change Mitigation (April 2021) available at: https://ec.europa.eu/finance/docs/level-2-measures/taxonomy-regulation-delegated-act-2021-2800-annex-1_en.pdf

SHORT DESCRIPTION OF INDICATOR

The company is actively developing business models around circular economy, in participating in business activities associated with reuse and recycling of material.

DATA REQUIREMENTS

The questions comprising the information request that are relevant to this indicator are:

Description of business activity, Stage of development, Activity timeframe, Indicator of business size (over activity timeframe), Business size, Future plans for this activity, Deployment timeframe Management of the business plan deployment.

CDP 2021 Questionnaire mapping to this indicator:

- C2.4a
- C3.3
- C4.3
- C-CH9.6
- C-CH9.6a

External sources of data may also be used for the analysis of this indicator.

HOW THE ASSESSMENT WILL BE DONE

Relevant business activity areas for this indicator are for example:

- Reduce amount of waste during the manufacture of chemicals
- Promote reuse of chemicals
- Increase the recycling rate of a chemical
- Increase the amount of waste and secondary material integration as feedstock
- Application of the principles of industrial ecology to create symbiosis with other industries or organizations (transmitting heat to another process or organization…)
- Chemical plants as key actors of the circular economy in their territory (e.g. sharing the surplus heat from the chemical production to supply as district heating to the local citizens)

See module introduction to know more on how the assessment is done and for the maturity matrix.

RATIONALE

CH 9.3 BUSINESS ACTIVITIES THAT PROMOTE CIRCULAR ECONOMY

RATIONALE OF THE INDICATOR

See Rationale for 9.1.

5. Assessment

5.1.SECTOR BENCHMARK

5.1.1. DESCRIPTION OF THE BENCHMARK

The fundamental target to achieve for all organizations is to contribute to not exceeding a threshold of 2º global warming compared to pre-industrial temperatures. This target has long been widely accepted as a credible threshold for achieving a reasonable likelihood of avoiding climate instability, while a 1.5ºC rise has been agreed upon as an aspirational target.

As a consequence, low carbon scenarios used for the benchmark are Well Below 2°C (WB2°C) scenarios or 1.5°C scenarios.

Every company shall be benchmarked according to an acceptable and credible benchmark that align with spatial boundary of the methodology. Three types of companies have been categorized:

- Type A companies: Companies producing primary chemicals (Ethylene, Propylene, Ammonia, Methanol, BTX, Chlorine and Hydrogen)
- Type B companies: Companies producing other chemicals
- Integrated companies: Companies producing both primary chemicals and other ones.

Type A companies are evaluated according to chemical-specific benchmarks, type B companies are evaluated according to a generic sectoral benchmark and integrated ones are evaluated according both as per the share of primary chemicals and other chemicals produced.

5.1.2. REFERENCE PATHWAY CLASSIFICATION

A reference pathway defines the carbon intensity (tCO_2/t) pathway for a given chemical or the carbon absolute emissions (tCO_2) trajectory for the general sector.

For the chemical sector, two types of pathways are considered:

- Specific pathways for primary chemicals (e.g. pathway related to the ammonia production, see section 5.1.3 below).
- A generic pathway for all other chemicals.

5.1.3. AVAILABLE REFERENCE PATHWAYS

The chosen scenario for the evaluation of Type A companies is the Sustainable Development Scenario (SDS) from the International Energy Agency (IEA) Energy Technology Perspective (ETP) 2020 document.

The scenario forecasts the production volume for the following main primary chemicals: Ethylene, Propylene, Methanol, Ammonia, BTX and the evolution of the chemical sector scope 1+2 emissions. To build the pathways a few assumptions have been made:

- Primary chemicals account for around 60% of the total direct CO_2 emissions in the chemical sector, ammonia being the largest source contributing to 49% of the primary chemicals' CO_2 emissions,

followed by high-value chemicals (HVCs) with 27% of these emissions and methanol which represents 24% of the primary chemicals emissions[25]. These shares are assumed to be constant over time.

- HVCs (Ethylene, Propylene, BTX) have the same carbon intensity as they usually are co-produced.
- Electricity and heat emissions factors are assumed to be the same given that most heat is produced in cogeneration.
- Primary chemicals account for 15% of scope 2 emissions in base year (2019)[26]. This share evolves as the share of electricity in the energy mix of the sector under the SDS does.

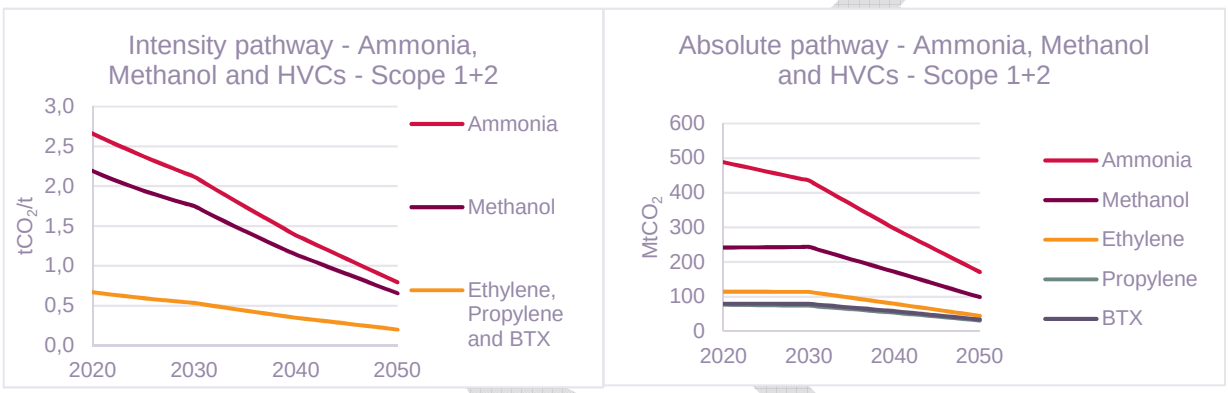


FIGURE 19 : CARBON EMISSIONS PATHWAYS FOR AMMONIA, METHANOL AND BTX

As for Chlorine, it is assumed that 2.45 MWh of electricity is needed per ton of chlorine. This value is the threshold set by the European Commission in the EU Taxonomy for the chlorine production activity to be considered an activity contributing to the transition to a low carbon economy, it is thus conservative. It is assumed that this energy consumption will not change over time and apply the electricity production carbon intensity pathway forecasted by the IEA ETP 2020 to the value. Indeed, the chlor-alkali process is used and has been enhanced for decades and it is consequently assumed that its process energy intensity will not undergo major drop anymore.

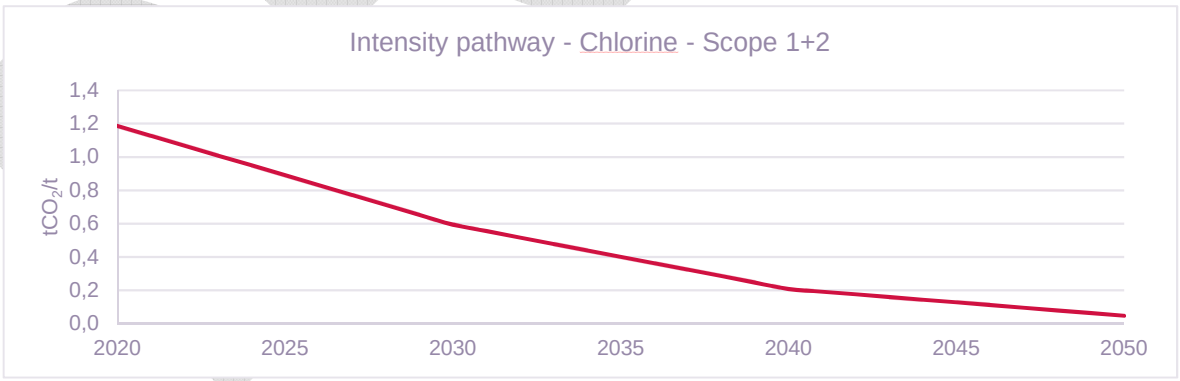


FIGURE 20 : CARBON INTENSITY PATHWAY FOR CHLORINE

[25] IEA, The Future of Petrochemicals – Towards more sustainable plastics and fertilisers

[26] IEA

The Hydrogen pathway comes from the global hydrogen production by technology forecasted by the IEA in the SDS scenario. Three routes have been identified for the production of hydrogen:

- Electrolysis
- Fossil feedstock cracking
- Fossil feedstock cracking and associated with CCU or CCS

The electrolysis-based hydrogen pathway is based on the global electricity production pathway similarly to the chlorine pathway. The fossil-based hydrogen is assumed to be produced 75% from natural gas and 25% from coal[27]. This share is assumed to be constant over time. For the fossil + CCU/CCS based hydrogen it is assumed that the capture rate of CCU/CCS is 90%.

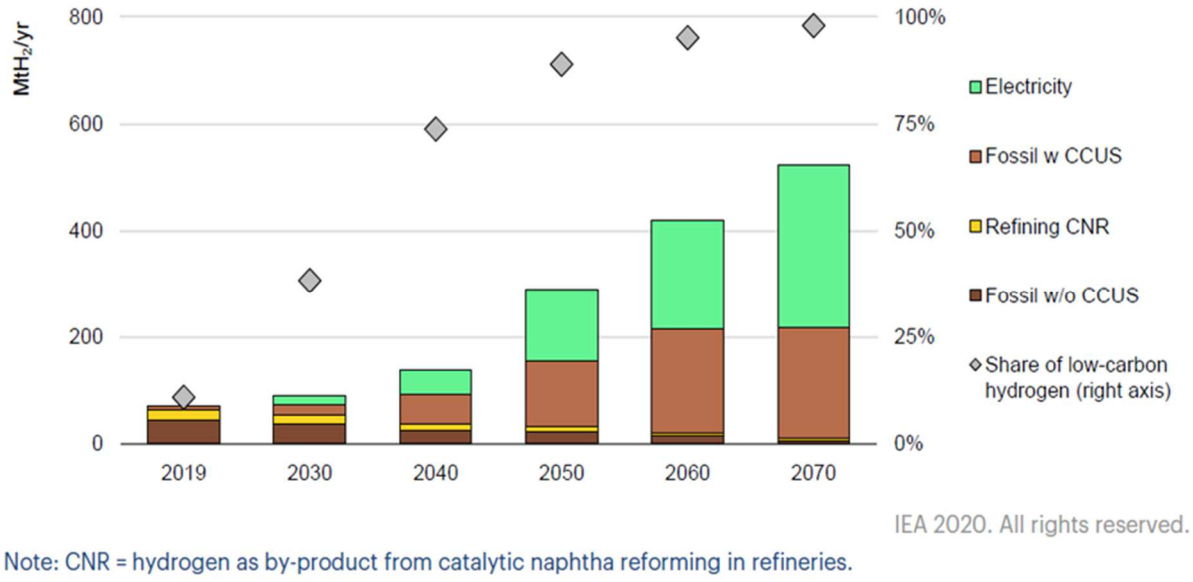


FIGURE 21 : GLOBAL HYDROGEN PRODUCTION BY TECHNOLOGY IN THE SUSTAINABLE DEVELOPMENT SCENARIO, 2019-2070, IEA ETP 2020

[27] IEA, The Future of Hydrogen

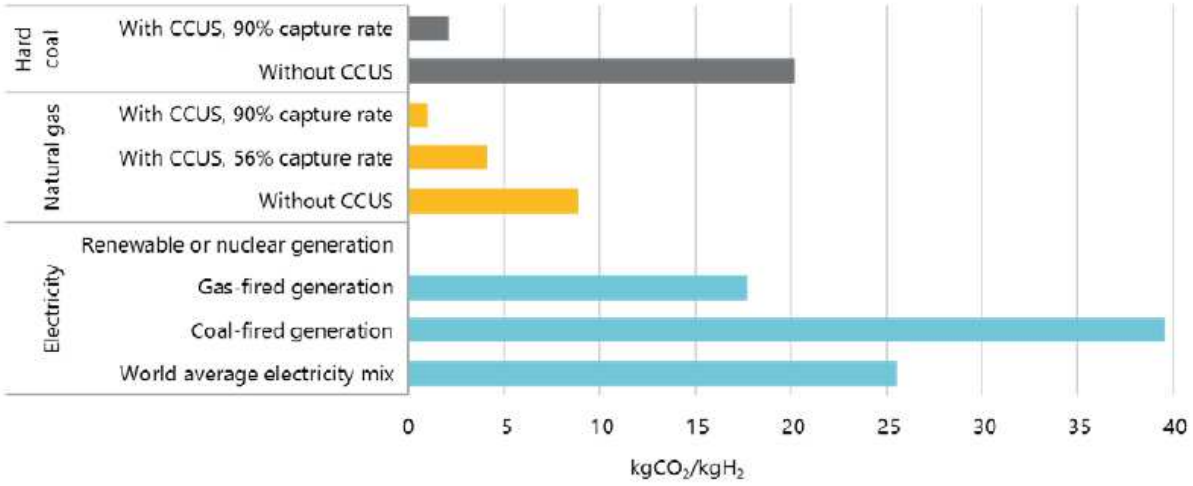


FIGURE 22 : CARBON INTENSITY OF HYDROGEN PRODUCTION. IEA ETP 2020

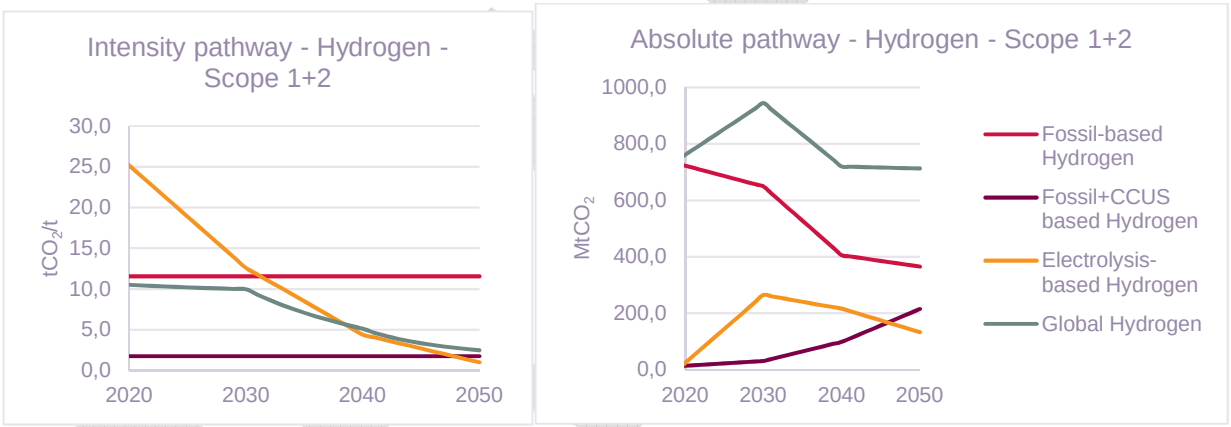


FIGURE 23 : CARBON EMISSIONS PATHWAYS FOR HYDROGEN

The benchmarks presented above for the primary chemicals are scope 1+2 emissions benchmarks that will be used for indicators CH 1.1, 2.1, 2.2. They will not be used for assessment of scope 1+2+3 emissions (under CH 2.1, CH 4.1, CH 4.2). Indeed, when considering the production of primary chemicals, scope 3 emissions are marginal compared to scope 1+2 emissions.

These primary chemicals related low-carbon scenarios allow to build pathways at the company level. To do so, the Sectoral Decarbonization Approach (SDA, see Glossary) allocation method is used.

As per the evaluation of type B companies and type B activities for integrated companies there is no sectoral pathway available, preventing the use of the SDA allocation method. Consequently, it has been decided to use the **Absolute Contraction Approach** (ACA, see Glossary) allocation method[28]. More precisely, according to the ACA method, all companies of Type B are expected to reduce their Scope 1+2+3 emissions by **2.5%** every year for 15 years, thus a reduction of 37,5% over a 15-years period (annual linear variation). This is the SBTi

[28] Both SDA and ACA have been developed by the SBTi methodology. See *SBTi - Foundations of Science-based Target Setting - 2019*

approach that corresponds to the WB2˚C scenario of IEA ETP. The contraction approach provides the company with the amount of absolute CO_2e emissions that it cannot exceed.

The same ACA allocation method and benchmark is used for scope 1+2+3 emissions.

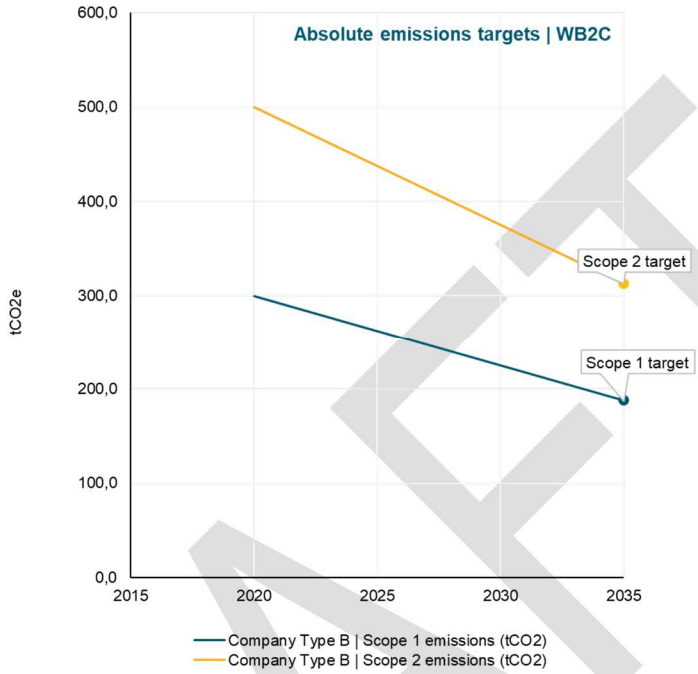


FIGURE 18: ILLUSTRATION OF ABSOLUTE CONTRACTION APPROACH FOR SCOPE 1 AND SCOPE 2 EMISSIONS

Benchmark	Performance indicators concerned	Status
Benchmarks for scope 1+2 GHG intensity	CH 1.1 / CH 2.1 / CH 2.2	Done
Benchmarks for scope 1+2+3 GHG intensity	CH 1.2 / CH 4.1 / CH 4.2	Done
Benchmark for locked-in emissions	CH 2.3	Done
Benchmark for the share of CAPEX in Low carbon, mitigation and carbon removal technologies	CH 2.4	Feedback from the Roadtest expected
Benchmark for energy management	CH 2.6	Feedback from the Roadtest expected

Benchmark for the R&D share in Low carbon, mitigation and carbon removal technologies	CH 3.1	Same as for CAPEX so far – to be updated after the Roadtest
Benchmark for the ammonia, methanol and HVC feedstock content	CH 4.3-4.5	Clean Technology Scenario (IEA - The Future of Petrochemicals)
Benchmark for the bio-sourced content of chemicals	CH 4.7	IEA ETP 2020

5.2. OTHER QUANTITATIVE BENCHMARKS USED FOR INDICATORS

Benchmark for the CAPEX Low-carbon & mitigation technologies

Low-carbon & mitigation technologies are the ones meeting the mitigation criteria of the EU Green Taxonomy. The list of eligible products will be detailed in an appendix and is set to be updated with the further development of this taxonomy.

Benchmark for the R&D in Low-carbon & mitigation technologies

A taxonomy has been established by the OECD (OECD Environment Working Papers No. 89 (2015)) in order to quantify the patents in environment-related technologies. It can be used to measure environmental innovation, if restricted to climate change mitigation technologies. It is based on the seven following categories:

- Environmental management
- Water-related adaptation technologies
- Biodiversity protection & ecosystem health
- Climate change mitigation related to energy
- CCS or CCU of GHG
- Climate change mitigation related to transportation
- Climate change mitigation related to building

The categories of this taxonomy used for this ACT methodology are the ones related to climate change mitigation (climate change mitigation related to energy, transportation and building) and CCS or CCU of GHG.

Benchmark for the Company patenting activity in low-carbon & mitigation technologies

The European Patent Office (EPO) and the US Patent and Trademark Office (USPTO) have developed a dedicated patent classification scheme (Cooperative Patent Classification - CPC) which details patents for climate change mitigation or technologies (EPO, 2017):

- Y02B – CCMTs related to buildings
- Y02C – Capture, storage, sequestration or disposal of greenhouse gases
- Y02E – Reduction of greenhouse gas emissions, related to energy generation, transmission or distribution
- Y02P – CCMTs relating to production in energy intensive industries
- Y02T – CCMTs related to transportation

- Y02W – CCMTs related to wastewater treatment or waste management

This classification is used for this ACT methodology.

5.3.WEIGHTINGS

5.3.1. RATIONALE FOR WEIGHTINGS

The selection of weights for both the modules and the individual indicators was guided by a set of principles (see the ACT framework document for more information). These principles helped define the weighting scheme of the modules and indicators.

Principle	**Explanation**
Value of information	The value of the information that an indicator gives about a company's outlook for the low-carbon transition is the primary principle for the selection of the weights.
Impact of variation	A high impact of variation in an indicator means that not performing in such an indicator has a large impact on the success of a low-carbon transition, and this makes it more relevant for the assessment.
Future orientation	Indicators that measure the future, or a proxy for the future, are more relevant for the ACT assessment than past & present indicators, which serve only to inform about the likelihood and credibility of the transition.
Data quality sensitivity	Indicators that are highly sensitive to expected data quality variations are not recommended for a high weight compared to other indicators, unless there is no other way to measure a particular dimension of the transition.

The weightings have been designed for each the three types of companies mentioned along the document:

- Type A companies: Companies producing primary chemicals (Ethylene, Propylene, BTX, Ammonia, Methanol, Chlorine and Hydrogen)
- Type B companies: Companies producing any other chemicals
- Integrated companies: Companies producing both primary chemicals and other chemicals

This aims at reflecting the strategic stakes which are different from a chemical company to another mostly according to its position along the chemical sector value chain.

For the sake of the dynamic weighting companies will have to disclose the share of their scope 1 & 2 emissions attributable to each of its products:

A = Share of scope 1 & 2 emissions attributable to Ammonia production

B = Share of scope 1 & 2 emissions attributable to Methanol production

C = Share of scope 1 & 2 emissions attributable to HVC production

D = Share of scope 1 & 2 emissions attributable Chlorine

E = Share of scope 1 & 2 emissions attributable to Hydrogen

F = Share of scope 1 & 2 emissions attributable to other chemicals production

The sum A+B+C+D+E+F must be equal to 100%.

	Type A company		Type B company		Integrated company	
Module	**Weighting**	**Rationale**	**Weighting**	**Rationale**	**Weighting**	**Rationale**
1. Targets	15%	Fixed weight across all sectors	15%	Fixed weight across all sectors	15%	Fixed weight across all sectors
2. Material Investment	27-32%	Owned assets (production infrastructure) represent the highest source of emissions	10%	Owned assets (production infrastructure) represent a significant source of emissions	10-32%	Owned assets represent a high source of emissions
3. Intangible Investment	10%	R&D investments for low-carbon innovation are crucial for the value chain	5%	R&D investments for low-carbon innovation are crucial for the value chain	5-10%	R&D investments for low-carbon innovation are crucial for the value chain
4. Sold Product Performance	2-7%	Indirect emissions (from feedstock or use of products) are significantly lower than direct emissions	20%	Indirect emissions (from feedstock mostly) are significant	2-20%	Indirect emissions can be high depending on the share of type B products
5. Management	12%	Fixed weight across all sectors	12%	Fixed weight across all sectors	12%	Fixed weight across all sectors
6. Supplier	10%	Lower influence on the suppliers midstream/upstream as partly integrated	17%	Suppliers for Upstream are not strategic, compared to the rest of the value chain.	10-17%	High level of influence on the upstream
7. Client	4%	Little leverage on clients	6%	Little leverage on clients	4-6%	Little leverage on clients
8. Policy engagement	5%	Average weight compared to the other sectors	5%	Average weight compared to the other sectors	5%	Average weight compared to the other sectors
9. Business Model	10%	Fixed weight across all sectors	10%	Fixed weight across all sectors	10%	Fixed weight across all sectors
	100%		**100%**		**100%**	

5.3.2. WEIGHTINGS BY TYPE OF COMPANY

♦ TYPE A COMPANIES

For type A companies, the share of emissions attributable to the production of other chemicals than the primary ones is F=0%, hence A+B+C+D+E=100%.

CH	Module	Indicator	Module weight	Indicator weight
1.1	Targets	Alignment of Scope 1+2 emissions reduction targets	15%	9%
1.2		Alignment of Scope 1+2+3 emissions reduction targets		0%
1.3		Time horizon of targets		3.5%
1.4		Historic Target Ambition and Company Performance		2.5%
2.1	Material Investment	Past performance – Scope 1+2 emissions	27% + (D+E) x 5%	4%
2.2		Trend in future Scope 1+2 emissions		6%
2.3		Locked-in emissions		5%
2.4		Low carbon, mitigation and carbon removal technologies CAPEX share		7%
2.5		Energy management		5% + (D+E) x 5%
3.1	Intangible Investment	R&D spending in low carbon, mitigation and carbon removal technologies	10%	7%
3.2		Company low-carbon patenting activity		3%
4.1	Sold Product Performance	Past performance – Scope 1+2+3 emissions	2% + (A+B+C) x 5%	0%
4.2		Trend in future Scope 1+2+3 emissions		0%
4.3		Ammonia feedstock		A x 5%
4.4		Methanol feedstock		B x 5%
4.5		HVC feedstock		C x 5%
4.6		Recycled content of products (including CO_2)		2%
4.7		Bio-based Type B products		0%
5.1	Management	Oversight of climate change issues	12%	3%
5.2		Climate change oversight capability		3%
5.3		Low carbon transition plan		2%
5.4		Climate change management incentives		1%
5.5		Climate change scenario testing		1%
5.6		Carbon pricing integration		2%
6.1	Supplier	Strategy to influence suppliers to reduce their GHG emissions	10%	5%
6.2		Activities to influence suppliers to reduce their GHG emissions		5%
7.1	Client	Strategy to influence customer behavior to reduce their GHG emissions	4%	2%
7.2		Activities to influence consumer behavior to reduce their GHG emissions		2%
8.1	Policy engagement	Company policy on engagement with trade associations	5%	1%
8.2		Trade associations supported do not have climate-negative activities or positions		2%
8.3		Position on significant climate policies		2%
9.1	Business model	Business activities that develop low-carbon, mitigation and carbon removal technologies	10%	6%
9.2		Business activities that develop products enabling energy transition		0%
9.3		Business activities that that promote circular economy		4%
Overall			**100%**	**100%**

RATIONALE:

Targets 15%

The targets module has a relatively large weight of 15%. Most of it is placed on the alignment of Scope 1+2 emissions reduction targets with 9%. For primary chemicals manufacturers, Scope 1+2 emissions are the largest sources of emissions. A 2.5% score is attributed to the previous achievement indicator, which measures the company's past credentials on target setting and achievement. Although ACT is a future-oriented methodology it can provide contextual information on the company's experience to meet ambitious targets. Finally, the time horizon of targets set has a weight of 3.5%. It is a proxy of how forward-looking the company is, which is long-term oriented.

Material Investment 27-32%

This module carries a weight of 27 to 32% depending on the share of emissions attributable to each of its products. It is the largest weight out of all the modules. Indeed, production infrastructures are crucial in the source of emissions related to the primary chemical manufacturers. As these emissions are mainly contributing to the scope 1+2, the analysis of the trend in future scope 1+2 emissions intensity receives a high weight of 6%. The Past performance – Scope 1+2 emissions is an indication of the 'adjustment' that the company has to make to place itself on a low-carbon pathway. It principally adds information about what kind of changes the company needs to undergo in order to become low-carbon aligned, and therefore receives smaller weight of 4%.

Emissions lock-in which has a 5% weighting, tries to measure the amount of carbon emissions that the company has committed from its individual carbon budget through its current and future projects.

The CAPEX allocated to low-carbon, mitigation and carbon capture technologies is a relevant signal for understanding the future alignment of the company with a low-carbon pathway. Low carbon, mitigation and carbon removal technologies (CCS, CCU, CDR) CAPEX share has a weight of 7%.

Finally, the Energy management indicator which aims at evaluating how energy intensive the company is as well as the share of low-carbon energy sourced has a dynamic weighting of 5% + (D+E) x 5% which encompasses the fact that chlorine and hydrogen production are particularly power-intensive. Energy management is the main lever to achieve low-carbon alignment.

Intangible Investment 10%

The R&D spending in low-carbon, mitigation and carbon removal technologies indicator is focused around the company's intangible investments or financial costs into climate change low-carbon, mitigation and carbon removal technologies. Even though it may not be the main activity of the company, R&D investments for low-carbon innovation are crucial for the value chain, especially for the upstream segments. Thus, the module is heighted to 10%, 7% of it going to this indicator. The 3% missing goes to the indicator on patenting of low-carbon technologies or processes to reflect on the knowledge diffusion of the company with regards to low-carbon innovation.

Sold product performance 2-7%

This module carries a low weight compared to type B companies. The module encompasses the specific low-carbon routes for the production of ammonia, methanol and HVCs with a weight of 5% x respectively A, B and C. 2% of the module weighting goes to the indicator assessing the recycled content of products, including captured and recycled CO_2.

Management 12%

Management is a multi-faceted module that makes up 12% of the score, because it incorporates many indicators that together paint a picture of the company's management and strategic approach to the low-carbon transition. The majority of this weight is placed on the oversight of climate change issues and the climate change oversight capability, which are weighted 3% each. These two indicators measure the ability of the company to integrate sustainability to its strategy and to embrace the main challenges related to low-carbon transition. Besides, according to the principle of future orientation, the transition plan provides more information on how this company will specifically deal with the transition, and has a weight of 2%.

The next two indicators (climate change management incentives and climate change scenario testing) have a low weight of 1%, as they are contextual indicators whose outcome can either strengthen or undermine the company's ability to carry out the transition plan and meet ambitious science-based targets.

A final indicator weighting 2% has been added to the management module since it is related to a specific stake of the chemical sector. It aims at promoting the integration of an internal carbon price to the company's strategy

Supplier engagement 10%

In order to decarbonize the whole economy, it is essential that all stakeholders get involved. Primary chemicals producers lay at the entrance of the chemical sector and they are *in fine* responsible for the nature of the initial feedstock the whole chemical value chain will carry. Hence it is essential in order to get aligned with a low-carbon economy than type A companies engage with their suppliers to source their inputs from alternative feedstock (biomass, low-carbon electrolysis, best-in-class refineries, etc.)

Client engagement 4%

In order to decarbonize the whole economy, it is essential that all stakeholders get involved. This module is not the most important one for type A companies, which explains the relatively low weighting attributed.

Policy engagement 5%

In line with the rationale for the management indicators of low weight, the policy engagement indicators are also contextual aspects which tell a narrative about the company's stance on climate change and how the company expresses it in their engagement with policy makers and trade associations.

Business model 10%

The module captures many elements and aspects that cannot otherwise be captured in any of the other modules. It includes those aspects that are relevant to the transition but are not directly a part of the primary activities. It is future oriented by asking the companies on its narrative on certain future directions it can/has to take is standard to enable the transition.

♦ TYPE B COMPANIES

For type B companies, the share of emissions attributable to the production of other chemicals than the primary ones is F=100%, hence A =B = C = D = E= 0%.

CH	Module	Indicator	Module weight	Indicator weight
1.1	**Targets**	Alignment of Scope 1+2 emissions reduction targets	15%	4%
1.2		Alignment of Scope 1+2+3 emissions reduction targets		8%
1.3		Time horizon of targets		2%
1.4		Historic Target Ambition and Company Performance		1%
2.1	**Material Investment**	Past performance – Scope 1+2 emissions	10%	2%
2.2		Trend in future Scope 1+2 emissions		2%
2.3		Locked-in emissions		2%
2.4		Low carbon, mitigation and carbon removal technologies CAPEX share		2%
2.5		Energy management		2%
3.1	**Intangible Investment**	R&D spending in low carbon, mitigation and carbon removal technologies	5%	3.5%
3.2		Company low-carbon patenting activity		1.5%
4.1	**Sold Product Performance**	Past performance – Scope 1+2+3 emissions	20%	6%
4.2		Trend in future Scope 1+2+3 emissions		7%
4.3		Ammonia feedstock		0%
4.4		Methanol feedstock		0%
4.5		HVC feedstock		0%
4.6		Recycled content of products (including CO_2)		3.5%
4.7		Bio-based Type B products		3.5%
5.1	**Management**	Oversight of climate change issues	12%	3%
5.2		Climate change oversight capability		3%
5.3		Low carbon transition plan		2%
5.4		Climate change management incentives		1%
5.5		Climate change scenario testing		1%
5.6		Carbon pricing integration		2%
6.1	**Supplier**	Strategy to influence suppliers to reduce their GHG emissions	17%	8.5%
6.2		Activities to influence suppliers to reduce their GHG emissions		8.5%
7.1	**Client**	Strategy to influence customer behavior to reduce their GHG emissions	6%	3%
7.2		Activities to influence consumer behavior to reduce their GHG emissions		3%
8.1	**Policy engagement**	Company policy on engagement with trade associations	5%	1%
8.2		Trade associations supported do not have climate-negative activities or positions		2%
8.3		Position on significant climate policies		2%
9.1	**Business model**	Business activities that develop low-carbon, mitigation and carbon removal technologies	10%	2%
9.2		Business activities that develop products enabling energy transition		4%
9.3		Business activities that that promote circular economy		4%
Overall			**100%**	**100%**

RATIONALE:

Targets 15%

The targets module has a relatively large weight of 15%. Most of it is placed on the alignment of Scope 1+2+3 emissions reduction targets with 8%. As in the chemical sector, most of the emissions come from the upstream side (type A companies), for type B companies, scope 3 upstream emissions are the largest source of emissions. However, as the company is directly responsible for its scope 1 & 2 emissions, a +4% weighting on this indicator is still awarded. A 2% score is attributed to the previous achievement indicator, which measures the company's past credentials on target setting and achievement. Although ACT is a future-oriented methodology it can provide contextual information on the company's experience to meet ambitious targets. Finally, the time horizon of targets set has a weight of 1%. It is a proxy of how forward-looking the company is, which is long-term oriented.

Material Investment 10%

Type B companies have a module 2 weighting significantly lower than type A companies. This comes from the fact that most of the impact relies upstream for a type B company, while this module mainly focuses on scope 1 & 2 emissions and reduction levers. The different indicators have been quite similarly weighted.

Intangible Investment 5%

As for module 2, since a type B company's impact materiality will rely upstream, the direct measures it may take e.g. through R&D and patenting will not have the same impact as type A companies, explaining a significantly lower module weight (half the weight of type A companies)

Sold product performance 20%

With a 20% weighting, this module is one of the most significant one for Type B companies. As scope 3 emissions are the most important ones for such companies, the past and future efforts translated within the indicators 4.1 and 4.2 score high weightings. Indicators 4.3 to 4.5 are not applicable to type B companies has they do not produce any of these primary chemicals. Finally, 4.6 and 4.7 score each a 3.5% weighting reflecting the result of the effort of the company to integrate alternative input within its products – either directly (with recycling and integration of biomass within the process) or directly by sourcing its chemical feedstock from suppliers incorporating a share of bio-sourced or secondary raw material.

Management 12%

Management is a multi-faceted module that makes up 10% of the score, because it incorporates many different smaller indicators that together paint a picture of the company's management and strategic approach to the low-carbon transition. The majority of this weight is placed on the oversight of climate change issues and the climate change oversight capability, which are weighted 3% each. These two indicators measure the ability of the company to integrate sustainability to its strategy and to embrace the main challenges related to low-carbon transition. Besides, according to the principle of future orientation, the transition plan provides more information on how this company will specifically deal with the transition, and has a weight of 2%.

The remaining indicators (climate change management incentives and climate change scenario testing) have a low weight of XX%, as they are contextual indicators whose outcome can either strengthen or undermine the company's ability to carry out the transition plan and meet ambitious science-based targets.

A final indicator weighting 2% has been added to the management module since it is related to a specific stake of the chemical sector. It aims at promoting the integration of an internal carbon price to the company's strategy.

Supplier engagement 17%

Type B companies come after the primary chemicals' producers in the chemical value chain. Since most of the GHG emissions come up the hill, one of their main levers of carbon reduction relies in the engagement with tier 1+ suppliers to encourage them to provide low-carbon material down the value chain. Both indicators of this module 6 receive the high weighting of 8.5%.

Client engagement 6%

In order to decarbonize the whole economy, it is essential that all stakeholders get involved.

Policy engagement 5%

In line with the rationale for the management indicators of low weight, the policy engagement indicators are also contextual aspects which tell a narrative about the company's stance on climate change and how the company expresses it in their engagement with policy makers and trade associations.

Business model 10%

The module captures many elements and aspects that cannot otherwise be captured in any of the other modules. It includes those aspects that are relevant to the transition but are not directly a part of the primary activities. It is future oriented by asking the companies on its narrative on certain future directions it can/has to take is standard to enable the transition.

♦ INTEGRATED COMPANIES

CH	Module	Indicator	Module weight	Indicator weight
1.1	**Targets**	Alignment of Scope 1+2 emissions reduction targets	15%	4% + (1-F) x 5%
1.2		Alignment of Scope 1+2+3 emissions reduction targets		F x 8%
1.3		Time horizon of targets		2% + (1-F) x 1.5%
1.4		Historic Target Ambition and Company Performance		1% + (1-F) x 1.5%
2.1	**Material Investment**	Past performance – Scope 1+2 emissions	10% + (1-F) x 17% + (D+E) x 5%	2% + (1-F) x 2%
2.2		Trend in future Scope 1+2 emissions		2% + (1-F) x 4%
2.3		Locked-in emissions		2% + (1-F) x 3%
2.4		Low carbon, mitigation and carbon removal technologies CAPEX share		2% + (1-F) x 5%
2.5		Energy management		2% + (1-F) x 3% + (D+E) x 5%
3.1	**Intangible Investment**	R&D spending in low carbon, mitigation and carbon removal technologies	5% + (1-F) x 5%	3.5% + (1-F) x 3.5%
3.2		Company low-carbon patenting activity		1.5% + (1-F) x 1.5%
4.1	**Sold Product Performance**	Past performance – Scope 1+2+3 emissions	2% + (A+B+C) x 5% + F x 18%	F x 6%
4.2		Trend in future Scope 1+2+3 emissions		F x 7%
4.3		Ammonia feedstock		A x 5%
4.4		Methanol feedstock		B x 5%
4.5		HVC feedstock		C x 5%
4.6		Recycled content of products (including CO_2)		2% + F x 1.5%
4.7		Bio-based Type B products		F x 3.5%
5.1	**Management**	Oversight of climate change issues	12%	3%
5.2		Climate change oversight capability		3%
5.3		Low carbon transition plan		2%
5.4		Climate change management incentives		1%
5.5		Climate change scenario testing		1%
5.6		Carbon pricing integration		2%
6.1	**Supplier**	Strategy to influence suppliers to reduce their GHG emissions	10% + F x 7%	5% + F x 3.5%
6.2		Activities to influence suppliers to reduce their GHG emissions		5% + F x 3.5%
7.1	**Client**	Strategy to influence customer behavior to reduce their GHG emissions	4% + F x 2%	2% + F x 1%
7.2		Activities to influence consumer behavior to reduce their GHG emissions		2% + F x 1%
8.1	**Policy engagement**	Company policy on engagement with trade associations	5%	1%
8.2		Trade associations supported do not have climate-negative activities or positions		2%
8.3		Position on significant climate policies		2%
9.1	**Business model**	Business activities that develop low-carbon, mitigation and carbon removal technologies	10%	2% + (1-F) x 4%
9.2		Business activities that develop products enabling energy transition		F x 4%
9.3		Business activities that that promote circular economy		4%
Overall			**100%**	**100%**

RATIONALE:

Integrated companies derive their weightings from their proximity with either type B, either type A companies, depending on the production mix they generate. Hence the weighting is dynamic, ranging from the type A weighting to the type B weighting depending on the share of non-primary chemicals emissions (F).

5.4.DATA REQUEST

TABLE 5 TABLE 5 introduces the list of information that will be requested to companies through a questionnaire, as well as the corresponding modules.

Description of the data requested to the company	List of all data points required	Module relevance	CDP 2020 Questionnaire mapping
General information about the company and the data availability	General description and introduction to your organization	General	C0.1 C-OG0.7
	The start and end date for which data is reported		C0.2
	The countries/regions 1 to N for which data will be provided.		C0.3 C7.2
	The currency in which the response is submitted		C0.4
	The boundary you are using for your Scope 1+2 GHG inventory		C0.5 C6.2
	Attach the latest relevant company reports. Add rows to the table as required		C12.4
	Any sources (e.g. facilities, specific GHGs, activities, geographies, etc.) of Scope 1 and Scope 2 emissions that are within your selected reporting boundary which are not included in your disclosure?		C6.2 C6.4
	Details of the sources of Scope 1 and Scope 2 emissions that are within your selected reporting boundary which are not included in your disclosure. Add columns to the table as required		C6.2 C6.4a
	Do you have emissions intensities data from your suppliers that will be used to calculate a part of your scope 3?		/
Past targets set with a past target year and current targets	• Base year • Start year • Target year • Percentage of reduction target from base year in absolute emissions • Percentage of reduction target achieved in absolute emissions • Percentage of reduction target from base year in emissions intensity • Percentage of reduction target achieved in emissions intensity • Percentage of scope 1+2 emissions covered by the targets • Emissions of the company on the year the target was set	Module 1	C4.1a C4.1b
Volume produced and emissions	Total volume produced per chemical (Mt)	Module 2	C6.1 C6.3 C6.5
	• Associated Scope 1+2 emissions to each chemical ($MtCO_2$) at years Y and Y-5 and Y+5. Split process and energy related emissions		

	• Scope 3 emissions associated with each chemical Split raw material production and transport related emissions		
	Scope 1+2 carbon intensity per chemical (tCO_2/t chemical) at years Y, Y-5 and Y+5.		
	Scope 1+2 emissions intensity of suppliers and clients if available (tCO_2/t chemical)		
Assets	Existing and planned assets (for the next 15 years) : • Name • Location • Plant type • Fuel mix • Capacity • Emission factor • Year of commissioning • Expected lifetime • Decommissioning or modernization year • Ownership stake • Share attributable to reporting boundary	Module 2	/
CAPEX	Share in low-carbon and mitigation technologies planned for the next 5 year	Module 2	/
	Share in carbon removal technologies planned for the next 5 years		
R&D and patents	Costs/investments in low-carbon, mitigation and carbon removal technologies	Module 3	C-CH9.6a
	Total R&D cost/investments of the company		
	Patenting activity in climate change mitigation technologies over the last 5 years		
	Total patenting activity over the last 5 years		
Product	If ammonia is produced, share of ammonia produced from electrolysis-based hydrogen	Module 4	C-CH8.3b
	If methanol is produced, share of methanol produced from electrolysis-based hydrogen		
	If HVCs are produced, share of bio-based HVC		
	Share of recycled content within products sold		
	Share of bio-based content within products sold		
Energy	Energy demand per energy type	Module 2	C8.2 C8.2a C-CH8.2a C8.2e
	Energy consumption targets		
	Action plan regarding energy management		
	Share of certified renewable energy (Renewable Energy Certificate, Power Purchase Agreement)		
Management	• Climate change management incentives • Position of the highest level of direct responsibility for climate change within the organization • Climate change expertise of the highest level of direct responsibility for climate change	Module 5	C1.1 C1.1a C1.1b C1.2 C1.2a C.3 C1.3a
Transition plan	• Details on the plan	Module 5	C3.1

	• Internal carbon pricing integration		C3.1a C3.1b C11.1 C11.1a C11.1b C11.1c C11.1d
Scenario testing	• Details on the scenario testing • Risks considered and identified	Module 5	C3.2 C3.2a C3.2b
Suppliers	• List of environmental/CSR contract clauses in purchasing & suppliers' selection process • List of initiatives implemented to influence suppliers to reduce their GHG emissions, green purchase policy or track record, supplier code of conduct	Module 6	C12.1 C12.1a
Clients	• Strategy to influence customer behaviour to reduce their GHG emissions • List of initiatives implemented to influence client behavior to reduce their GHG emissions	Module 7	C12.1 C12.1b
Company policy on engagement with trade associations	• Company policy on engagement with trade associations • Trade associations supported do not have climate-negative activities or positions • Position on significant climate policies	Module 8	C12.3 C12.3a C12.3c C12.3f
Business model	• For business activities that develop low-carbon, mitigation and carbon removal technologies • For business activities that promote circular econnomy • For business activities that develop CCS, CCU technologies For each : • Description of business activity • Stage of development (incl. profitability) • Exploration type • List and turnover or invested capital (or other financial KPI) of activities in new businesses related to low carbon business models • Current position and action plan of the company towards the identified low-carbon business models • What are your future plans for this activity? • Maturity of the targeted market	Module 9	C2.4a C3.3 C4.3 C-CH9.6 C-CH9.6a

TABLE 5: DATA REQUEST PER MODULE

6. Rating

The ACT rating shall comprise:

→ **A performance score**
→ **A narrative score**
→ **A trend score**

These pieces of information shall be represented within the ACT rating as follows:

a. **Performance score** as a number from 1 (lowest) to 20 (highest)
b. **Narrative score** as a letter from E (lowest) to A (highest)
c. **Trend score** as either "+" for improving, "-" for worsening, or "=" for stable.

In some situations, trend scoring may reveal itself to be unfeasible depending on data availability. In this case, it should be replaced with a "?".

The highest rating is thus represented as "20A+", the lowest as "1E-" and the midpoint as "10C=".

TABLE 6: HIGHEST SCORE FOR EACH ACT SCORE TYPE

The highest available ACT rating is 20 A +	A **performance rating** of **20**: the company received high scores in its assessment against the methodology indicators.
	An **assessment rating** of **A:** the information reported by the company and available from public sources was consistent and showed that the company is well aligned to transition to the low-carbon economy
	A **trend rating** of **+**: the information provided shows the company will be better placed to transition to the low-carbon economy in future.

Each company assessed using an ACT methodology received not only an ACT rating but a commentary on their performance across the three aspects of the rating. This gave a nuanced picture of the company's strengths and weaknesses. Detailed information on the ACT rating is available in the ACT Framework document

6.1.PERFORMANCE SCORING

Performance scoring shall be performed in compliance with the ACT Framework. Considering the characteristics of the Chemical sector, all the modules of ACT Framework are integrated in the analysis. The scoring will depend on the type of company assessed. Indeed, the weighting scheme depends on whether the company is a type A, B or an integrated one. No other additional sector-specific issues that impact the scoring split for the companies of the sector has been identified to date.

A detailed description of the Performance indicators and of their weightings for the Chemical sector is presented in 4.3. Performance indicators.Performance indicators.

Figure 24 : Example of scoring for the performance score shows an example of the decomposition of the performance score of a company along each module score.

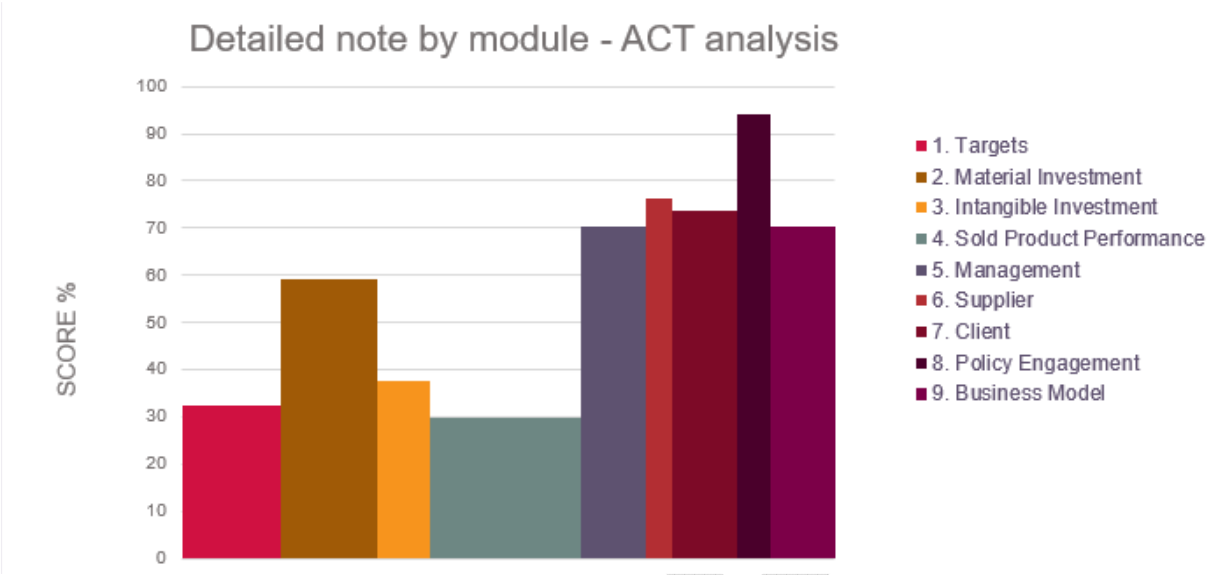


FIGURE 24 : EXAMPLE OF SCORING FOR THE PERFORMANCE SCORE

6.2.NARRATIVE SCORING

Narrative scoring shall be performed in compliance with the ACT Framework. No sector-specific issue that impacts the analysis scoring for the companies of the sector has been identified to date. The narrative scoring evaluates the business model and strategy, the consistency, credibility and reputation of the company regarding climate change and the risks it is facing. Depending on these criteria every indicator is relevant for the assessment. As examples, module 8 “Policy engagement” is relevant for the reputation and credibility of the company regarding climate change, modules 3 and 5 “Intangible investment” and “Material investment” are relevant for the consistency evaluation, module 1 and 9 “Targets” and “Business model” are relevant for the strategy assessment of the company, module 4 and 5, “Sold product performance” and “Management” are relevant for the assessment of how the company faces transition and climate change risks.

6.3.TREND SCORING

Scoring shall be performed in compliance with the ACT Framework.

To apply the trend scoring methodology presented in the ACT Framework, the analyst should identify the trends from the existing data infrastructure based on the data points and/or indicators that can indicate the future direction of change within the company.

The table below includes an overview of which indicators/data points could possibly have valuable information about future directions.

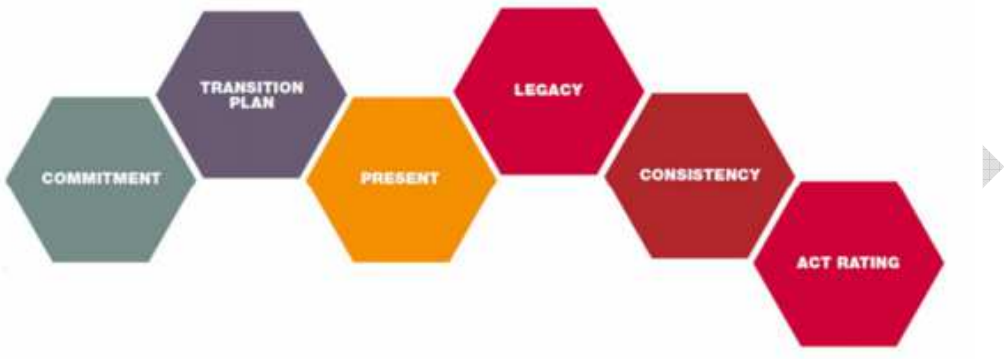
TABLE 7: RELEVANT PERFORMANCE INDICATORS FOR TRENDS IDENTIFICATION

MODULE	INDICATOR
Targets	CH 1.1 Alignment of Scope 1+2 emissions reduction targets
	CH 1.2 Alignment of Scope 1+2+3 emissions reduction targets
	CH 1.3 Time horizon of targets
Material Investment	CH 2.2 Trend in future Scope 1+2 emissions
Sold Product Performance	CH 4.2 Trend in future Scope 1+2+3 emissions intensity
Management	CH 5.3 Low carbon transition plan
	CH 5.5 Climate change scenario testing
	CH 5.6 Internal carbon pricing integration
Business model	CH 9.1 Business activities that develop low-carbon, mitigation and carbon removal technologies
	CH 9.2 Business activities that develop products enabling energy transition
	CH 9.3 Business activities that promote circular economy

7. Aligned state

The table below presents the response of a low-carbon aligned company of the sector to the 5 questions of ACT:

→ What is the company planning to do? [Commitment]
→ How is the company planning to get there? [Transition Plan]
→ What is the company doing at present? [Present]
→ What has the company done in the recent past? [Legacy]
→ How do all of these plans and actions fit together? [Consistency]



1	2	3	4	5
The company has set emissions reduction targets on the major segments of its value chain. These objectives are aligned with a relevant time horizon which reflects the lifetime of the company, its products and services.	The company understands where in the value chain the majority of its embedded emissions are. Therefore, the company discloses a transition plan that details operation steps to achieve their objectives.	Current strategies and actions aim at reducing operational emissions and leverage its market position to drive change across the value chain from upstream to downstream activities.	Clear evidence of reducing operational emissions, and a strong track record of successful intervention in the value chain that highlights the company's ability and will to enact change beyond its direct emissions.	The company's targets, transition plan, present and past actions show a consistent willingness to achieve the goals of the transition. The company operates as the connection between clients and suppliers to address all relevant emissions in the value chain and holds its due place in the circular economy.

FIGURE 25: ALIGNED STATE FOR COMPANIES

8. Sources

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9. Glossary

2 DEGREES (2°C)	A political agreement was reached at COP21 on limiting global warming to 2°C above the pre-industrial level (**COP21: Why 2°C?**). A 2°C scenario (or 2°C pathway) is a scenario (or pathway) compatible with limiting global warming to 2°C above the pre-industrial level.
ACA	Absolute Contraction Approach. "The absolute contraction approach is a method for companies to set emissions reduction targets that are aligned with the global, annual emissions reduction rate that is required to meet 1.5˚C or WB2˚C." See *Foundations of Science-based Target Setting* from SBTi (2019).
ACT	The Assessing low-Carbon Transition (ACT) initiative was jointly developed by ADEME and CDP. ACT assesses how ready an organization is to transition to a low-carbon world using a future-oriented, sector-specific methodology (**ACT website**).
ACTION GAP	In relation to emissions performance and reduction, the action gap is the difference between what a given company has done in the past plus what it is doing now, and what has to be done. For example, companies with large action gaps have done relatively little in the past, and their current actions point to continuation of past practices.
ACTIVITY DATA	Activity data are defined as data on the magnitude of human activity resulting in emissions or removals taking place during a given period of time (**UNFCCC definitions**).
ADEME	Agence de la Transition Ecologique; The French Agency for Ecological Transition (**ADEME webpage**).
ALIGNMENT	The ACT project seeks to gather information that will be consolidated into a rating that is intended to provide a general metric of the 2-degree alignment of a given company. The wider goal is to provide companies specific feedback on their general alignment with 2-degrees in the short and long term.
ANALYST	Person in charge of the ACT assessment.
ASSESS	Under the ACT project, to evaluate and determine the low-carbon alignment of a given company. The ACT assessment and rating will be based on consideration of a range of indicators. Indicators may be reported directly from companies. Indicators may also be calculated, modelled or otherwise derived from different data sources supplied by the company. The ACT project will measure 3 gaps (Commitment, Horizon and Action gaps

	– defined in this glossary) in the GHG emissions performance of companies. This model closely follows the assessment framework presented above. It starts with the future, with the goals companies want to achieve, followed by their plans, current actions and past actions.
ASSET	An item of property owned by a company, regarded as having value and available to meet debts, commitments, or legacies. Tangible assets include 1) fixed assets, such as machinery and buildings, and 2) current assets, such as inventory. Intangible assets are nonphysical such as patents, trademarks, copyrights, goodwill and brand value.
BARRIER	A circumstance or obstacle preventing progress (e.g. lacking information on supplier emissions and hotspots can be a barrier to companies managing and reducing their upstream indirect emissions).
BASE YEAR	According to the GHG Protocol and ISO14064-1, a base year is "a historic datum (a specific year or an average over multiple years) against which a company's emissions are tracked over time". Setting a base year is an essential GHG accounting step that a company must take to be able to observe trends in its emissions information (**GHG Protocol Corporate Standard**).
BENCHMARK	A standard, pathway or point of reference against which things may be compared. In the case of pathways for sector methodologies, a sector benchmark is a low-carbon pathway for the sector average value of the emissions intensity indicator(s) driving the sector performance. A company's benchmark is a pathway for the company value of the same indicator(s) that starts at the company performance for the reporting year and converges towards the sector benchmark in 2050 in case of a Sectoral Decarbonization Approach (SDA), based on a principle of convergence of emissions intensity.
BOARD	Also called the "Board of Directors" or "Executive Board"; the group of persons appointed with joint responsibility for directing and overseeing the affairs of a company.
BUSINESS MODEL	A plan for the successful operation of a business, identifying sources of revenue, the intended client base, products, and details of financing. Under ACT, evidence of the business model shall be taken from a range of specific financial metrics relevant to the sector and a conclusion made on its alignment with low-carbon transition and consistency with the other performance indicators reported.
BUSINESS-AS-USUAL	No proactive action taken for change. In the context of the ACT methodology, the business-as-usual pathway is constant from the initial year onwards. In general, the initial

	year – which is the first year of the pathway/series – is the reporting year (targets indicators) or the reporting year minus 5 years (performance indicators).
Capacity (power)	In relation to power generation, nameplate capacity is the power output number, usually expressed in megawatts (MW), and registered with authorities for classifying the power output of a power station.
Capital expenditure	Money spent by a business or organization on acquiring or maintaining fixed assets, such as land, buildings, and equipment.
Carbon Capture and Storage (CCS)	The process of trapping carbon dioxide produced by burning fossil fuels or other chemical or biological process and storing it in such a way that it is unable to affect the atmosphere.
Carbon offsets	Carbon offsets are avoidance of GHG emissions or GHG suppressions made by a company, sector or economy to compensate for emissions made elsewhere in the economy, where the marginal cost of decarbonization proves to be lower.
CDP	Formerly the "Carbon Disclosure Project", CDP is an international, not-for-profit organization providing the only global system for companies and cities to measure, disclose, manage and share vital environmental information. CDP works with market forces, including 827 institutional investors with assets of over US$100 trillion, to motivate companies to disclose their impacts on the environment and natural resources and take action to reduce them. More than 5,500 companies worldwide disclosed environmental information through CDP in 2015. CDP now holds the largest collection globally of primary climate change, water and forest risk commodities information and puts these insights at the heart of strategic business, investment and policy decisions (**CDP website**).
Climate change	A change in climate, attributed directly or indirectly to human activity, that alters the composition of the global atmosphere and that is, in addition to natural climate variability, observed over comparable time periods (UNFCCC).
Commitment gap	In relation to emissions performance, the difference between what a company needs to do and what it says it will do.
Company	A commercial business.
Company	A company's past emissions intensity performance pathway up until the present.

PATHWAY	
COMPANY TARGET PATHWAY	The emissions intensity performance pathway that the company has committed to follow from the initial year on until a future year, for which it has set a performance target.
CONFIDENTIAL INFORMATION	Any non-public information pertaining to a company's business.
CONSERVATIVE-NESS	A principle of the ACT project; whenever the use of assumptions is required, the assumption shall err on the side of achieving 2-degrees maximum.
CONSISTENCY	A principle of the ACT project; whenever time series data is used, it should be comparable over time. In addition to internal consistency of the indicators reported by the company, data reported against indicators shall be consistent with other information about the company and its business model and strategy found elsewhere. The analyst shall consider specific, pre-determined pairs of data points and check that these give a consistent measure of performance when measured together.
COP21	The 2015 United Nations Climate Change Conference, held in Paris, France from 30 November to 12 December 2015 (**COP21 webpage**).
CRACKER	Plant where cracking is done. Cracking is the process by which long chain hydrocarbons are broken into simpler molecules.
DATA	Facts and statistics collected together for reference and analysis (e.g. the data points requested from companies for assessment under the ACT project indicators).
DECARBONIZATION	A complete or near-complete reduction of greenhouse gas emissions over time (e.g. decarbonization in the electric utilities sector by an increased share of low-carbon power generation sources, as well as emissions mitigating technologies like Carbon Capture and Storage (CCS)).
EMISSIONS	The GHG Protocol defines direct GHG emissions as emissions from sources that are owned or controlled by the reporting entity, and indirect GHG emissions as emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity (**GHG Protocol**).

Energy	Power derived from the utilization of physical or chemical resources, especially to provide light and heat or to work machines.
Fossil fuel	A natural fuel such as coal, oil or gas, formed in the geological past from the remains of living organisms.
Future	A period of time following the current moment; time regarded as still to come.
Greenhouse gas (GHG)	Greenhouse gas (e.g. carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and three groups of fluorinated gases (sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs)) which are the major anthropogenic GHGs and are regulated under the Kyoto Protocol. Nitrogen trifluoride (NF_3) is now considered a potent contributor to climate change and is therefore mandated to be included in national inventories under the United Nations Framework Convention on Climate Change (UNFCCC).
Guidance	Documentation defining standards or expectations that are part of a rule or requirement (e.g. **CDP reporting guidance for companies**).
Horizon Gap	In relation to emissions performance, the difference between the average lifetime of a company's production assets (particularly carbon intensive) and the time-horizon of its commitments. Companies with large asset-lives and small-time horizons do not look far enough into the future to properly consider a transition plan.
Incentive	A thing, for example money, that motivates or encourages someone to do something (e.g. a monetary incentive for company board members to set emissions reduction targets).
Indicator	An indicator is a quantitative or qualitative piece of information that, in the context of the ACT project, can provide insight on a company's current and future ability to reduce its carbon intensity. In the ACT project, 3 fundamental types of indicators can be considered: ♦ Key performance indicators (KPIs); ♦ Key narrative indicators (KNIs); and ♦ Key asset indicators (KAIs).
Intensity (emissions)	♦ The average emissions rate of a given pollutant from a given source relative to the intensity of a specific activity; for example, grams of carbon dioxide released per MWh of energy produced by a power plant.
Intervention	Methods available to companies to influence and manage emissions in their value chain, both upstream and downstream, which are out of their direct control (e.g. a retail company

	may use consumer education as an intervention to influence consumer product choices in a way that reduces emissions from the use of sold products).
Lifetime	The duration of a thing's existence or usefulness (e.g. a physical asset such as a power plant).
Long-term	Occurring over or relating to a long period of time; under ACT this is taken to mean until the year 2050. The ACT project seeks to enable the evaluation of the long-term performance of a given company while simultaneously providing insights into short- and medium-term outcomes in alignment with the long-term.
Low-carbon benchmark pathway	Benchmark pathway (See 'Benchmark')
Low-carbon scenario (or pathway)	A low-carbon scenario (or pathway) is a 2°C scenario, a well-below 2°C scenario or a scenario with higher decarbonization ambition.
Low-carbon solution	A low-carbon solution (e.g. energy, technology, process, product, service, etc.) is a solution whose development will contribute to the low-carbon transition.
Low-carbon transition	The low-carbon transition is the transition of the economy according to a low-carbon scenario.
Manufacture	Making objects on a large-scale using machinery.
Maturity matrix	A maturity matrix is essentially a "checklist", the purpose of which is to evaluate how well advanced a particular process, program or technology is according to specific definitions.
Maturity progression	An analysis tool used in the ACT project that allows both the maturity and development over time to be considered with regards to how effective or advanced a particular intervention is.
Mitigation (emissions)	The action of reducing the severity of something (e.g. climate change mitigation through absolute GHG emissions reductions)

Model	A program designed to simulate what might or what did happen in a situation (e.g. climate models are systems of differential equations based on the basic laws of physics, fluid motion, and chemistry that are applied through a 3-dimensional grid simulation of the planet Earth).
Pathway (emissions)	A way of achieving a specified result; a course of action (e.g. an emissions reduction pathway).
Performance	Measurement of outcomes and results.
Plan	A detailed proposal for doing or achieving something.
Point	A mark or unit of scoring awarded for success or performance.
Power	Energy that is produced by mechanical, electrical, or other means and used to operate a device (e.g. electrical energy supplied to an area, building, etc.).
Power generation	The process of generating electric power from other sources of primary energy.
Primary chemical	The chemicals considered as primary in this ACT methodology are : Ethylene, Propylene, BTX, Ammonia, Methanol, Chlorine and Hydrogen.
Primary energy	Primary energy is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels, and other forms of energy received as input to a system. Primary energy can be non-renewable or renewable.
Progress ratio	An indicator of target progress, calculated by normalizing the target time percentage completeness by the target emissions or renewable energy percentage completeness.
Relevant / Relevance	In relation to information, the most relevant information (core business and stakeholders) to assess low-carbon transition.
Renewable energy	Energy from a source that is not depleted when used, such as wind or solar power.

Reporting year	Year under consideration.
Research and Development (R&D)	A general term for activities in connection with innovation; in industry; for example, this could be considered work directed towards the innovation, introduction, and improvement of products and processes.
Scenario	The **Fifth Assessment Report** (AR5) of the Intergovernmental Panel on Climate Change (IPCC) presents the results of an extensive climate modelling effort to make predictions of changes in the global climate based on a range of development/emissions scenarios. Regulation on climate change-related issues may present opportunities for your organization if it is better suited than its competitors to meet those regulations, or more able to help others to do so. Possible scenarios would include a company whose products already meet anticipated standards designed to curb emissions, those whose products will enable its clients to meet mandatory requirements or those companies that provide services assisting others in meeting regulatory requirements.
Scenario analysis	A process of analysing possible future events by considering alternative possible outcomes.
Science-Based Target	To meet the challenges that climate change presents, the world's leading climate scientists and governments agree that it is essential to limit the increase in the global average temperature at below 2°C. Companies making this commitment will be working toward this goal by agreeing to set an emissions reduction target that is aligned with climate science and meets the requirements of the **Science-Based Targets Initiative**.
Scope 1 emissions **Direct GHG emissions and removals**	All direct GHG emissions (**GHG Protocol Corporate Standard**). Category 1 from ISO 14064-1:2018*: Direct GHG emissions and removals occur from GHG sources or sinks inside organizational boundaries and that are owned or controlled by the* [reporting] *organization. Those sources can be stationary (e.g. heaters,electricity generators, industrial process) or mobile (e.g. vehicles).*
Scope 2 emissions **Indirect GHG emissions from imported energy**	Indirect GHG emissions from consumption of purchased electricity, heat or steam (**GHG Protocol Corporate Standard**). Category 2 from ISO 14064-1:2018: *GHG emissions due to the fuel combustion associated with the production of final energy and utilities, such as electricity, heat, steam, cooling and compressed air* [imported by the reported company]. *It excludes all upstream emissions (from cradle to power plant gate) associated with fuel, emissions due to the*

	construction of the power plant, and emissions allocated to transport and distribution losses.
SCOPE 3 EMISSIONS **INDIRECT GHG EMISSIONS**	Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc. (**GHG Protocol Corporate Standard**). Scope 3 also encompass the emissions related to the use of sold-products. ISO 14064-1:2018: *GHG emission that is a consequence of an organization's operations and activities, but that arises from GHG sources that are not owned or controlled by the* [reporting] *organization*. *These emissions occur generally in the upstream and/or downstream chain.* *Category 3: indirect GHG emissions from transportation* *Category 4: Indirect GHG emissions from products used by an organization* *Category 5: Indirect GHG emissions associated with the use of products from* *the organization* *Category 6: Indirect GHG emissions from other sources*
SECTOR	A classification of companies with similar business activities, e.g. automotive manufacturers, power producers, retailers, etc.
SECTORAL DECARBONIZATION APPROACH (SDA)	To help businesses set targets compatible with 2-degree climate change scenarios, SBT developed the **Sectoral Decarbonization Approach** (SDA). The SDA takes a sector-level approach and employs scientific insight to determine the least-cost pathways of mitigation.
SHORT-TERM	Occurring in or relating to a relatively short period of time in the future.
STRATEGY	A plan of action designed to achieve a long-term or overall aim. In business, this is the means by which a company sets out to achieve its desired objectives; long-term business planning.
STRESS TEST	A test designed to assess how well a system functions when subjected to greater than normal amounts of stress or pressure (e.g. a financial stress test to see if an oil & gas company can withstand a low oil price).
SUPPLIER	A person or entity that is the source for goods or services (e.g. a company that provides engine components to an automotive manufacturing company).

TARGET	A quantifiable goal (e.g. to reduce GHG emissions). ♦ The following are examples of absolute targets: → metric tonnes CO_2e or % reduction from base year → metric tonnes CO_2e or % reduction in product use phase relative to base year → metric tonnes CO_2e or % reduction in supply chain relative to base year ♦ The following are examples of intensity targets: → metric tonnes CO_2e or % reduction per passenger. Kilometre (also per km; per nautical mile) relative to base year → metric tonnes CO_2e or % reduction per square foot relative to base metric tonnes CO_2e or % reduction per MWh
TECHNOLOGY	The application of scientific knowledge for practical purposes, especially in industry (e.g. low-carbon power generation technologies such as wind and solar power, in the electric power generation sector).
TRADE ASSOCIATION	Trade associations (sometimes also referred to as industry associations) are an association of people or companies in a particular business or trade, organized to promote their common interests. Their relevance in this context is that they present an "industry voice" to governments to influence their policy development. The majority of organizations are members of multiple trade associations, many of which take a position on climate change and actively engage with policymakers on the development of policy and legislation on behalf of their members. It is acknowledged that in many cases companies are passive members of trade associations and therefore do not actively take part in their work on climate change (**CDP climate change guidance**).
TRANSITION	The process or a period of changing from one state or condition to another (e.g. from an economic system and society largely dependent on fossil fuel-based energy, to one that depends only on low-carbon energy).
TYPE A COMPANIES	Companies exclusively producing primary chemicals.
TYPE B COMPANIES	Companies producing any chemical except for primary chemicals.
TREND	A general direction in which something (e.g., GHG emissions) is developing or changing.

Verifiable / Verifiability	To prove the truth of, as by evidence or testimony; confirm; substantiate. Under the ACT project, the data required for the assessment shall be verified or verifiable.
Weighting	The allowance or adjustment made in order to take account of special circumstances or compensate for a distorting factor.

10. Appendix

10.1. TWG MEMBERS

This ACT methodology has been developed with inputs and feedbacks of the Technical Working Group, which met five times over the course of the development phase.

TABLE 8: LIST OF TWG MEMBERS

ORGANISATION	NAME
ADEME	Marlène Dresch, Julie Georges, Yann Rosetti
Agora Energiewende	Oliver Sartor
Borealis	Bertrand Walle
Cabot Corporation	Gordon Reynolds
Candriam	Arnaud Peythieu
CDP	Alice De Palma
Climate Check	Patrick Hardy
DECHEMA	Florian Ausfelder
Deloitte	Joel Neave, Julien Paulou
ECO2 Initiative	Rémi Marcus
Firmenich	William Gischlar
France Chimie	Sylvain Le Net
Grantham Institute	Gbemi Oluleye
Icare	Tony Jugan, Nikolaos Kordevas, Olivier Polidori
INC@CNRS	Jean-François Gérard
Inovyn	Cyril Menard
International Energy Agency	Peter Levi
JRC	Jose Moya
JRC (previously)	Aikaterini Boulamanti
Kemira Chemicals	Mark Wenclawiak
Mosaic Company	Natali Archibee
Nippon Paint Holding	Yuji Matsushita
Sabara	Giovanna Cappellano
SBTi	Nate Aden, Kylee Chang

Synthos	Norbert Eichler
Vencorex	Philippe Barbeau
Welya SAS	Olivier Pons Y Moll
Yara	Susan Giles
Yygdrasill	Yves Lenain

10.2. COMPANIES INVOLVED IN THE ROADTEST

TABLE 9: LIST OF COMPANIES INVOLVED IN THE ROADTEST

COMPANIES
To be completed once the roadtest has occurred

10.3. PEDAGOGICAL GRAPHS FOR INDICATORS USING TREND RATIO

Illustration of the different cases applied to type A companies (emission intensity used).

- **CASE 1**

Conditions	Score
$Company's\ trend > 0$ Increase in company emissions intensity	0%

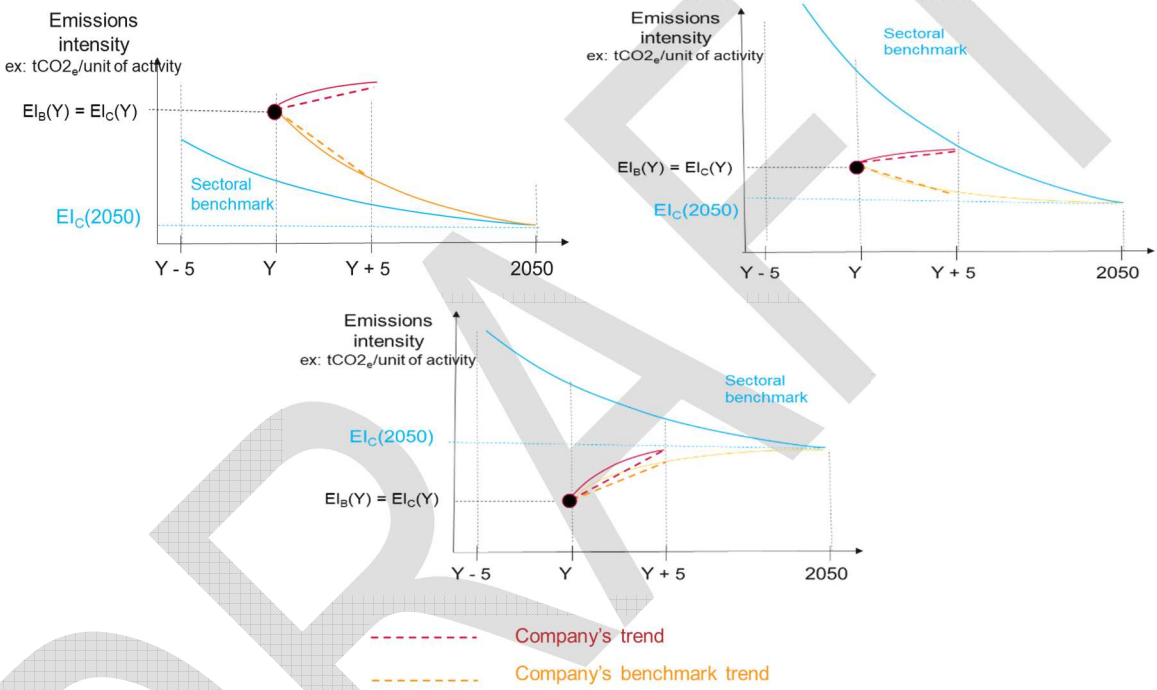


FIGURE 26: TREND RATIO - CASE 1

- **CASE 2**

Conditions	Score
$Company's\ trend \leq 0$ and $E_C(Y_R) \geq E_B(2050)$ $0 \leq trend\ ratio \leq 1$ Decrease in company emissions intensity but company's pathway does not go beyond the company's benchmark ambition	$Trend\ ratio \times 100\%$

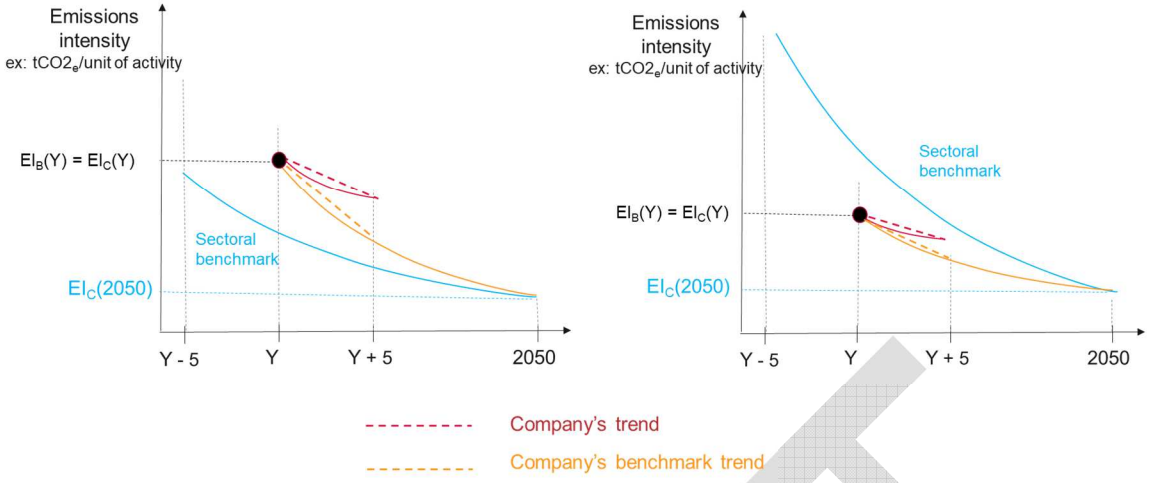


FIGURE 27: TREND RATIO - CASE 2

- **CASE 3**

Conditions	Score
$Company's\ trend < 0$ $trend\ ratio > 1$ Decrease in company emissions intensity and company's pathway equals or exceeds the company's benchmark ambition	100%

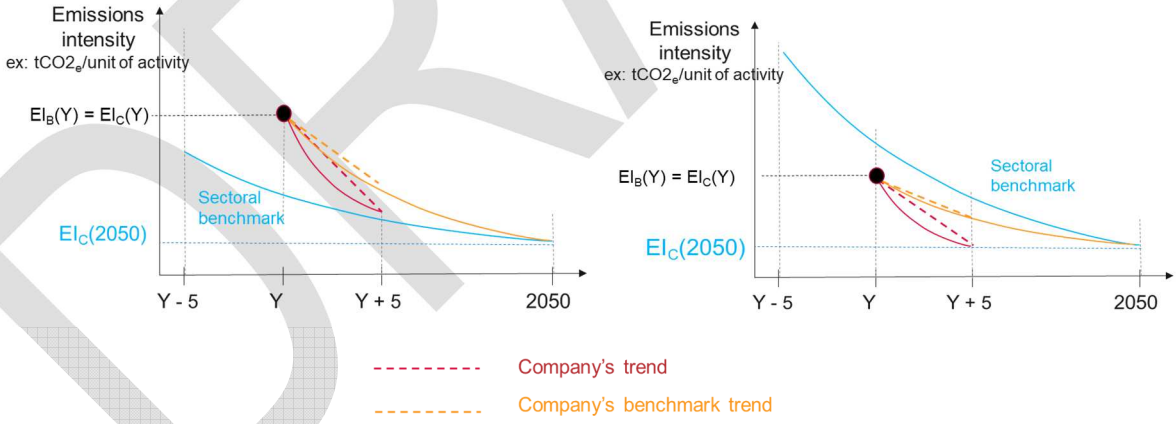


FIGURE 28: TREND RATIO - CASE 3

- **CASE 4**

Conditions	Score
$Company's\ target\ trend \leq 0\ and\ E_C(Y_R) \leq E_B(2050)$ No increase in company emissions intensity and company's emissions intensity is already below the company's benchmark ambition for 2050	100%

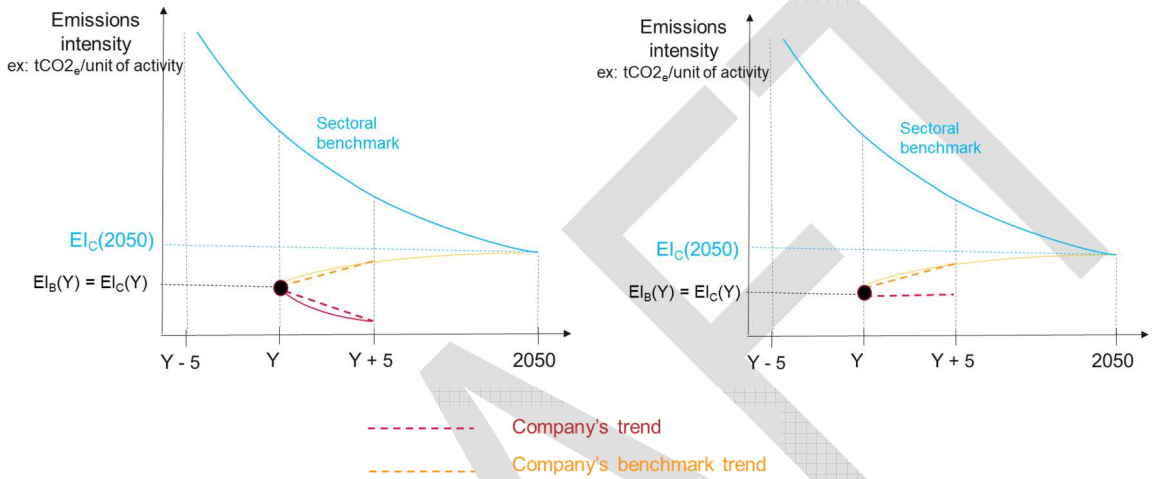


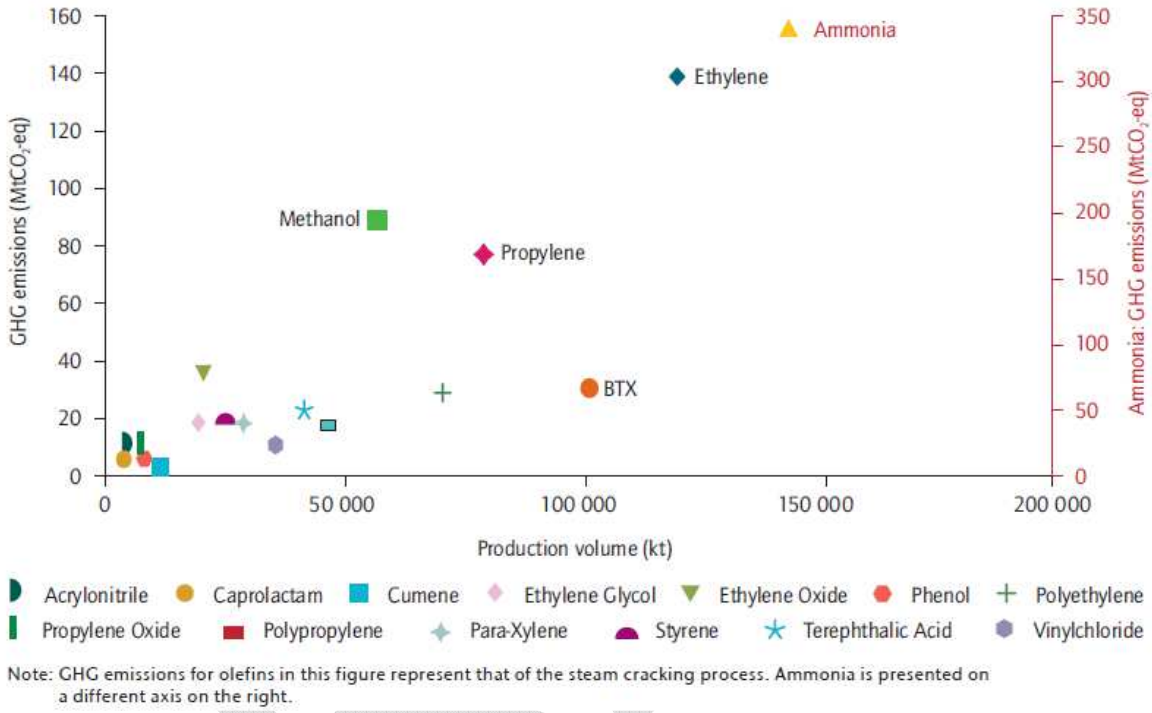
FIGURE 29: TREND RATIO - CASE 4

10.4. LITERATURE REVIEW SYNTHESIS

10.4.1. CHEMICAL SECTOR STATISTICS

10.4.1.1. GLOBAL OVERVIEW

Dechema, the ICCA and the IEA co-established a comparison of both global production volumes and related absolute GHG emissions of the main 'primary chemicals' (see Figure 30). The biggest emissions are attributed to ammonia (by far), followed by the main petrochemical products, i.e. ethylene, propylene and BTX. Methanol is also identified as a big contributor to GHG emissions. Even if not appearing on this chart, both chlorine and hydrogen are also responsible for high energy demand and GHG emissions release.

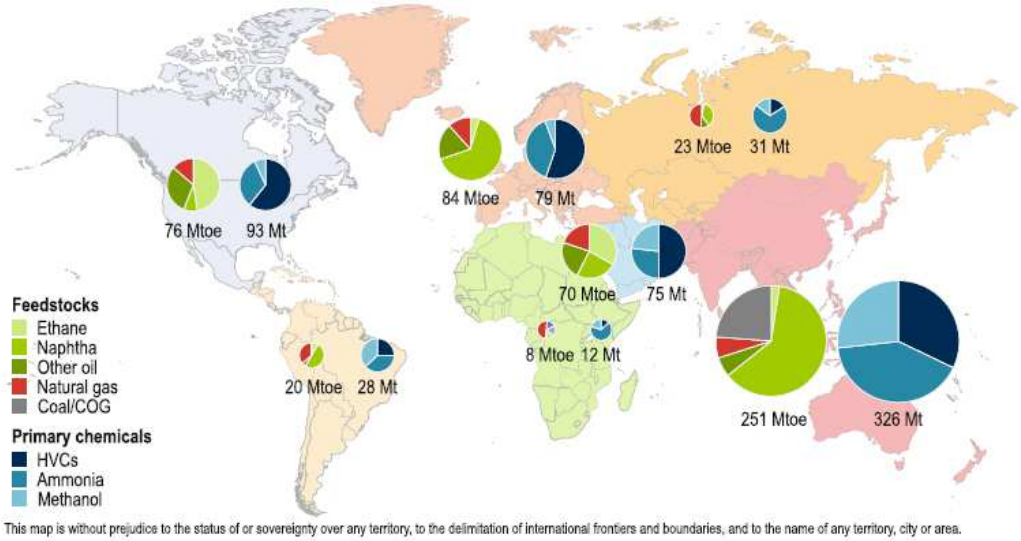


Note: GHG emissions for olefins in this figure represent that of the steam cracking process. Ammonia is presented on a different axis on the right.

FIGURE 30: GLOBAL GHG EMISSIONS AND PRODUCTION VOLUME OF MAIN CHEMICALS, 2010 (1)

A specificity of the chemical sector is the global repartition of both feedstocks and chemical productions (see Figure 31Figure 31). It can be seen that all regions exhibit similar levels of feedstock and chemical production shares. However significant variations of available feedstocks are seen. For instance, North America and Middle East mainly base their production on ethane, whereas other regions preferentially use naphtha. One can note an intensive usage of coal in Asia, which unfortunately leads to very high levels of GHG emissions.

Primary chemicals production consequently differ as well from a region to another one. North America, Europe and Middle East mainly produce HVCs, whereas their respective part is less important in other regions. Russia, Africa and Asia are more dedicated to ammonia production. The highest share of methanol in production is encountered in South America, Asia and Middle East.



Notes: The left pie chart of the pair for each region displays feedstock usage, while the right pie chart displays primary chemical production. The pie charts are sized in proportion to the total quantity (Mtoe or Mt) in each case.

FIGURE 31: PRIMARY FEEDSTOCK AND USE AND CHEMICAL PRODUCTION BY REGION (2)

The sector is **highly energy intensive** with a final energy demand of more than **1 000 Mtoe**. Around 60% of the energy consumed by the industry comes from the feedstock itself, the rest being the energy consumed during the chemical process (see Figure 32Figure 32).

Figure 2.2 • Feedstock and process energy consumption in the chemical sector

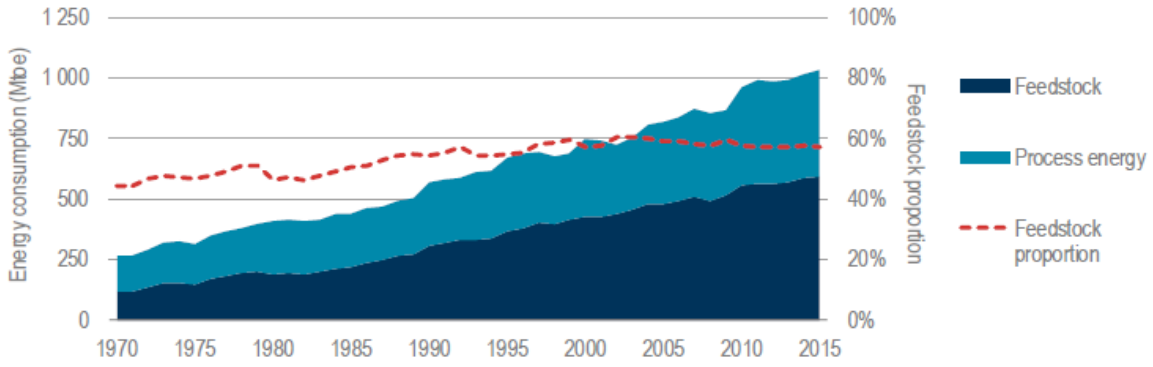


FIGURE 32: FEEDSTOCK AND PROCESS ENERGY CONSUMPTION IN THE CHEMICAL SECTOR (2)

The sector is of high complexity due to the high variety of products, processes and companies along the value chain.

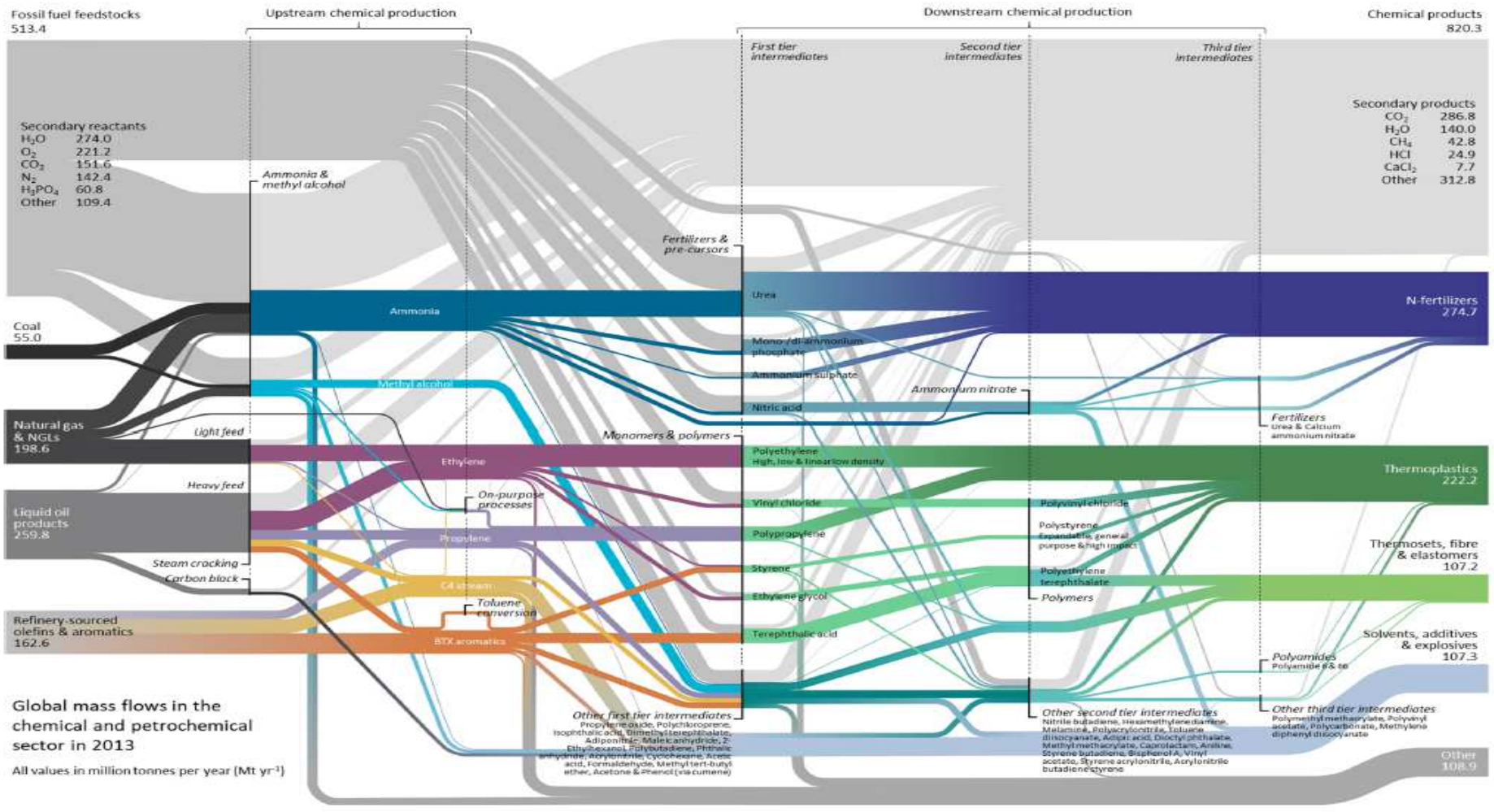


FIGURE 33: FLOW DIAGRAM OF THE CHEMICAL SECTOR, 2013 (3)

10.4.1.2. FOCUS ON PRIMARY CHEMICALS

10.4.1.2.1. AMMONIA

STATISTICS

Ammonia (NH_3) is a major industrial chemical and the principal source of nearly all synthetic nitrogen fertilizers. Almost all ammonia is produced in the anhydrous form, a colorless non-flammable gas at normal pressure and temperature, by combining nitrogen with hydrogen[29].

Global production of ammonia was **182 Mt in 2019**. Within European Union, natural gas accounts for about 90% of the feedstock used for ammonia production, whereas all around the world this share falls to more or less 70%. The remaining 30% are mainly coming from coke and coal gas (massively used in China), in the meanwhile fuel and naphta account for no more than 2-3%[30].

Fertilizer production absorbs 80 to 90% of the global ammonia production, of which half of it is transformed into urea. The other main ammonia uses are organic compound and polymer production (as polyurethane, polyamide, acrylonitrile, etc.) and explosives[30].

About 48% of the global ammonia production is used in the production of urea ($CO(NH_2)_2$), the most commonly used nitrogen fertiliser, 11% in the production of ammonium nitrate, 20% in the production of other fertilisers and 3% directly as fertiliser. Other uses of ammonia include synthesis of chemicals, explosives, fibres and plastics, refrigeration and others[29].

ENERGY CONSUMPTION AND GHG EMISSIONS

Ammonia is by far the primary chemical responsible for the **highest amount** of absolute global GHG emissions. Estimating the global GHG emissions related to its production is quite tricky. Indeed, the amount of CO_2 emitted will change depending on whether the ammonia is produced using coal, natural gas, naphtha, or oil as a feedstock; also some ammonia plants are more efficient and/or less polluting than others[31].

The Institute for Industrial Productivity publishes an extremely useful Industrial Efficiency Technology Database (IETD) which benchmarks CO_2 emissions per ton ammonia for producers in every region, leading in 2010 to a global average emissions intensity of 2.87 tons CO_2/tNH_3[31].

TABLE 10: GHG EMISSIONS RELATED TO AMMONIA PRODUCTION

Region	Worldwide (2019)	Europe (2017)

[29] **JRC.** *Energy efficiency and GHG emissions: Prospective scenarios for the Chemical and Petrochemical Industry.* 2017.

[30] **Elementarium .** Elementarium - Ammoniac. [En ligne] https://www.lelementarium.fr/product/ammoniac/

[31] **Brown, Trevor.** Ammonia Industry. [En ligne] https://ammoniaindustry.com/ammonia-production-causes-1-percent-of-total-global-ghg-emissions/.

GHG emissions (Mt CO_2e)	523[32]	25.5[33]

The global GHG emissions presented in Table 10 might be a bit overestimated, principally because the calculated value for 2019 emissions has been calculated considering the same global average emissions intensity than the one that was estimated in 2010 thanks to IETD data. Anyway, it is established for a few years now that ammonia production is responsible for more or less **1% of the global anthropogenic GHG emissions**[34].

Both energy consumption and GHG release related to ammonia production are highly impacted by the way hydrogen is obtained. About 70% of global ammonia production is based on steam reforming concepts using natural gas, with the use of steam reforming of natural gas considered the best available technology from the point of view of energy use and CO_2 emissions. It has been estimated that if all plants worldwide were to achieve the efficiency of the best plants, energy consumption could fall by 20–25%[35].

Of the different types of steam reforming, conventional reforming has the lowest feedstock consumption and auto-thermal reforming the highest, while the fuel demands follow the reverse order. In the case of conventional reforming, the nitrogen supply equals the ammonia nitrogen content plus the purge losses, while if excess air is used or in auto-thermal reforming the requirements are about 50 % and 100 % higher, respectively. A typical heavy oil-based process uses 1.3 times as much as energy as a gas-based process, while a coal-based process 1.7 times[29].

TABLE 11: ENERGY EFFICIENCY OF AMMONIA PRODUCTION DEPENDING ON BEST AVAILABLE TECHNOLOGIES (BAT) AND RELATED GHG EMISSIONS INTENSITY

Process	Feedstock	Energy consumption (GJ/t NH_3)	GHG emissions intensity (tCO_2e/tNH_3)
Steam reforming	Natural gas	28	1.6
	Naphtha	35	2.5
Partial oxidation	Heavy fuel oil	38	3.0
	Coal	42	3.8

[32] According to http://www.iipinetwork.org/wp-content/letd/content/ammonia.html#benchmarks, in 2010 the production of 157 Mt of ammonia led to 451 Mt CO_2 (calculation based on IEA data, involving share of all processes around the world). Assuming the same processes shares, in 2019 the production of 182 Mt of ammonia should have resulted in the release of 523 Mt CO_2.

[33] From CEFIC - The European chemical industry facts and figures (2020)

[34] **Chemical & Engineering News.** [En ligne] https://cen.acs.org/environment/green-chemistry/Industrial-ammonia-production-emits-CO2/97/i24.

[35] **Brightling, John.** Ammonia and the Fertiliser Industry: The Development of Ammonia at Billingham. *Johnson Matthey Technol. Rev.* 2018, Vol. 62.

10.4.1.2.2. ETHYLENE

STATISTICS

Ethylene is the simplest alkene, consisting in two carbon atoms double-bonded carrying a pair of hydrogen atoms each. It is the most produced organic compound in the world, since it is implied in a consequent number of chemical processes.

Global production of ethylene **in 2017 reached 153 Mt**, whereas the global capacity of production was estimated the same year to be around 180 Mt[36]. The ratio of these two values indicates a production ratio of 0.85. Global production capacity is increasing really fast, leading to a value of about 192 Mt in 2019 and forecasts around 280 Mt in 2024[37]. **Annual growth rate** of global ethylene production is **higher than 3%**[38]. In 2018, only 12 companies worldwide shared about the half of global ethylene production. The top producer was Dow with 14 Mt, followed by Sinopec, Sabic and Exxonmobil[36].

ENERGY CONSUMPTION AND GHG EMISSIONS

Estimating global GHG emissions related to ethylene production can be challenging at least for two reasons. First because as exposed above, there are various ways of processing ethylene, as well as various types of feedstocks. Secondly because the main processes (steam cracking and FCC) give a bunch of product at the same time, amongst others ethylene, propylene and BTX. Nevertheless, it can be estimated that ethylene is the primary chemical responsible for the **second biggest GHG emissions**.

TABLE 12: GHG EMISSIONS RELATED TO ETHYLENE PRODUCTION

Region	Worldwide	Europe (2013)
GHG emissions (Mt CO_2e)	140[39]	24[40]

10.4.1.2.3. PROPYLENE

STATISTICS

Propylene is considered to be a high-value chemical (HCV) alongside ethylene and the aromatics (BTX).

Propylene's largest derivative (two thirds of the demand) is polypropylene (PP) or polypropene, a thermoplastic polymer. Similar to polyethylene yet harder and more heat resistant, polypropylene is the second-most widely produced commodity plastic. It is used in a variety of sectors, among which automotive

[36] **Elementarium.** Elementarium - Ethylène. [En ligne] https://www.lelementarium.fr/product/ethylene/.

[37] Statista. [En ligne] https://www.statista.com/statistics/1067372/global-ethylene-production-capacity/.

[38] **TechnipFMC.** *Ethylene Production - A technology leader for grassroots plants and expansions.* 2017.

[39] From graphical lecture (1)

[40] From graphical lecture (4)

and textile industries as well as plastic films for packaging, and other applications. Propylene oxide (16% of the propylene demand in the EU) is a second important derivative.

Propylene and ethylene collectively amount for 255 Mt/year[41]. **Global propylene demand was 88 Mt in 2012 and total capacity was estimated to 100 Mt**[29].

ENERGY CONSUMPTION AND GHG EMISSIONS

As detailed for ethylene above, propylene can be obtained thanks to various processes (Steam Cracking, Fluid Catalytic Cracking, Dehydrogenation of propane, Olefin Metathesis). The two main processes, SC and FCC allow to obtain different products simultaneously. Therefore, precise establishment of GHG emissions related to propylene production is quite tricky. Nevertheless, it is estimated that propylene production is responsible for the emission of c**. 80 $MtCO_2e$ yearly**[42].

10.4.1.2.4. BTX

STATISTICS

BTX, also called aromatics, combine benzene, toluene and xylenes. They are high-value chemicals (HVC) and precursors to a wide range of secondary chemicals, mostly polymers.

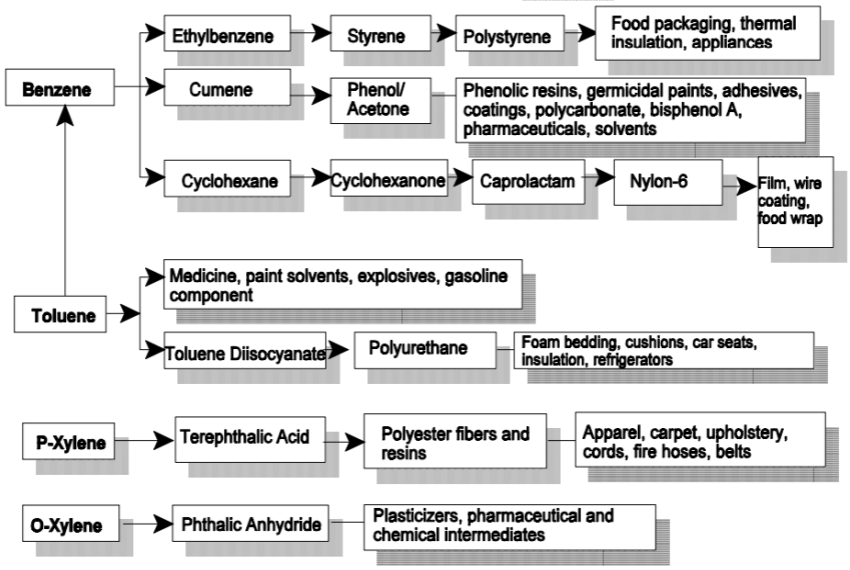


FIGURE 34: AROMATICS DOWNSTREAM BY PRODUCTS (13)

Their production volume was of **110 Mt**[41] **in 2018**.

[41] **IEA.** *The Future of Petrochemicals.* 2018.

[42] SBTi. SBTi Scoping Document for the Chemical Sector. 2020.

ENERGY CONSUMPTION AND GHG EMISSIONS

The European production of BTX is responsible for the consumption of around **5,5 Mtoe**[29]. The global emissions due to the production of BTX reach around **40 $MtCO_2$**[43]. With a production of 11,7 Mt of BTX and emissions of 6,6 $MtCO_2$ in Europe, the JRC calculated an average intensity of 0,56 tCO_2 / t_{BTX} in 2012.

10.4.1.2.5. CHLORINE

STATISTICS

Chlorine is produced over the world in more than 650 sites, dispersed in 85 countries. Global chlorine production **in 2017 is roughly estimated to be 70 Mt**, whereas the total production capacity is not far to 90 Mt[44].

A third of chlorine production is absorbed for the synthesis of polyvinyl chloride (PVC), the thirdly most produced polymer (about 45 millions tons/year). Around a second one is dedicated to the synthesis of isocyanates which are mainly used for polyurethane synthesis, and oxygenates (a broad family including amongst others alcohol and ethers). The third most important application relates to inorganic products (as disinfectants or pigments) with consumes a bit more than 20% of the chlorine production. Finally, other chemicals as chloromethane or epichlorhydrin are also important chlorine derivatives[44].

ENERGY CONSUMPTION AND GHG RELEASE

The three main processes used for chlorine production exhibit different levels of energy consumption and GHG emissions intensity (Table 13). Global share is also included.

TABLE 13: ENERGY EFFICIENCY OF CHLOR-ALKALI PROCESS DEPENDING ON TECHNOLOGY AND RELATED GHG EMISSIONS INTENSITY (FROM (4))

Technology	Energy consumption (kWh/tCl_2)	GHG emissions intensity (tCO_2e/tCl_2)[45]	Global share[46] (%) From (16)
Diaphragm	3600	2.1	17
Mercury	3800	2.0	5
Membrane	3050	1.7	78

[43] *Dehydrogenation of Ethane to Ethylene by CO2 over Highly Dispersed Cr on Large-Pore Mesoporous Silica Catalysts.* **Abdulrhman S. Al-Awadi, Saeed M. Al-Zahrani, Ahmed Mohamed El-Toni, Ahmed E. Abasaeed.** 97, s.l. : MDPI, 2020, Vol. 10.

[44] **Elementarium.** Elementarium - Dichlore. [En ligne] https://www.lelementarium.fr/product/dichlore/.

[45] Note that GHG emissions intensity depends on the electricity mix used for each individual case

[46] Shares are coming from a study from HBN (that estimates to cover 73% of global production). The hypothesis that these ratios are the same for the totality of chlorine production is made. Furthermore, these shares are those of capacity production and are supposed to be the same as the real production.

Note that the Mercury technology should be faded out by 2027 according to the Minamata Protocol. Chlorine production using the oxygen-depolarized cathode (ODC) technology is also growing yet marginal in volume produced compared to the previous technologies – it claims electricity consumption (hence GHG emissions) inferior up to 30% compared to standard cathodes.[47]

The federation Eurochlor provides European GHG emissions related to chlorine production. However, no available data has been found at the global level. The latter has been estimated thanks to the global share of the chlor-alkali technologies listed above. **Several assumptions have been made** and this value shall be considered as indicative.

TABLE 14: GHG EMISSIONS RELATED TO CHLORINE PRODUCTION

Region	Worldwide	Europe (2013)
GHG emissions (Mt CO_2e)	106[48]	11.3[49]

10.4.1.2.6. METHANOL

STATISTICS

Methanol is the primary chemical whose production is rising the most quickly with **6% growth in 2018**. It is mainly used for fuels (37% of global demand[29], with China driving the rise of methanol production), for the production of formaldehyde (31% of global demand[29]) in refrigerant systems or as an intermediary product for HVCs. The production volume of methanol was of around **100 Mt worldwide in 2018**.

ENERGY CONSUMPTION AND GHG EMISSIONS

Methanol emissions account for **216 MtCO_2**[41] which represents **14% of the chemical sector emissions.** With the steam reforming and methanol synthesis processes, each ton of methanol requires around 38 GJ and emits around 1.5 tCO_2 for a global energy consumption of around **100 Mtoe**[41]. Low carbon processes (power to methanol) do not emit CO_2 as a product of reaction but are very energy intensive.

10.4.1.2.7. HYDROGEN

Hydrogen is a chemical gas with several different potential use: as a vector to transport or store energy, as a fuel, for desulphurization of petroleum products in refineries, or as a reactive component to produce other chemicals.

---

[47] Johannes Jung, Sarah Postels, André Bardow, "Cleaner chlorine production using oxygen depolarized cathodes? A life cycle assessment", Journal of Cleaner Production,

[48] A corrective ratio has been applied since the Dechema study considers an global electricity carbon footprint of 558 gCO_2/kWh, whereas the most recent value (2019) obtained from IEA is 475 gCO_2/kWh.

[49] From (4)

STATISTICS

Demand for hydrogen has grown to reach **over 70 Mt of pure hydrogen and 45 Mt hydrogen mixed** with other chemicals in 2018[50]. However, this demand is expected to skyrocket in the coming decades to reach up to 550 Mt or pure hydrogen by 2050[51].

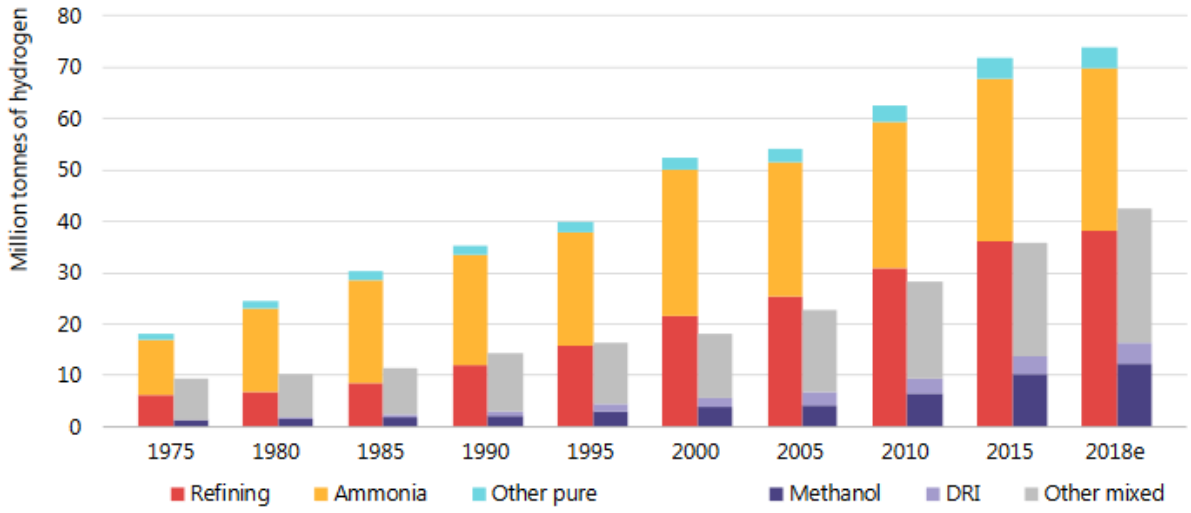


FIGURE 35: GLOBAL ANNUAL DEMAND FOR HYDROGEN SINCE 1975. SOURCE: IEA

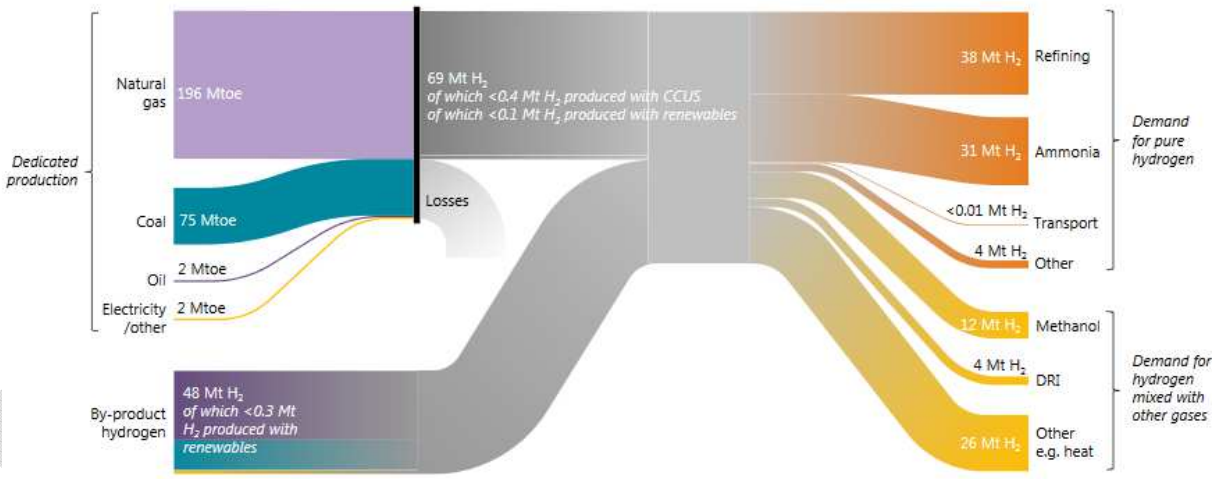


FIGURE 36: HYDROGEN'S VALUE CHAINS. SOURCE: IEA

ENERGY CONSUMPTION AND GHG EMISSIONS

Combustion of hydrogen only generates water, hence the GHG emissions associated with the hydrogen will come from its production upstream and not its consumption. If produced with low-carbon sources, hydrogen has the potential to provide significant contribution to decarbonize hard-to-abate sectors such as transport

[50] **IEA.** *The Future of Hydrogen.* 2019.

[51] **Council, Hydrogen.** *Decarbonization Pathways - Part-2_Supply-Scenarios.* 2021.

(aviation, shipping, long-distance road transport), industry (iron and steel, chemicals, high temperature industry) and building (residential heat).

In 2019, the production of hydrogen consumed **an estimated 275 Mtoe of energy** representing 2% of the world primary energy demand[50]. According to the IEA, **total annual hydrogen demand worldwide is around 330 Mtoe**.

The production of hydrogen is mainly derived from fossil fuel sources, mostly natural gas (75% of the production) and coal (23% of the production), the rest with oil and electricity. **Overall, hydrogen production worldwide is accountable for a yearly 830 $MtCO_2$**, but this number covers more than the sole hydrogen production[50] and should not be double-counted with ammonia and methanol production (consuming hydrogen in their production process).

10.4.2. LOW CARBON TRANSITION

10.4.2.1. BARRIERS TO DECARBONIZE THE CHEMICAL SECTOR

The *Reaching zero with renewables* report from IRENA (International Renewable Energy Agency), published in 2020, categorizes the annual CO_2 emission streams related to the chemicals and petrochemicals products as follows:

- Direct energy emissions from production processes (around 1.2 Gt/yr)
- Direct process emissions from production processes (around 0.5 Gt/yr)
- Emissions from product use, decomposition and waste (around 0.4 Gt/yr)
- CO_2 stored in a growing stock of products (around 1 Gt/yr)

The sector has roughly equal amounts of emissions from energy used in production processes and from feedstock use. Both of these need to be eliminated if the sector's emissions are to be reduced to zero.[52]

Barriers that are encountered within the sector to decarbonize the activities are:

- The limits to further energy efficiency improvements since efforts have already been made in this area
- The high-temperature processes which are highly energy demanding and not easily fed by renewable sources of energy
- The integration of petrochemical production within refineries (fossil fuels demand being locked-in)
- The current non-competitive cost of low-carbon alternatives for many products
- The difficulty to collect, sort and reinject products into a circular economy
- Clear rules for the accounting of CCU, CCS and recycling

10.4.2.2. IDENTIFIED LEVERS

Due to the diversity of the sector and the broad range of products and related processes, many levers can be activated to decarbonize the Chemical sector. They can be listed in the following categories:

- Renewable sources of energy for processes

Many processes, especially those related to the primary chemicals production, are highly energy demanding. Today a large share of this energy is provided by fossil fuels, which are responsible for enormous releases of CO_2 emissions while they are burnt. Switching from fossil fuels to renewables sources of energy could significantly decrease the emissions of chemical industry. One of the solutions is the electrification of processes when possible, using low-carbon electricity – however electrification can lead to higher emission if the power intensity is higher than the conventional fuel, hence the sole electrification is not a solution if one does not ensure the electricity used is low-carbon. Another way is the use of biomass when properly cultivated (as certified by REDcert[53] for instance, or any other relevant standard).

- Alternatives to fossil fuels feedstocks

A particularity of the chemical sector is that fossil fuels are not only used as an energy source for the processes, but also as a feedstock. It means that their carbon content is (at least partially, depending on the chemical reactions) retrieved in the chemicals / chemical products and will eventually be released in the

[52] **IRENA.** *Reaching zero with renewables.* 2020.

[53] https://www.redcert.org/en/

atmosphere during the use or end-of-life steps. Using alternative feedstocks consequently appears as a key lever to decarbonize the chemical sector. Typical examples are: hydrogen obtained thanks to water-electrolysis to replace natural gas (for ammonia and methanol production mainly), biomass (sugarcane, wood, etc.) to replace oil in HVCs production, bio-sourced molecules for specific polymers production (chitin from crustaceans and other animals involved as a monomer to get chitosan), etc.

- Circular economy

Recycling products allows lowering the demand of raw materials that are needed to feed the processes. Plastics, which represent a high share of the chemical industry outputs, are already partially recovered and recycled (when their chemical composition makes it possible). It is important here to make the difference between “mechanical” and “chemical” recycling: the first corresponds to a manufacturing step of products for them to be reused whereas the second encompasses several technologies that break the chemical structure of plastics to come back to raw materials that can be used again.

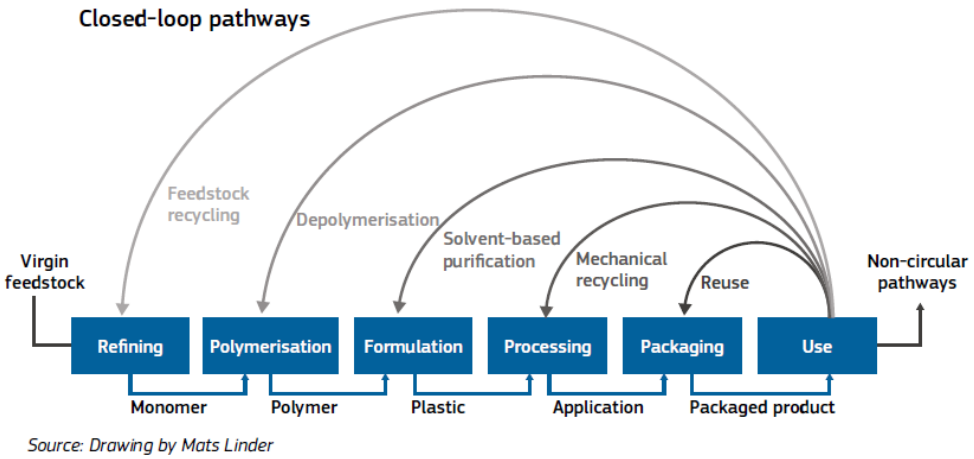


FIGURE 37: DIFFERENT LOOPS FOR PLASTICS IN A CIRCULAR ECONOMY. FROM (20)

- Energy efficiency

Improving energy efficiency means increasing the production rates while keeping the energy input (and related GHG emissions) constant. The chemical industry (mainly in Europe) has already been engaged in this way but there is still some room of maneuver to keep on going. Remaining enhancements are related to: incremental improvements, implementation of best practice technologies, advanced heat integration and process-intensifying equipment[54].

- CCU and CCS technologies

It is estimated that the process-related CO_2 emissions amount for 15% of the emissions arising from the chemical industry, against 85% of energy-related CO_2 emissions. Even if not majoritarian, the process-related CO_2 (which correspond to the CO_2 release occurring during chemical reactions) still represent a high amount

[54] *Low carbon energy and feedstock for the European chemical industry.* **DECHEMA.** 2017.

of emissions that need to be cut. This could be achieved thanks to the development of CCU and CCS technologies at a large scale. As precised by the IEA, several methods of CO_2 capture have already been proven in the chemical sector[55]. CCS is close to being an economically viable option to capture CO_2 from high-concentration flue gas streams[52]. However, it has to be noted that high costs are still limiting the possibilities of global deployment and technological breakthroughs are still expected.

[55] **IEA.** *Energy Technology Perspectives.* 2020.

10.5. INTEGRATION OF PHYSICAL RISKS AND ADAPTATION IN ACT

10.5.1. INTRODUCTION AND CONTEXT

There is a lack of standardized framework for analysing physical risks and assessing the adaptation strategy of private actors. Standards exist but they provide some generic guidelines and recommendations (e.g.: ISO 14090 and ISO 14091). **This ACT physical risks and adaptation framework aims at assessing the physical risks analysis and the adaptation strategy of companies, thanks to precise indicators through several modules. It is a first version to integrate these dimensions in ACT historical assessment method.** A specific method will be developed with a separate score, modules specific to climate risks and adaptation, and a possible joint assessment with the mitigation part of ACT.

This maturity matrix is mainly based on the work of the WRI and the IPCC. The climate physical risks dimension also relies on the reports from Carbone 4 and I4CE. The indicators and the structure of the adaptation part mainly focuses on reports from ADEME. Modules and indicators include recommendations from the EU Taxonomy, EBRD, TCFD and Norme ISO 14 090. **All references can be found in the bibliography, in the long version of this document.**

The structure of this physical risks and adaptation maturity matrix is different from the 9-module in ACT mitigation. It is to better take into account certain specific aspects of physical risks and adaptation such as the exposition and vulnerability of the different part of the value chain or the four aspects of a company's adaptation to climate change. The two dimensions do not have the same characteristics and each could have a different level of maturity for the same company.

To be noted :

- This framework is not a risk analysis methodology
- Each line (row) of the matrix corresponds to an indicator that is independent from others. Indicators are just grouped by module. The matrix is composed of two dimensions, the physical climate risks and adaption. Each of these dimensions contains several modules.
- **Scores and weightings are detailed in this document.**
- The lists of impacts and vulnerabilities for the different activities of a company along its value chain are not exhaustive. Any other impact or vulnerability that is relevant for the company can be considered and analysed.
- A **glossary** of climate physical risks and adaptation terms is available at the end of this document.

10.5.2. MATURITY MATRIX

The two dimensions of the maturity matrix are climate physical risks and adaptation.

Physical climate risks correspond to the potential for negative consequences from physical climate events or trends. Risks from climate change impacts arise from the interaction between hazard (triggered by an event or trend related to climate change), vulnerability (susceptibility to harm) and exposure (people, assets or ecosystems at risk) (from IPCC, 2014) (see chart page 17 of this document).

Hazards refer to the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. In this note, the term hazard usually refers to climate-related physical events or trends or their physical impacts. Thus, it includes processes that range from brief events, such as severe storms, to slow trends, such as multi-decade droughts or multi-century sea level rise (from IPCC, 2014).

Exposition is the degree to which a company's value chain (e.g., assets, operations, supply chain, customers) has the potential to be impacted by physical climate hazards due to its geographic location. These metrics should link part of a company's value chain (e.g., physical assets) with specific physical climate hazards (e.g., tropical cyclones) (from IPCC, 2014).

Vulnerability is the propensity of different parts of a company's value chain to suffer negative impacts when exposed to and then impacted by physical climate hazards. These metrics should assess specific characteristics of a company's value chain (e.g., water intensity) that may make that part of the value chain more or less likely to suffer negative impacts from physical climate hazards (WRI, 2021).

The second dimension of the matrix is **adaptation**. It is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Adaptation options exist in all sectors, but their context for implementation and potential to reduce climate-related risks differs across sectors and regions. Some adaptation responses involve significant co-benefits, synergies and trade-offs (from IPCC, 2014).

Here is presented the complete physical risks and adaptation maturity matrix.

Resilience can be defined as the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation (IPCC, 2014).

CLIMATE PHYSICAL RISKS DIMENSION

	Basic	Standard	Advanced	Next practice	Resilient
Analysis Integration of physical and non-physical climate measures to reduce all material physical risks to that activity (assessment risks). It should have the following characteristics :					
1.1 Data and scenarios	The company has not conducted any climate physical risks data, projection or scenario analysis nor assessment.	Exploration of some climate data and projections	Considers at least past weather events and eventualy current weather variability Based if possible on available climate data and projections across a least one scenario, that should be the RCP 2.6	Considers at least past and current weather variability and if possible future climate change Based on available climate data and projections across a least two scenarios, that shall be RCP 2.6 and RCP8.5	Considers past and current weather variability, as well as future climate change, including uncertainty Based on robust analysis of available climate data and projections across a range of future scenarios, that shall be at least RCP 2.6 and RCP 8.5
1.2 Hazards	The company has not considered any hazard and how it could affect its activity	Exploration and identification of the hazards that affect the most the company, depending on the location and the activity (along the value chain) Exploration of the notions of likelihood, magnitude and duration of hazards	Considers the hazards that affect the most the company in a qualitative way on the most important part of the value chain in terms of physical climate impact Hazards should be analysed through their likelihood, magnitude and duration.	Considers the hazards that affect the most the company, if possible in a quantitative way, along the complete value chain Consistent with the expected lifetime of the activity and the specific location of facilities Hazards shall be analysed through their likelihood, magnitude and duration.	Considers the hazards that affect the most the company in a quantitative way along the complete value chain Consistent with the expected lifetime of the activity and the specific location of facilities Hazards shall be analysed through their likelihood, magnitude and duration.
1.3 Exposition and vulnerability /sensitivity	The company has not conducted any in-depth climate physical risk analysis or assessment regarding, among others, its exposition and vulnerability/sensitivity	Exploration of the notions of exposition and vulnerability / sensitivity	Evaluation of the exposition and sensitivity/vulnerability of some facilities on a part of the value chain, at least qualitative, for the most important hazards identified	Evaluation of the exposition and sensitivity/vulnerability of all facilities on the complete value chain, in a quantitative way, for the most important hazards identified The relationship between current and future weather variability and the performance is identified along the complete value chain performance	Quantitative evaluation of the exposition and sensitivity/vulnerability of all facilities for the most important hazards identified The relationship between current and future weather variability and the performance is identified and analysed along the complete value chain performance

Supply chain / raw materials impacts and vulnerabilities

Disruptions
Impact on production depending on the availability of water, electric energy, raw materials or on climate variation sensitive materials
Geographic concentration of suppliers/cluster tendency
Shortage of inputs or raw materials
Increased cost of supplies due to scarcity
Change in input/resource prices

2	These impacts and vulnerabilities on the supply chain/raw materials of the company are not considered, it remains passive in the face of climate risks for this dimension of the value chain.	The most relevant impacts and vulnerabilities were considered for some hazards The most relevant impacts and physical risks are identified depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analysed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the most important hazards identified, depending on the location of facilities

Production / Process / Operations / Machineries / Infrastructures impacts and vulnerabilities

Weather sensitivity of production and operation process
Need to cool or heat processes and workplaces / variations in energy costs
Disruptions or reduced productivity of operations/production capacity due to impacts on fixed capital, labor force (stress on human health and productivity), natural resources
Permanent loss
Relocation costs
Workforce intensity of production
Physical damage to assets : production facilities, infrastructures, stock & equipment
Increased insurance premiums and capital costs

3	These impacts and vulnerabilities on the production/process/operations/ machineries/infrastructures of the company are not considered, it remains passive in the face of climate risks for this dimension of the value chain.	These impacts and vulnerabilities were considered for some hazards The most relevant impacts and risks are identified depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analysed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the most important hazards identified, depending on the location of facilities

Logistics / Transports (upstream & downstream) impacts and vulnerabilities Need for cold chain Damage to transportation infrastructure when use of road, water and rail transportation or permanent loss and relocation cots Dependency to port facilities, fluvial transportations and operations Cost of delays due to degraded transport conditions Loss of revenue due to failed delivery or service disruption					
4	These impacts and vulnerabilities on the logistics/transports of the company are not considered, it remains passive in the face of climate risks for this dimension of the value chain.	These impacts and vulnerabilities were considered for some hazards The most relevant impacts and risks are identified depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analysed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the most important hazards identified, depending on the location of facilities
Demand & Sales					
5	The climate-related opportunities were not considered, neither the impacts and vulnerabilities on the demand and sales.	The most relevant impacts and vulnerabilities were considered for some hazards (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analyzed for some hazards (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities Breakdown of sales by country and by segment for monitoring and analysis	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities Identification of climate-related opportunities based on adapting to market shifts driven by a changing climate Breakdown of sales by country and by segment for monitoring and analysis	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the main hazards identified (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities Identification of climate-related opportunities based on adapting to market shifts driven by a changing climate and development Breakdown of sales by country and by segment for monitoring and analysis

ADAPTATION DIMENSION

	Basic	Standard	Advanced	Next practice	Resilient
Organizational capacity Governance, exchange and decision-making bodies. Among other aspects, the business model of the company has to be profitable, viable and should integrate climate physical risks and climate adaptation strategy.					
6.1 The climate head	No one is in charge or supervising climate change issues	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is the manager/officer	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is Senior manager/officer	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is Senior manager/officer closely related to decision-making structure within the company	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is the Board or individual/sub-set of the board or other committee appointed by the board
6.2 Climate governance	The company has not engaged any adaptation strategy regarding its corporate projects and policies	Assessments of the gaps in management governance of physical climate risks and the needs to integrate climate change adaptation approach in corporate projects and policies	The gaps in management governance of physical climate risks and the needs to integrate climate change adaptation approach in corporate projects and policies were identified and work is in progress (eg: major plans of action, risk management policies, annual budgets, reviewing and guiding strategy)	The management governance of physical climate risks and the climate change adaptation approach in corporate projects and policies are formalized (eg: major plans of action, risk management policies, annual budgets, reviewing and guiding strategy)	The management governance of physical climate risks and the climate change adaptation approach in corporate projects and policies are formalized and in place (eg: major plans of action, risk management policies, annual budgets, reviewing and guiding strategy)

6.3 Decision support tools & external expertise	The company has not engaged in setting up any indicator, impact threshold, assessment, monitoring system or external collaborations/partneships for expertise	Assessments of the needs for systems that monitor and assess physical climate risks and adaptation	The needs for systems that monitor and assess physical climate risks and adaptation were identified and formalized First contacts with third parties for potential collaborations/partnerships and expertise	The company started to investigate indicators for decision making and impact thresholds (eg: maximum flood flow without damage to the activity), as well as monitoring and assessment systems for physical climate risks and adaptation Collaborations/partnerships for further expertise in progress	The company has set up indicators for decision making and impact thresholds (eg: maximum flood flow without damage to the activity), as well as monitoring and assessment systems for physical climate risks and adaptation, that are regularly reviewed Collaborations/partnerships for further expertise developed
6.4 Adaptation strategy	The company has not engaged any adaptation strategy regarding its organizational capacity or didn't considered how it is aligned with other strategies		It has an adaptation strategy that partly takes into account other environmental issues (impact on climate mitigation, biodiversity, health and pollution) The adaption actions are context and location-specific	It has an adaptation strategy in place that takes into account other environmental issues (impact on climate change mitigation, biodiversity, health and pollution) The adaption actions are context and location-specific Engagement with relevant actors (suppliers, local or national governments, local stakeholders, distributors, keys customers, suppliers with local and national governments) to identify, assess and manage climate-related physical risks, as well as local adaptation Consider diversification of activities related to climate physical risks when relevant	It has an adaptation strategy in place that takes into account other environmental issues (impact on climate change mitigation, biodiversity, health and pollution) The adaption actions are context and location-specific Engagement with relevant actors (suppliers, local or national governments, local stakeholders, distributors, keys customers, suppliers with local and national governments) to identify, assess and manage climate-related physical risks, as well as local adaptation Consider diversification of activities related to climate physical risks when relevant

Financial ressources Financing available to implement actions					
7	The company has not engaged any adaptation strategy regarding its financial ressources or took any measure.	Identification of financial positions that could suffer from climate change impacts		Definition and quantification of financial costs from climate change impacts (eg: value-at-risk, annual average loss projected impacts of climate change from disruptions, projected change in production, revenues, markets, opex, capex due to climate change) Integration of climate physical risks to financial planning tools and definition of critical financial thresholds Subscription to insurance in order to prevent physical climate risks to which the company is exposed, as analysed in the first module in terms of hazards, scenarios, data and value chain. Identification of climate-related opportunities	Definition and quantification of financial costs from climate change impacts regularly updated (eg: value-at-risk, annual average loss projected impacts of climate change from disruptions, projected change in production, revenues, markets, opex, capex due to climate change) Integration of climate physical risks to financial planning tools and definition of critical financial thresholds regularly revised Subscription to insurance in order to prevent physical climate risks to which the company is exposed, as analysed in the first module in terms of hazards, scenarios, data and value chain. Identification of climate-related opportunities and development

Technological ressources Technologies, techniques and new solutions					
8.1 Technical tools and solutions	The company has not engaged any adaptation strategy regarding its technological ressources or took any measure	Start/begining of considerations regarding potentials needs in tools and technical solutions	Needs in tools and technical solutions are identified and start of development	Identification and development of technical knowledge (for example through experimental projects) Tools and technical services in finalization phase The company has to explore how the choices of new technologies and solutions (eg: better farming practices such as crop management, crop species, land use) take into account both current weather variability and future climate change, including uncertainty	Technical knowledge developed (for example through experimental projects) Tools and technical services developed The company has to develop and mention how the choices of new technologies and solutions (eg: better farming practices such as crop management, crop species, land use) take into account both current weather variability and future climate change, including uncertainty
8.2 R&D	The share of adaption R&D is below 5% of total R&D investments	The share of adaption R&D is between 5% and 10% of total R&D investments	The share of adaption R&D is between 10% and 15% of total R&D investments	The share of adaption R&D is between 15% and 20% of total R&D investments	The share of adaptation R&D is above 20% of total R&D investments

Human ressources The specific skills and working time that the company mobilises					
9.1 Teams trainings	The company has not engaged any adaptation strategy regarding the training of its employees and its key decision makers	Assessments of the gaps and needs of training for physical climate risks and adaptation of teams and key decision makers	Awareness-raising of employees to physical climate risks and adaptation, especially for the individual/committee with highest responsability for climate change (i.e. module 6.1)	Training of employees to physical climate risks and adaptation is in progress and almost completed, especially for the individual/committee with highest responsability for climate change (i.e. module 6.1) It concerns between 60% and 80% of teams members	Training and integration in-depth of issues and dimensions related to physical climate risks and adaptation for all employees with content and objectives regularly updated, especially for the individual/committee with highest responsability for climate change (i.e. module 6.1) It concerns above 80% of teams members
9.2 Watch and sharing information device	The company has not engaged in the development of a watch and sharing information device		Watch, acquisition and sharing device of information and knowledge about climate physical risks and adaptation		Watch, acquisition and sharing device of information and knowledge about climate physical risks and adaptation with regularly updated content

10.5.3. WEIGHTINGS

The weightings on 100% are distributed equally among Physical risks and Adaptation dimensions, as they are considered as equally important for a company to face climate change impacts. Analysis and Organizational capacity modules are both fixed to 25%. They have the higher weightings among their respective dimension since they contain the indicators that determine the most respectively the climate physical risks exposition and vulnerability analysis (indicators 1.1, 1.2 and 1.3), and the Adaptation strategy (indicator 6.4). The remaining weightings are distributed approximately equally among the other modules. The ones that have a slightly higher weightings (for example production / operations / infrastructures impacts and vulnerabilities, indicator 3.0) are the ones on which companies might have more space for decision and action.

If a company is not concerned by one or several modules between Supply chain, Production, Logistics or Demand (indicators 2, 3, 4 and 5), the analyst can decide to attribute a weighting of 0 for it. Weightings are then computed proportionally, on a new base that is less than 100%, while respecting previous computation rules.

For example, if the indicator 2.0 is excluded from the analysis, the total will be on 94% and proportionally, the physical risks dimension on 47% and the analysis module on 23.5%.

The final score of the complete matrix will be computed on 20 thanks to a weighted average. Two other scores will be computed, the physical risks score on 100% and the adaptation score on 100%.

MODULE		AG	INDICATOR	WEIGHTINGS	
				Indicator	Module
CLIMATE PHYSICAL RISKS 50%	**ANALYSIS**	1.1	Data and scenarios	8%	**25%**
		1.2	Hazards	9%	
		1.3	Exposition and vulnerability/sensitivity	8%	
	SUPPLY CHAIN / RAW MATERIALS	2.0	Impacts and vulnerabilities	6%	**6%**
	PRODUCTION / PROCESS / OPERATIONS / MACHINERIES / INFRASTRUCTURES	3.0	Impacts and vulnerabilities	7%	**7%**
	LOGISTICS / TRANSPORTS	4.0	Impacts and vulnerabilities	6%	**6%**
	DEMAND AND SALES	5.0	Opportunities, impacts and vulnerabilities	6%	**6%**
ADAPTATION 50%	**ORGANIZATIONAL CAPACITY**	6.1	The climate head	4%	**25%**
		6.2	Climate governance	5%	
		6.3	Decision support tools & external expertise	5%	
		6.4	Adaptation strategy	11%	
	FINANCIAL RESSOURCES	7.0	Financing available to implement actions	9%	**9%**
	TECHNOLOGICAL RESSOURCES	8.1	Technical tools and solutions	5%	**7%**
		8.2	R&D	2%	
	HUMAN RESSOURCES	9.1	Teams trainings	5%	**9%**
		9.2	Watch and sharing information device	4%	

10.5.4. GLOSSARY

ACTIONS THAT DO NOT (SIGNIFICANTLY) HARM MITIGATION, BIODIVERISTY, HEALTH AND POLLUTION

According to the European Taxonomy proposed by the Technical Expert Group, economic activities making a substantial contribution to climate change mitigation or adaptation must be assessed to ensure they do not cause significant harm to all remaining environmental objectives. An activity contributing to climate change adaptation must avoid significant harm to climate change mitigation and the other four environmental objectives (and vice versa):

- Sustainable use and protection of water and marine resources
- Transition to a circular economy, waste prevention and recycling
- Pollution prevention and control
- Protection of healthy ecosystems

This assessment ensures that progress against some objectives are not made at the expense of others and recognises the reinforcing relationships between different environmental objectives. (TEG, 2020)

ADAPTATION

The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Adaptation options exist in all sectors, but their context for implementation and potential to reduce climate-related risks differs across sectors and regions. Some adaptation responses involve significant co-benefits, synergies and trade-offs. Increasing climate change will increase challenges for many adaptation options.

Adaptation and mitigation responses are underpinned by common enabling factors. These include effective institutions and governance, innovation and investments in environmentally sound technologies and infrastructure, sustainable livelihoods and behavioural and lifestyle choices. (IPCC, 2014)

ADAPTIVE CAPACITY

The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences. (IPCC, 2014)

CLIMATE PROJECTION

A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases (GHGs) and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which is in turn based on assumptions concerning, for example, future socio-economic and technological developments that may or may not be realized. (IPCC, 2014)

CLIMATE-RELATED OPPORTUNITY	It is the potential positive impacts related to climate change on an organisation. It will vary depending on the region, market and industry in which an organisation operates. In the ACT framework, climate-related opportunity focuses on opportunities to adapt to market shifts driven by physical climate impacts and cater to any resulting new market needs, that is to say, the fundamental shifts in climate over the longer term may affect value chains and drive new consumer needs. For example, technology to keep buildings cool, along with water- and energy-efficient technologies, or crops that are better suited to chronic changes in precipitation and temperature. (EBRD)
EMISSION SCENARIO	A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g., greenhouse gases (GHGs), aerosols) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socio-economic development, technological change, energy and land use) and their key relationships. Concentration scenarios, derived from emission scenarios, are used as input to a climate model to compute climate projections. (IPCC, 2014)
EXPOSITION / EXPOSURE	The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected. (IPCC, 2014)
EXPOSURE METRICS	Metrics designed to assess the degree to which a company's value chain (e.g., assets, operations, supply chain, customers) has the potential to be impacted by physical climate hazards due to its geographic location. These metrics should link part of a company's value chain (e.g., physical assets) with specific physical climate hazards (e.g., tropical cyclones). (IPCC, 2014)
FINANCIAL RESSOURCES	It is the funds available to implement its adaptive capacity. (ADEME, 2019)
HAZARDS	The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. In this report, the term hazard usually refers to climate-related physical events or trends or their physical impacts. Thus, it includes processes that range from brief events, such as severe storms, to slow trends, such as multi-decade droughts or multi-century sea level rise. (IPCC, 2014) A climate hazard should be appreciated in function of its likelihood, magnitude and duration.

HUMAN RESSOURCES

It is the internal skills and working time that the company uses to improve its adaptive capacity. (ADEME, 2019)

ORGANIZATIONAL CAPACITY

It is the governance bodies, exchanges, decision-making processes and the management mode that contribute to its adaptive capacity. (ADEME, 2019)

PHYSICAL CLIMATE RISKS

The potential for negative consequences from physical climate events or trends.

Acute physical risks refer to those that are event-driven, including increased severity of extreme weather events, such as tropical cyclones or floods.

Chronic physical risks are longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level change or chronic heat waves.

Risks from climate change impacts arise from the interaction between hazard (triggered by an event or trend related to climate change), vulnerability (susceptibility to harm) and exposure (people, assets or ecosystems at risk). (IPCC, 2014)

The classification of physical hazards is the following :

CHRONIC PHYSICAL HAZARDS	Includes	Definition
Sustained temperature rise	Urban heat island	A gradual increase in overall temperature.
Change in precipitation patterns		Increase or decrease in precipitation annually and seasonally.
Water Stress	Degraded water quality	High ratio of total water withdrawals to available renewable surface and groundwater supplies.

Sea level change	Costal erosion	Change to the height of sea level, both globally and locally (relative sea level change) at seasonal, annual, or longer time scales due to (1) a change in ocean volume as a result of a change in the mass of water in the ocean (e.g., due to melt of glaciers and ice sheets), (2) changes in ocean volume as a result of changes in ocean water density (e.g., expansion under warmer conditions), (3) changes in the shape of the ocean basins and changes in Earth's gravitational and rotational fields, and (4) local subsidence or uplift of the land.
Ocean acidification		Ocean acidification refers to a reduction in the pH of the ocean over an extended period, typically decades or longer, which is caused primarily by uptake of carbon dioxide (CO_2) from the atmosphere, but can also be caused by other chemical additions or subtractions from the ocean. Anthropogenic ocean acidification refers to the component of pH reduction that is caused by human activity.
Ice melt/permafrost melt		Progressive loss of sea ice, glacier, or ground (soil or rock and included ice and organic material) that remains at or below 0°C for at least two consecutive years.

ACUTE/EXTREME PHYSICAL HAZARDS	Includes	Definition
Extreme temperatures	Freeze Heat wave	Temperature that is rare (unusually low or high) in a particular place and at a particular time of year. An extreme event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations.

	**Drought**	Severe low-water levels	A period of abnormally dry weather long enough to cause a serious hydrological imbalance. Drought is a relative term; therefore any discussion in terms of precipitation deficit must refer to the particular precipitation-related activity that is under discussion. A period with an abnormal precipitation deficit is defined as a meteorological drought. A megadrought is a very lengthy and pervasive drought, lasting much longer than normal, usually a decade or more.
	**Wildfires**		Uncontrolled fires that burn in wildland vegetation, often in rural areas.
	**Extreme precipitation**		Precipitation that is rare (unusually low or high) in a particular place and at a particular time of year. An extreme event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations.
	**Hail**		A form of precipitation consisting of solid ice.
	**Extreme sea level (storm surge)**		The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds).
	**Flood**	River Flood Pluvial Flood Groundwater Flood Coastal Flood	The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas not normally submerged. Floods include river (fluvial) floods, flash floods, urban floods, pluvial floods, sewer floods, coastal floods and glacial lake outburst floods.
	**Landslides**	Mass mouvements	A mass of material that has moved downhill because of gravity, often assisted by water when the material is saturated.

		Shrinkage-swelling of clay soils (SSCS)	Clay soils can have their consistency change according to their water content. In a humid context, a clayey soil appears supple and malleable, while the same soil dried out will be hard and brittle. Variations of volume more or less consequent according to the structure of the soil and the minerals in presence, accompany these modifications of consistency.
	**Extreme winds**	Storm	Wind speed that is rare (unusually low or high) in a particular place and at a particular time of year. An extreme event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations.
	**Tornadoes**		A violently rotating column of air touching the ground; usually attached to the base of a thunderstorm.
	**Tropical cyclones**		The general term for a strong, cyclonic-scale disturbance that originates over tropical oceans. Distinguished from weaker systems (often named tropical disturbances or depressions) by exceeding a threshold wind speed. A tropical storm is a tropical cyclone with 1-minute average surface winds between 18 and 32 m s–1. Beyond 32 m s–1, a tropical cyclone is called a hurricane, typhoon, or cyclone, depending on geographic location.
	**Dust Storm**		The result of terminal winds raising large quantities of dust into the air and reducing visibility at eye level (1.8 meters) to less than 1,000 meters.

Note: The definitions of these hazards from the WRI and the IPCC are examples, any other relevant definition and corresponding indicator will be appropriate.

Sources : WRI based on a review of reports from the IPCC (2014a, 2021, 2018, 2019a, 2019b), Géorisques, and adapted from I4CE

REPRESENTATIVE CONCENTRATION PATHWAYS (RCP)

Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover (Moss et al., 2008). The word representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term pathway emphasizes that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome (Moss et al., 2010).

RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment Models produced corresponding emission scenarios. Extended Concentration Pathways (ECPs) describe extensions of the RCPs from 2100 to 2500 that were calculated using simple rules generated by stakeholder consultations and do not represent fully consistent scenarios.

Four RCPs produced from Integrated Assessment Models were selected from the published literature and are used in the present IPCC Assessment as a basis for the climate predictions and projections presented in WGI AR5 Chapters 11 to 14 (IPCC, 2013b):

RCP2.6

One pathway where radiative forcing peaks at approximately 3 W/m2 before 2100 and then declines (the corresponding ECP assuming constant emissions after 2100). RCP2.6 is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures. The increase of global mean surface temperature by the end of the 21st century (2081–2100) relative to 1986–2005 is *likely* to be 0.3°C to 1.7°C under RCP2.6.

RCP4.5 and RCP6.0

Two intermediate stabilization pathways and scenarios in which radiative forcing is stabilized at approximately 4.5 W/m2 and 6.0 W/m2 after 2100 (the corresponding ECPs assuming constant concentrations after 2150). The increase of global mean surface temperature by the end of the 21st century (2081–2100) relative to 1986–2005 is *likely* to be 1.1°C to 2.6°C under RCP4.5, 1.4°C to 3.1°C under RCP6.0.

RCP8.5

It is the scenario with very high GHG emissions. One high pathway for which radiative forcing reaches >8.5 W/m2 by 2100 and continues to rise for some amount of time (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250). Scenarios without additional efforts to constrain emissions ('baseline scenarios') lead to pathways ranging between RCP6.0 and RCP8.5. The increase of global mean surface temperature by the end of the 21st century (2081–2100) relative to 1986–2005 is *likely* to be 2.6°C to 4.8°C under RCP8.5.

Relative to 1850–1900, global surface temperature change for the end of the 21st century (2081–2100) is projected to *likely* exceed 1.5°C for RCP4.5, RCP6.0 and RCP8.5 (*high confidence*). Warming is *likely* to exceed 2°C for RCP6.0 and RCP8.5 (*high confidence*), *more likely than not* to exceed 2°C for RCP4.5 (*medium confidence*), but *unlikely* to exceed 2°C for RCP2.6 (*medium confidence*).

(IPCC, 2014)

RESILIENCE

The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation. (IPCC, 2014)

TECHNICAL RESSOURCES

The technologies, techniques and new solutions that contribute to improving its adaptive capacity. (ADEME, 2019)

THRESHOLD	Identifying the stages beyond which the operation of a system is significantly or irreversibly compromised, and understanding how climate change interacts with these functional thresholds, threshold analysis enables to identify different levels of risk. The identification of these different risks thresholds in space and time then allows to prioritize and sequence incremental adaptation solutions. (ADEME, 2020)
TRANSFORMATION	A change in the fundamental attributes of natural and human systems. (IPCC, 2014)
VULNERABILITY / SENSITIVITY	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. (WRI, 2021)
VULNERABILITY METRICS	Metrics designed to assess the propensity of different parts of a company's value chain to suffer negative impacts when exposed to and then impacted by physical climate hazards. These metrics should assess specific characteristics of a company's value chain (e.g., water intensity) that may make that part of the value chain more or less likely to suffer negative impacts from physical climate hazards. (WRI, 2021)

10.5.5. BIBLIOGRAPHY

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