ACT

ACT | ASSESSING LOW CARBON TRANSITION®

Assessing low-Carbon Transition

Glass Sector Methodology

(version 0.6 – July 2021)

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1. Introduction

The 2015 United Nations Climate Change Conference (COP21) in Paris strengthened the global recognition of limiting dangerous climate change. Political agreement was reached on limiting warming to well below “2 degrees” and pursuing efforts to limit temperature rise to “1.5 degree” above pre-industrial levels. The Assessing Low-Carbon Transition (ACT) Initiative measures how ready a company is to transition to a low-carbon economy. The ACT initiative aims at helping businesses to drive their climate strategy, their business model(s), their investments and operations, and set targets compatible with a low-carbon pathway. The general approach of ACT is based on the Sectoral Decarbonization Approach (SDA) developed by the Science-Based Targets Initiative (SBTi) in order to compare a company’s alignment with a low-carbon world (compatible with 2°C - or beyond - climate change scenarios), the application of which is described in the ACT Framework (1). The ACT Glass methodology aligns with other reporting frameworks where applicable (e.g., CDP, TCFD, EU Taxonomy (2)).

Why do we need to develop a methodology for Glass Sector?

Glass adopts many guises and almost every area of our lives involves products with glass at their heart: from transport to homes and workplaces, from food production to health, leisure activities and communications, from museums to art galleries. Glass production requires high temperature and therefore energy, so it is necessary to make a proposition to assess sustainable strategy of companies within this sector. Glass sector GHG emissions is ranked after Cement, Iron and steel, Aluminium and Chemicals. The GHG emissions of this sector are commonly included in the mineral non-metallic sector emissions.

It is important to note that the choice of low-carbon scenario might differ between each ACT sectoral methodology, so it is not always possible to compare assessment results across sectors. In addition, the methodology itself is scenario agnostic; it means that companies within the same sector could be given two different scores if the scenario chosen in the benchmark was to change.

1.1. INTRODUCTION TO GLASS PROCESSES

1.1.1. WHAT IS GLASS?

The term ‘glass’ does not have a convenient simple definition. In its broadest sense, glass is a collective term for an unlimited number of materials of different compositions in a glassy state. Glass is an inorganic material obtained from different inorganic raw materials which react at high temperature to form a new random network (glass), where different elements are linked together, typically by oxygen bridges[1]. In the glass industry, the term is usually used to refer to silicate glasses, substances containing a high proportion of silica (SiO2), and which naturally form glass under normal conditions of cooling from the molten state.

[1] Definition from Glass Alliance Europe

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The exact composition of glass may vary to meet specific applications requirements but the most commonly used type of glass, soda-lime glass, is produced from silica sand, soda ash (natural or synthetic), limestone, dolomite and glass cullet (recycled glass). Additional materials such as iron oxide or cobalt can be added to the mix to give a green or blue colour to the glass.

The general chemical formation for silicate glass can be illustrated by the following simplified reaction equation:

$$a\ SiO2\ [sand] + b\ Na2CO3\ [soda] + c\ CaCO3\ [lime] + d\ CaMg(CO3)2\ [dolomite] + e\ Na2SO4\ [sodium\ sulphate] + \cdots \rightarrow x\ SimNanCaoMgp \ldots \ldots Os)\ [glass] + y\ CO2 \uparrow + z\ SO2 \uparrow + \cdots + + + + \rightarrow + \uparrow + \uparrow +$$

Raw materials used in a glass formulation undergo physical (melting) and chemical (formation of the network) processes. During the chemical reaction to form glass (synthesis), different crystalline substances (a, b, c, d, e, …) are transformed into a non-crystalline vitreous substance (x).

The physio-chemical properties of the new glass substance (chemical resistance, mechanical resistance, transmittance, colour, etc.) are a function of the network formed. Different compositions lead to different glass chemical structures and consequently to different physio-chemical properties of the final material.

Glass is often classified by its chemical composition; 4 main groups can be defined:

- Soda lime
- Crystal glass (containing lead, according to the directive 69-493)
- Borosilicate
- Special glass

The first three groups represent more than 95% of all the glass produced. The special glass category is composed of more than a thousand different chemical compositions and represents the last 5%.

Soda lime is mainly used in the manufacturing of bottles, jars, tableware and glazing.

Crystal glass are mainly used for glassware, carafe, bowls and other decorative artefacts of high quality.

Borosilicate is mainly used in fibreglass production, both for continuous filaments and fibreglass insulation as well as for cookware and pharmaceutical packaging.

Special glass concerns optical components, wafers and substrates, glass rods, glass tubing, heat tempered and chemically strengthened glass and include glass solutions for the following: abrasives, computer heads, vitrified-bonded grinding wheels, dental glass fillers, electronics, sealing, wood preservation plus many other technical glass applications.

The production of glass can include different steps depending on the type of glass handled and the type of product manufactured. Regardless of the product, the manufacture will always include the following steps:

1. **Batch preparation and mixing** (raw material preparation)
2. **Hot end** (melting in a furnace, forming process, internal treatment - homogenization and refining, annealing, …)
3. **Cold end** (inspection, secondary processing, label, coatings, cooling)

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1.1.2. GLASS PRODUCTS OVERVIEW

The glass sector is very diverse both in terms of chemical composition and production processes. The three main types of glass products are hollow glass (containers, tableware, packaging…), flat glass and glass fibre and wool. Inside these 3 main products there is still important diversity of chemical compositions, shapes, colours and aspects. More details on these 3 types of products are given in the following paragraphs.

- **FLAT GLASS**

The float glass process, invented by Sir Alastair Pilkington in 1952, makes flat glass. This process allows the manufacture of clear, tinted and coated glass for buildings, and clear and tinted glass for vehicles.

The raw materials are mixed in a batch process, then fed together with suitable cullet (waste glass), in a controlled ratio, into a furnace where it is heated to approximately 1500 °C. Common float glass furnaces are 9 m wide, 45 m long, and contain more than 1200 tons of glass[2]. Once molten, the temperature of the glass is stabilised to approximately 1200 °C to ensure a homogeneous specific gravity.

The molten glass is fed into a "tin bath", a bath of molten tin (about 3–4 m wide, 50 m long, 6 cm deep), from a delivery canal and is poured into the tin bath by a ceramic lip known as the spout lip. The amount of glass allowed to pour onto the molten tin is controlled by a gate called a tweel. Tin is suitable for the float glass process because it has a high specific gravity, is cohesive, and is immiscible with molten glass. Tin, however, oxidises in a natural atmosphere to form tin dioxide (SnO2). Known in the production process as dross, the tin dioxide adheres to the glass. To prevent oxidation, the tin bath is provided with a positive pressure protective atmosphere of nitrogen and hydrogen.

The glass flows onto the tin surface forming a floating ribbon with perfectly smooth surfaces on both sides and of even thickness. As the glass flows along the tin bath, the temperature is gradually reduced from 1100 °C until at approximately 600 °C the sheet can be lifted from the tin onto rollers. The glass ribbon is pulled off the bath by rollers at a controlled speed. Variation in the flow speed and roller speed enables glass sheets of varying thickness to be formed.

Once off the bath, the glass sheet passes through a lehr kiln for approximately 100 m, where it is cooled gradually so that it anneals without strain and does not crack from the temperature change. On exiting the "cold end" of the kiln, the glass is cut by machines.

Tempered glass, also known as toughened and safety glass is a product made from heat treatment or chemical processes to increase its strength. First, this product is heated through chemical process which hardens it, then rapidly cooled with the help of blowers. This product is approximately four times stronger than normal glass and majorly used for safety purposes as it breaks into small granular chunks rather than sharp edges thereby preventing damage and injuries. Strong application outlook in automotive, construction, furniture, and home appliances, along with its superior properties is expected to fuel the tempered glass market share.

The tempering step is usually done in “integrated” facilities, it can also be done in specific facilities specialised in the finishing steps of flat glass. Such facilities described in this document as “product shaping” facilities

[2] http://www.novalglass.com/glass/do-you-konw-how-to-manufacture-float-glass/ and https://www.caremach.com/2018/03/12/float-glass-introduction/

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receive flat glass and apply specific processes in order to give it its final properties (tempering, decoration, laminating, cutting, bending…) they use specific raw materials and heat to work the glass.

The specific steps of flat glass production are presented in Figure 1.

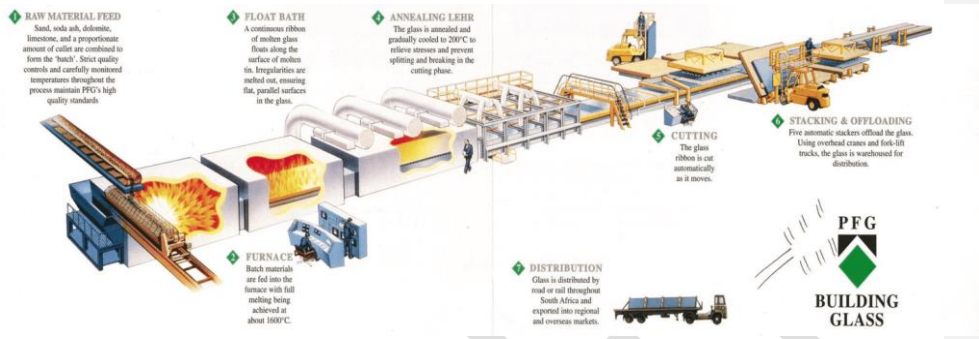

FIGURE 1: PRODUCTION OF FLAT GLASS[3]

- **HOLLOW GLASS**

The glass packaging industry is very diverse and covers a wide variety of technology to produce glass bottles, jars and flaconnage. Container glass covers different industries: beverages and food (beer and alcoholic container), cosmetics, pharmaceuticals. From one industry to another, what is changing is the "recipe" of the glass. For example, in the pharmaceutical industry, more borosilicate glass is used because of the specific properties: low thermal expansion, high material strength and chemical stability. Soda-lime(-silica) glass is the most common glass used for beverages and food containers due to the low cost of manufacturing.

Tableware is also a part of the hollow glass sector, this sector is even more diverse in terms of chemical composition, furnace and production technologies.

Hollow glass begins with melting together several largely naturally occurring minerals. The most common input materials used to produce glass are:

- Cullet (recycled glass)
- Silica sand
- Soda ash (acts as a fluxing agent that eventually lowers the melting temperature of molten silica)
- Limestone (enhances durability)
- Materials can be added to produce different colours.

Hollow glass has a lower magnesium oxide and sodium oxide content than flat glass, and a higher Silica, Calcium oxide, and aluminium oxide content. Its higher content of water-insoluble oxides imparts slightly higher chemical durability against water, which is required for storage of beverages and food.

[3] Figure extracted from the website http://pfg.co.za/manufacturing-process/

Bottles and jars glass furnaces are generally designed to melt large quantities of glass over a continuous period of more than 20 years and range in output from 150 tons of glass per day to over 600 tons of glass per day (3). Another source gives 12-16 years of lifetime for container glass furnaces and 6-8 years for tableware soda lime silica glass (4). According to experts, the lifetime of furnaces is closely linked to the melting technology used. Traditional fossil fuel fired regenerative designs and oxy-fuel furnaces range in life from 15 - 20 years depending on pull rate. Tableware furnaces using similar technology would expect a similar life. 100% electric furnaces commonly found in the production of tableware typically have a 6 - 8-year lifetime.

Materials are heated to 1280 °C at a constant temperature and the glass gob cools slowly to a working temperature around 1180 °C. Then the glass goes through a two-stage moulding process by using either the press-and-blow or the blow-and-blow techniques.

- Blow & Blow Process (Figure 2) - used for narrow containers where the parison is formed by compressed air.
- Press & Blow Process (Figure 3) - used for large diameter finish containers in which the parison is shaped by pressing the glass against the blank mould with the metal plunger.

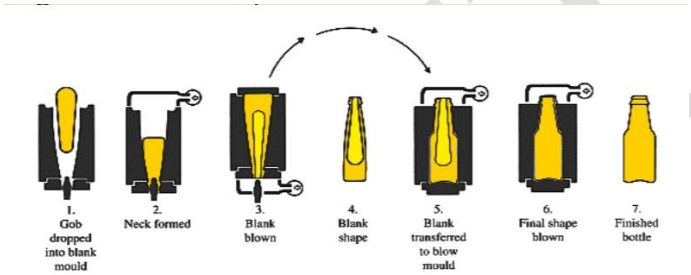

FIGURE 2: BLOW AND BLOW (BB) TECHNOLOGY

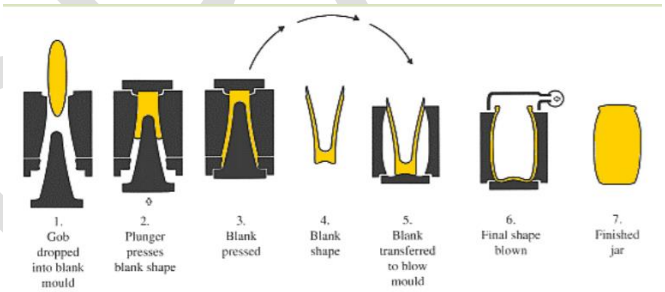

FIGURE 3: PRESS AND BLOW TECHNOLOGY (PB)

Another technology combining both advantages of blow & blow process and press & blow process is used in some plants. It is called narrow neck press and blow.

Additionally, some hollow glass articles are tempered.

- **GLASS FIBRES**

The two basic types of glass fibre products, textile and wool, are manufactured by similar processes.

Glass fibre production can be segmented into three phases: raw materials handling, glass melting and refining, and wool glass fibre forming and finishing, this last phase being slightly different for textile and wool glass fibre production. These phases are presented on Figure 4.

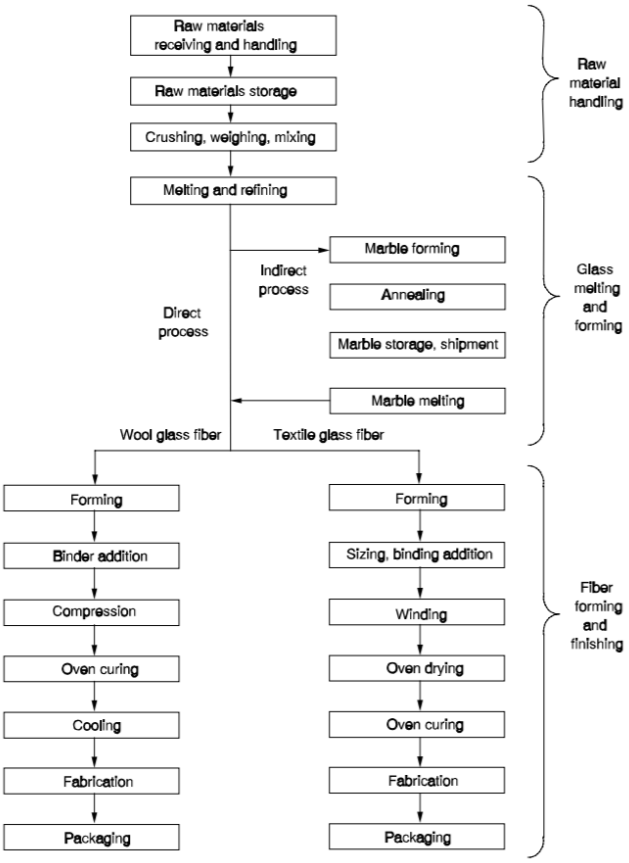

FIGURE 4: TYPICAL FLOW DIAGRAM OF THE GLASS FIBRE PRODUCTION PROCESS (5)

In the "indirect" melting process, molten glass passes to a forehearth, where it is drawn off, sheared into globs, and formed into marbles by roll-forming. The marbles are then stress-relieved in annealing ovens, cooled, and conveyed to storage or to other plants for later use. In the "direct" glass fibre process, molten glass passes from the furnace into a refining unit, where bubbles and particles are removed by settling, and the melt is allowed to cool to the proper viscosity for the fibre forming operation.

The specific steps of fibreglass production (wiring) are illustrated in Figure 5. Different sub processes are illustrated in Figure 6.

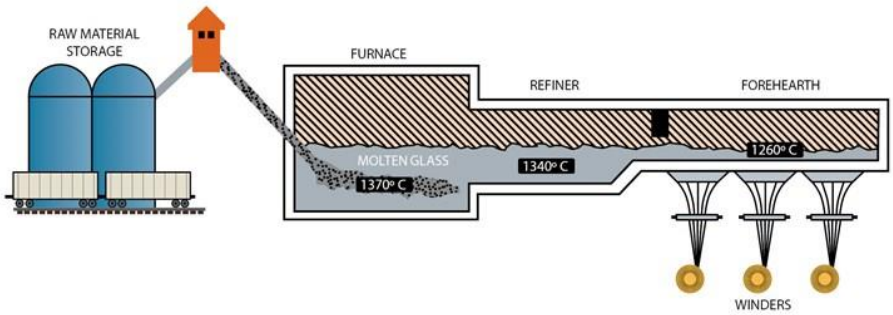

FIGURE 5: PRODUCTION OF FIBREGLASS

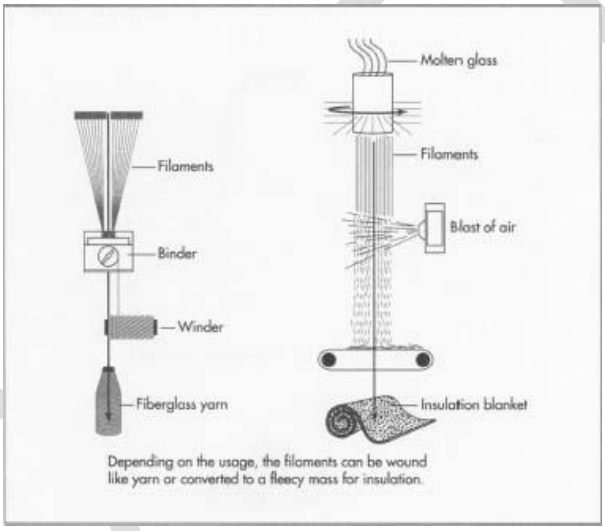

FIGURE 6: SPECIFIC STEPS OF THE PROCESS FOR DIFFERENT FIBREGLASS USE[4]

Continuous Filament Fibre

Continuous filament fibres are especially used for the production of composite materials like fibre-reinforced plastics. Continuous filament fibre is generally manufactured from a glass melt in either cross-fired recuperative furnaces that are employing fossil fuels to supply the melting energy or oxy-fuel fired furnaces, generally using natural gas. In the year 2007, about 55 % of continuous filament fibre furnaces were oxyfuel fired with some of them also applying electric boosting. As the production volume of continuous filament fibre is lower than that of the large bulk materials (hollow glass, flat glass), smaller furnaces are used. The use of

[4] Figure extracted from website http://www.3mb.asia/everything-about-fibreglass-manufacturing-benefits-and-applications/

regenerative furnaces is technically unfeasible. Most commonly, an E glass formulation is employed for continuous filament fibre. With a low electrical conductivity of E glass, electrical melting is not seen as efficient process for continuous filament fibre production.

Glass wool

Glass wool is essentially used for the building industry. The basic materials for glass wool manufacture include sand, soda ash, dolomite, limestone, sodium sulphate, sodium nitrate, and minerals containing boron and alumina. The furnace (with a few rare exceptions) will either be an electrically heated furnace, a traditional gas-fired recuperative furnace, or less commonly an oxy-gas furnace.

1.1.3. GLASS PRODUCTION TECHNOLOGIES

In a glass manufacturing installation, the high material investments are the furnaces. Regardless of the type of infrastructure, furnaces which contain molten glass cannot be shutdown.

The furnace types and their lifetime are diverse and vary depending on the products manufactured and the amount produced. The most common types of furnaces are end fired and cross fired technology, but oxy-fuel furnaces, electric furnaces and hybrid furnaces are coming to the market to decarbonize the sector.

Increasing cullet (recycled glass) and use of renewable electricity are two of the major levers for decarbonization. Other levers are under development to decarbonize the sector as for example increased energy efficiency, use of alternative fuels, development of low-carbon electricity melters, design of low-carbon products, use of Carbon capture and Storage and Use (CCS and CCU) technologies.

1.2. GHG EMISSIONS IN THE GLASS SECTOR AND GLOBAL GLASS MARKET

Companies from the glass industry are reporting their emissions according to the GHG Protocol and ISO 14064-1 which are the international standard for GHG inventory and reporting at company level. These sources of guidance are the most known and used standard for CO2 emissions accounting and reporting guidance for organizations. These standards cover the accounting and reporting of seven greenhouse gases covered by the Kyoto Protocol.

1.2.1. MAIN GHG EMISSIONS SOURCES FOR GLASS PRODUCTION

Glass productions require high temperature and therefore energy, the process also emits some GHG as process emissions.

Major carbonates used in the production of glass are limestone, dolomite, and soda ash. The use of these carbonates in the glass manufacturing process is a complex high-temperature reaction that is not directly comparable to the calcination process used in lime manufacture and limestone/dolomite use but has the same net effect in terms of GHG emissions (IPCC 2006).

In the glass manufacturing industry, heat is used to fuse the carbonates and other raw materials into the specified glass type. Some glass melting furnaces are heated using electricity. For non-electric glass melting furnaces, coal, natural gas, distillate fuel oil, and residual fuel oil are all possible fuel inputs, although most, if not all, are fired with natural gas. The actual mix of fuels will be site-specific and depend on the geographical zone and the possibility of supply. Smaller furnaces are easier to fuel with electricity than largest one.

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Transport occurs at different stages in the glass manufacturing process, the transport of raw materials to the plant and the transport of finished products from the plant to the market. The GHG emissions related to raw materials transport represents between 1% and 2% of the total products impacts (6).

1.2.2. EUROPEAN PRODUCTION STATISTICS

For Europe, Glass Alliance has published some data on glass production per type from 1986. These are presented in the Figure 7 and Figure 8. In 2018, containers product represented 61% of the total European production, and flat glass, 30%. Tableware, reinforcement fibres and other products accounted only for 8,5%.

The table also presents an average increase of the production for the last five years (EU28) of

- 3,5% for flat glass;
- 1,7% for container glass;
- 3,6% for table ware;
- 3,7% for reinforcement fibres.

These values should be confronted with others values from other regions. Production trends depend on glass type and also social development (ex: flat glass for windshield for automotive sector and building sector, glass for smartphone, glass fibres for building sector and composites…). Projected data for future horizons (2030 or 2050) are difficult to find. Very specific data, at country level could be found.

GAE GLASS PRODUCTION

(GAE Glass Sectors)

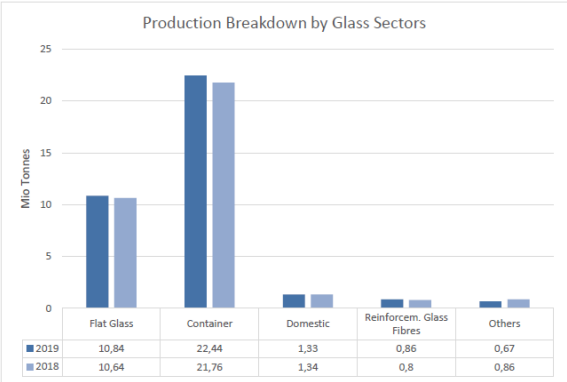
melted '000 t	FLAT GLASS	CONTAINER	TABLEWARE	Reinforcement FIBRES	OTHERS(*)	*TOTAL*
						(in million T)
EUR-12						
1986	4 683	12 160	859	286	544	***18.54***
1995	6 168	16 465	979	466	1 421	***25.50***
EUR-15						
1995	6 458	16 938	998	488	1 531	***26.41***
2000	7 640	17 690	1 177	550	1 284	***28.34***
2005	8 021	18 441	1 267	727	865	***29.32***
EUR-25						
2004	9 220	19 900	1 570	693	1 210	***32.55***
2005	9 372	20 404	1 456	727	1 090	***33.05***
2006	9 605	20 750	1 463	796	951	***33.57***
EUR-27						
2005	10 692	20 724	1 498	727	1 121	***34.76***
2006	10 981	20 967	1 526	796	1 162	***35.43***
2007	10 119	21 621	1 547	821	1 214	***35.32***
2008	10 865	21 270	1 440	823	966	***35.36***
2009	10 965	19 366	1 041	476	946	***32.79***
2010	10 099	19 990	1 016	713	1 005	***32.83***
2011	10 293	19 920	1 090	831	1 031	***33.17***
2012	9 216	19 779	1 006	634	980	***31.62***
2013	8 894	19 935	1 108	664	1 020	***31.62***
EUR-28						
2014	9 284	20 146	1 050	658	975	***32.11***
2015	9 641	20 319	1 080	677	1 218	**32.94**
2016	9 835	21 025	1 181	702	1 178	**34.00**
2017	10 665	21 537	1 253	700	1 052	**35.21**
2018	10 643	21 755	1 337	808	861	**35.40**
	- 0.2%	*+ 1 %*	*+ 6.7%*	*+ 15%*	*- 18%*	*+ 0.5 %*

D: former BRD until 1991
EU12: EUR10 (Benelux, Denmark, France, Germany, Greece, Italy, Ireland & United-Kingdom) + Portugal and Spain
EU15: including Austria, Finland & Sweden
EU25: including Poland, Czech Republic, Hungary, Slovakia, Slovenia, Baltic Countries,
EU27: Bulgaria and Romania
EU28: Croatia

(*) Others : mainly based on estimates, including the special glass sector.
Container glass sector: Since 2015, report for the production of food and beverage glass packaging in the EU 28 represents 90% of the production and excludes flaconnage.
Flat glass sector: Total untransformed flat glass (melted glass for float)

FIGURE 7: HISTORICAL PRODUCTION OF GLASS IN EUROPE (7)

Production Breakdown By Sectors



EU 28 (in million tonnes) *Source : GAE Members+Estimates*

FIGURE 8: EUROPEAN PRODUCTION IN 2018 AND 2019 (SOURCE: GLASS ALLIANCE EUROPE)

The glass industry within the European Union (EU) is extremely diverse, both in the products made and the manufacturing techniques employed. Products range from intricate handmade lead crystal goblets to the huge volumes of float glass produced for the construction and automotive industries. Manufacturing techniques vary from the small electrically heated furnaces in the high temperature insulation wools (HTIW) sector to the cross-fired regenerative furnaces in the flat glass sector, producing up to 1 000 tonnes per day. The wider glass industry also includes many smaller installations that fall below the 20 tonnes per day threshold, commonly used into the European regulation (IED – Industrial Emissions Directive, ETS – Emissions Trading system…). However, for some of the statistical data given in this chapter, it has not been possible to separate out the contribution from the smaller plants. This is not considered significant since they account for less than 5 % of the total industry output.

1.2.3. GLOBAL GLASS MARKET

The market is mainly concentrated on flat glass and container production. Worldwide production: flat glass and container production are equivalent for the year 2020 according to the Glassglobal database (8) (source: https://plants.glassglobal.com/login/). The market is smaller for glass fibres.

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TABLE 1: CAPACITY OF PRODUCTION AND NUMBER OF FURNACES FOR THREE CATEGORIES OF GLASS PRODUCTS (TPA:TONS PER YEAR; TPD:TONS PER DAY). SOURCE: GLOBALGLASS DATABASE

Glasstype	Capacity tpd	Capacity tpa	Furnaces
Flat	288.129	105.166.979	578
Container	255.446	93.237.790	1.187

The Figure 9 shows that Asia and Europe are the first producers for flat glass and container glass.

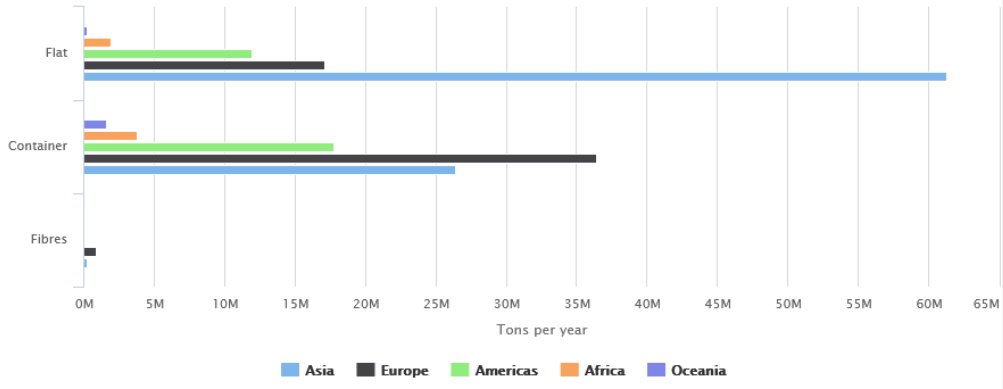

FIGURE 9: REPARTITION OF THE PRODUCTION OF FLAT GLASS, CONTAINERS AND FIBRES BETWEEN WORLD REGIONS (IN TON.YEAR). SOURCE: GLOBALGLASS DATABASE

Considering flat glass production in tons per year, China is the first producer (41,37 million tons per year), United States is the second (6,2 million tons per year) and Germany is the third (3,64 million tons per year).

Considering containers production in tons per year, China is the first producer (10,65 million tons per year), Russia is the second (7,9 million tons per year) and United States is the third (7,8 million tons per year).

Considering fibre glass production in tons per year, China is the first producer (1,8 million tons per year), United States is the second (0,9 million tons per year) and Germany is the third (0,7 million tons per year).

Confidentiality is a major problem in the glass industry. In the flat glass industry for example, there are only four companies that control about 80% of the market for flat glass products (Pilkington, Saint-Gobain, Asahi with its European subsidiary AGC Flat Glass Europe and Guardian with its European subsidiaries). The high degree of industry concentration in the flat glass market leads to the effect that most of the relevant data on production volumes and input of energy carriers is not publicly available. Benchmark curves are therefore not accessible to Glass Alliance Europe (old name CPIV); they are handled by an independent institute. The situation is similar for container glass (hollow glass) and glass fibres.

According to the Tempered Glass Market Analysis, made by Global Market Insights (9) and the Figure 10, the major market for tempered glass is construction, automotive and home appliance. The gadget segment has also a high potential of development because of the demand increase for smartphones, tablets and laptops or computers as screen protectors.

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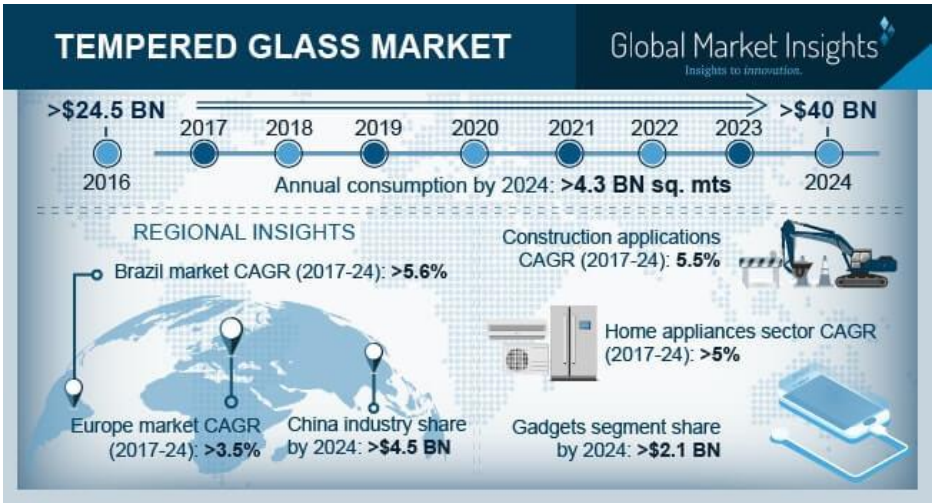

FIGURE 10:TEMPERED GLASS MARKET (9)

2. Principles

The selection of principles to be used for the methodology development and implementation are explained in the general ACT Framework. Table 2 recaps the principles that were adhered to when developing the methodology.

TABLE 2: 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.

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3. Scope

3.1. SCOPE OF THE DOCUMENT

This document presents the ACT assessment methodology for the Glass (GL) sector. It includes descriptions of indicators alongside their calculation methods and rationale for the sector-specific aspects of performance, narrative and trend scorings. It was developed in compliance with the ACT Guidelines for the development of sector methodologies (10), which describe the governance and process of this development, as well as the required content for such documents. It is intended to be used in conjunction with the ACT Framework, which describes the overarching philosophy of the ACT Initiative and elements of the methodology that are not sector specific.

3.2. SCOPE OF THE SECTOR

The Scope of the sector is defined to focus on companies which could have important production with a consistent organisation within the sector.

3.2.1. PRODUCTS CLASSIFICATION

According to the BAT document on Manufacture of Glass (11), the industrial activities falling within the definitions in Sections 3.3 and 3.4 of Annex I of Directive 2010/75/EU ("the glass industry") is comprised of eight sub-sectors. These sub-sectors are based on the products manufactured, but inevitably there is some overlap between them.

The eight sub-sectors are:

1. Container glass
2. Flat glass
3. Continuous filament glass fibre
4. Domestic glass
5. Special glass (without water glass)
6. Mineral wool (with two divisions, glass wool and stone wool)
7. High temperature insulation wools (excluding polycrystalline wool)
8. Frits.

Note: The high temperature insulation wool (HTIW) manufacturing sector differs significantly from the other sectors of the glass industry. The typical production of the installations is between 5 – 10tonnes/day, therefore below the tonnage requirement of 20 tonnes/day set by the Directive.

3.2.2. ACTIVITIES COVERED BY THE SCOPE OF THE SECTOR

There are mainly two types of activity classifications: NACE or PRODCOM (Europe) and ISIC (International). The NACE classification is generally more detailed. The ISIC Rev4 code 2310 is the equivalent to NACE Code "23.1 Manufacture of glass and glass products".

Table 3 presents the description of the activities included in the NACE/PRODCOM classification.

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TABLE 3: NACE/PRODCOM CODE DESCRIPTION

NACE or PRODCOM class	**Activities included in the description**	**Activities excluded from the description**
23.11 *Manufacture of flat glass*	Manufacture of flat glass, including wired, coloured or tinted flat glass	
23.12 *Shaping and processing of flat glass*	Manufacture of toughened or laminated flat glass Manufacture of glass mirrors Manufacture of multiple-walled insulating units of glass	
23.13 *Manufacture of hollow glass*	Manufacture of bottles and other containers of glass or crystal Manufacture of drinking glasses and other domestic glass or crystal articles	Manufacture of glass toys, see 32.40
23.14 Manufacture of glass fibres	Manufacture of glass fibres, including glass wool and non-woven products thereof	Manufacture of woven fabrics of glass yarn, see 13.20. Manufacture of fibre optic cable for data transmission or live transmission of images, see 27.31
23.19 Manufacture and processing of other glass, including technical glassware	Manufacture of laboratory, hygienic or pharmaceutical glassware Manufacture of clock or watch glasses, optical glass and optical elements not optically worked Manufacture of glassware used in imitation jewellery Manufacture of glass insulators and glass insulating fittings Manufacture of glass envelopes for lamps Manufacture of glass figurines Manufacture of glass paving blocks Manufacture of glass in rods or tubes	Manufacture of optical elements optically worked, see 26.70. Manufacture of syringes and other medical laboratory equipment, see 32.50

Considering the volumes manufactured in the world (average of 95% for flat glass, hollow glass and glass fibres and 5% for specialty glass) and the specificities of each category of products as presented in this report in chapters 1.1.1 and 1.2, some of 23.19 activities which are mainly specialty glass are manufactured in small quantities (ex: Manufacture of glassware used in imitation jewellery, glass figurines…) and could be excluded of the scope of the sector.

The following NACE/PRODCOM classes that could be covered by the scope of the ACT glass methodology:

TABLE 4: ACTIVITIES COVERED BY ACT GLASS METHODOLOGY

NACE or PRODCOM class	**Activities included in the scope of the sector**	**Activities excluded from the scope of the sector**

23.11 *Manufacture of flat glass*	Manufacture of flat glass, including wired, coloured or tinted flat glass	
23.12 *Shaping and processing of flat glass*	Manufacture of toughened or laminated flat glass. Manufacture of glass mirrors Manufacture of multiple-walled insulating units of glass	
23.13 *Manufacture of hollow glass*	Manufacture of bottles and other containers of glass or crystal Manufacture of drinking glasses and other domestic glass or crystal articles	Manufacture of glass toys, see 32.40
23.14 Manufacture of glass fibres	Manufacture of glass fibres, including glass wool and non-woven products thereof	Manufacture of woven fabrics of glass yarn, see 13.20. Manufacture of fibre optic cable for data transmission or live transmission of images, see 27.31
23.19 Manufacture and processing of other glass, including technical glassware	Manufacture of laboratory, hygienic or pharmaceutical glassware	Manufacture of clock or watch glasses, optical glass and optical elements not optically worked. Manufacture of glassware used in imitation jewellery Manufacture of glass insulators and glass insulating fittings Manufacture of glass envelopes for lamps Manufacture of glass figurines Manufacture of glass paving blocks Manufacture of glass in rods or tubes Manufacture of optical elements optically worked, see 26.70. Manufacture of syringes and other medical laboratory equipment, see 32.50

3.2.3. TYPE OF ACTORS COVERED BY THE ACT METHODOLOGY

The ACT methodology (1) relies on the principle of relevance and therefore only the companies that have both significant climate impacts and significant mitigation levers can be covered by the ACT methodology.

Considering the type of companies existing in the sector and the relative impact of the different manufacturing steps, it appears that the companies operating a furnace should be included in the scope of the sector.

The glass sector is relatively homogeneous regarding organisation of the companies, most are integrated. But some GHG emissions could appeared at other steps of the value chain when the organisation within company is split between factories active only on glass melting and others on glass shaping. There are also different levers regarding glass products (flat glass, hollow glass, fibre glass) and technologies decarbonization: production equipment, glass composition, process steps…

Some companies could be active on several glass sub-sector (manufacturing of different glass products) and/or even on non-glass sector. This ACT methodology will focus only on the glass activity of the company (relative to relevant NACE code concerned).

The companies covered by the ACT Glass methodology are the following:

1. **Integrated**: which are active in both glassmaking and glass shaping activities.
2. **Raw material (batch house) and glass melters**: which are active only on upstream value chain
3. **Glass shapers**: which are active only on downstream value chain

The companies from type 1 and type 2 have relatively the same organisation and same levers when they are produced the same type of product. Since most of the direct emissions occur at the furnace, all the companies which are managing a furnace are evaluated by the ACT methodology for the glass sector.

Considering the volumes manufactured in the world (average of 95% for flat glass, hollow glass and glass fibres and 5% for specialty glass) and the specificities of each category of products as presented in this report in chapters 1.1.1 and 1.2, some of 23.19 activities which are mainly specialty glass are manufactured in small quantities (ex: Manufacture of glassware used in imitation jewellery, glass figurines…) and could be excluded of the scope of the sector.

To simplify the methodology, two business segments are built, one concerning the integrated factories and batch house and melting actors regardless products manufactured and sold; the other one concerning the actors only active in the product shaping step (tempering, coating, decorating, …) for flat glass. Hollow glass shapers concerning specifically decoration activities and not tempering or coating activities, they are not covered by the methodology.

The methodology has been built as to take into consideration the product specificities when assessing the low carbon strategy of a glass company. This is reflected in the weighting chapter 6.3.

Since their activities are excluded from the scope, Glass services providers (who are designing plants, providing engineering and/or maintenance services), cannot be evaluated using the present methodology.

Companies who are active only in primary materials production for the glass sector without being active in other parts of the value chain will not be covered by the methodology (example: sand miners, chemicals producers…).

Glass product traders (importers, exporters) cannot be evaluated using the present methodology.

The actors that can be assessed by the ACT methodology for the glass sector is illustrated in the Figure 11.

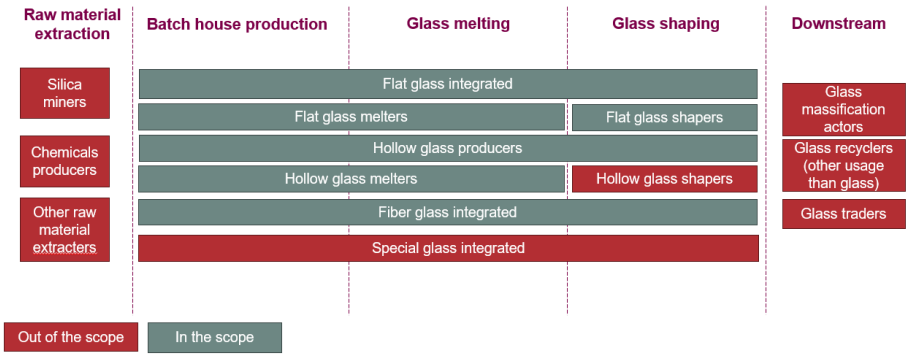

FIGURE 11: ACTORS THAT CAN BE ASSESSED BY THE ACT METHODOLOGY FOR THE GLASS SECTOR

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Note for the roadtest: If there is an opportunity to assess a hollow glass shaper or a hollow glass company with hollow glass shaping facility with furnaces it would be an improvement of the methodology to decide if this actor should be included or excluded from the scope of the sector. If there also an opportunity to assess special glass actor, it could be interesting to be sure if the methodology should be applied to this type of actor.

4. Boundaries

Hereafter, the term "emissions" will refer to all GHG emissions (not only CO_2) which shall be measured in CO_2 equivalent.

ACT provides guidelines concerning the scope and boundaries of the sectors covered by this methodology to determine which type of GHG emissions are included or excluded. However, it does not provide tools and databases to measure and compute these emissions. In particular, the choice of emission factors does not fall under the responsibility of the ACT methodology. However, emission factors should be consistent with emission factors' and GWP's (Global Warming Potential) used to compute the reference pathways and benchmark scenarios for the quantitative indicators in order to be relevant.

Based on the principle of relevance and to facilitate the data collection on the companies' side, the ACT methodology focuses on the main sources of GHG emissions throughout the value chain.

4.1. REPORTING BOUNDARIES

The GHG emissions accounting (in CO2eq as reference) should be based on GHG Protocol guidance (and ISO 14064) as per location-based methodology (without taking into account guarantees of origin). Emissions from Kyoto Protocol are reported. GHG emissions are not the only type of pollutant emission which are generated by the glass industry. Significant emissions (including NOx and SOx) can also occur in glass production. The monitoring of all facilities emissions should be done. The ACT methodology focused on the GHG emissions reduction but the others gases should also be reduced if possible. It is important that a company does not focus exclusively on GHG emission reduction without taking into account potential pollution transfers to air pollution when a low-carbon transition is implemented.

4.2. GHG EMISSIONS FOR GLASS PRODUCTS

GHG emissions intensity of glass production can vary significantly depending on the type of glass product. The Table 5 presents the most contributing steps of the glass production life cycle GHG emissions, for the three types of glass products considered in the ACT methodology. The scope 1 and 3 upstream represent the majority of GHG emissions for all products. The scope 2 could be non negligeable depending on the furnace type in operation within the company and the supplied electricity mix of the country. Moreover scope 2 could vary a lot during the transition period to a neutral economy taking into account electrification rate of the activities and transition of the electricity sector.

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TABLE 5: GHG EMISSIONS RELATING TO SCOPE AND GLASS TYPES

Scope	Step	Flat glass (source: Ecoinvent 3.7)	Hollow glass (source: Ecoinvent 3.7)	Fiber glass (source: GlassFibreEurope)
Scope 1	Process emission and fuel combustion			*Scope 1+2+3 are aggregated*
Scope 2	Electricity		*	
Scope 3	Fossil fuel extraction and supply		*	
Scope 3 Upstream	Raw material extraction			
Scope 3 Upstream	Transport of raw materials			
Scope 3 Downstream	Transport of finished products			

*for hollow glass depending on the source, the ratio between electricity and fossil fuels can vary.

	Important GHG emissions (>50%)	Note: The percentage presented in the table could be variable according to the geographical zone (mix of fuels and mix of electricity used or distance of transportation)
	Relative importance of GHG emissions (between 10 and 50%)	
	Low importance GHG emissions (less than 10%)	

4.3. SETTING APPROPRIATE BOUNDARIES

According to the Table 5, it is appropriate setting the boundaries for the glass sector on scope 1, 2 (process emissions, fuels combustion emissions and electricity emissions) and 3 (raw materials and fuels extraction). A specificity of the glass sector is the use of external cullet (recycled glass) as inputs of the manufacture process. The use of cullet could reduce the GHG emissions of some glass products. This external cullet should however be collected (and collection could be improved by improving client engagement) and so this is linked also with transport emissions of inputs (raw materials) and actions through the value chain.

GHG emissions coming from transport is also directly linked to the loading rate of the trucks. For hollow glass, it could be a more important issue because of the low density of some products (hollow glass contains lot of air). Furthermore, the reuses of some packaging glass can imply additional transport steps during the lifetime of the products. GHG emissions from the use phase are not considered significant enough to be included in the reporting boundaries. However, many companies producing flat glass and insulation products also estimate avoided emissions during the use phase of their product. Indeed, the use of these products in buildings can reduce heat losses. Those avoided emissions are not part of the reporting boundaries of the ACT methodology. According to all existing GHG accounting standards (including ISO14064-1 and GHG Protocol GHG accounting corporate standard), the avoided GHG emissions should not be added to the GHG inventory of a company, and it appears impossible to quantitatively assess avoided emissions in a relevant and standardised way within ACT performance score. However, when relevant, a performance indicator related to enabling activities can be integrated within the 'Business model' module. This way, proposing products that are participating to the low-carbon transition of other actors/sectors is acknowledged. Even

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though inclusion of avoided emissions is not considered appropriate for ACT assessment of quantitative performance indicators, it is nevertheless possible to integrate company estimations and communications on avoided emissions within the ACT narrative score.

4.4. RELATION BETWEEN BOUNDARIES AND BENCHMARK

An ACT assessment is based on a comparison of the emissions at corporate level to a benchmark. It is important that both the benchmark and company emissions are calculated using the same boundaries, whether the company is fully integrated or outsourcing part of its production process.

For Integrated actors and glass melting actors, the scope 1+2 includes:

- Direct emissions
- Emissions from purchased or acquired electricity, steam, heat and cooling.

For glass shaping actors, for consistency with how the sectoral benchmark has been developed, the companies will be assessed taking into account their scope 1+2 and emissions from purchased glass (upstream scope 3 emissions) called externalized glass melting emissions.

The boundaries for this methodology are presented in the Figure 12.

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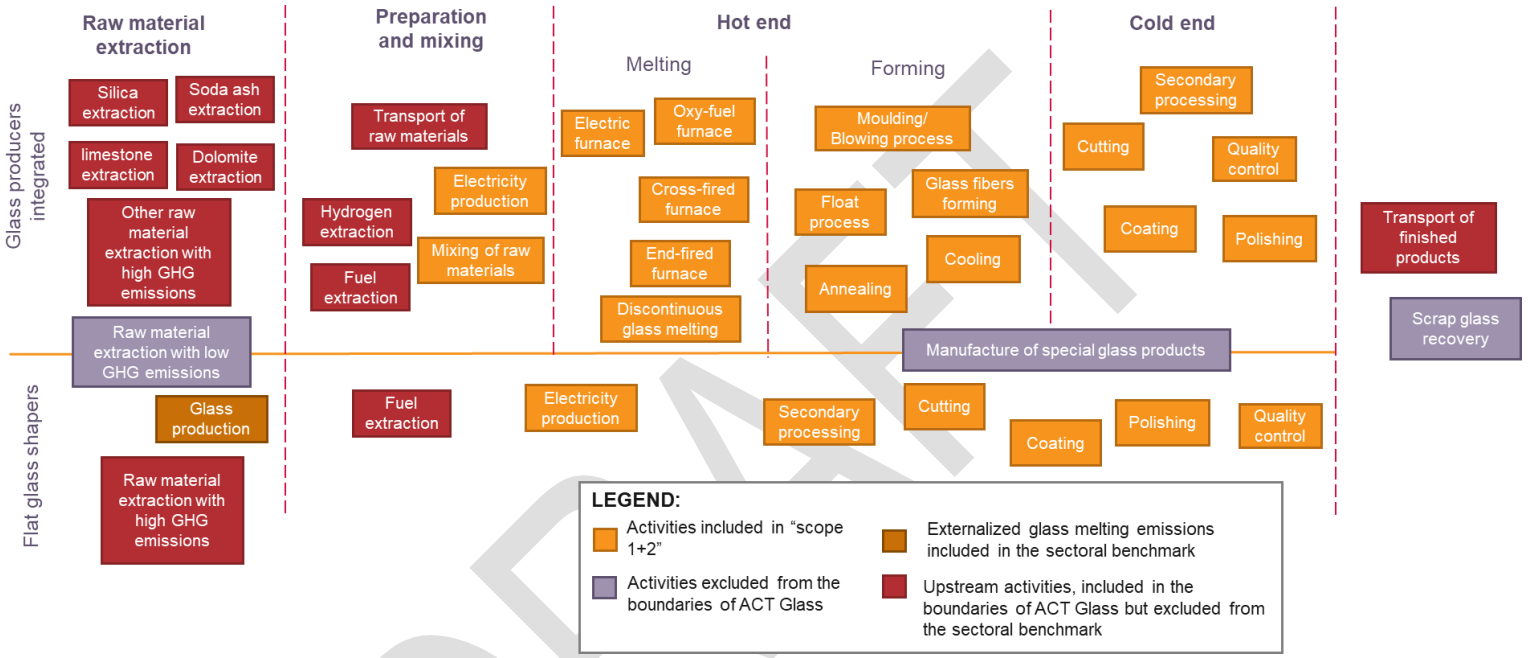

FIGURE 12: BOUNDARIES FOR THE GLASS SECTOR METHODOLOGY

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4.5. RATIONALE

The most significant emissions for the Glass sector occur during the step of Glass melting (process emissions – scope 1, use of fossil fuels - scope 1, and electricity - scope 2), raw material extraction or glass purchased (scope 3 upstream) and other use of energy (fossil fuels - scope 1 and electricity - scope 2).

Several technologies for Glass melting are currently under development with the consequence of transferring carbon emissions at other steps in the value chain (electricity or hydrogen). Therefore, it is impossible to create an exhaustive list of all processes that should be included in the boundaries. Future evolutions in the glass sector will tend to displace carbon emissions from the direct emissions to electricity generation or hydrogen combustion. Future evolutions could also tend to develop low-carbon products with low-carbon raw materials or lots of external cullet (without degrading the performance of the products). It is therefore important to include those emissions into the boundaries even if they do not represent a big share of the emissions for most of the companies today.

5. Construction of the data infrastructure

Indicators have been built using sectoral bibliography work and collaboration with the Technical Working Group in accordance with the ACT Guidelines (10).

5.1. DATA SOURCES

In order to carry out an activity at 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.

TABLE 6: ACT ASSESSMENT DATA SOURCES

Data requested to the company
GHG emissions (on scope defined in module 1,2 & 4 in quantitative indicators)
Activity data
Reduction targets (absolute and intensity)

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R&D 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

5.2. COMPANY DATA REQUEST

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

Where indicators refer to third party data sources as the default option, reporting companies may provide their own data to replace it if they can provide a justification for doing so, and information about its verification status, any assumptions used and the calculation methodology.

The CDP questionnaire can be a source of information for data collection. The ACT data collection form will highlight correspondence between requested data in the ACT Glass methodology and the 2021 version of the CDP questionnaire. All data would be collected by the analyst or the company.

For modules 5, 6, 7, 8, the CDP questionnaire could integrate all the activities (and not only the glass activities) of the company. If possible, the company should inform the analyst and/or could extract answers that are relevant for the glass sector (if possible).

Scope 1+2 are used for quantitative indicators in Module 1: Targets and 2: Material investment. The efforts of a company on Scope 3 upstream emissions which are not included in their module 2 are also assessed by ACT in Module 4: Sold Product Performance and Module 6: Supplier Engagement.

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5.3. PERFORMANCE INDICATORS

The performance indicators have been conceived following the main principles described in Chapter 2.

5.3.1. CHOICE OF CARBON INTENSITY METRIC

In the benchmark, the carbon intensity metric should be aligned with the emissions intensity of the benchmark chosen. Regarding the proxy used, it would be tonnes of glass.

In the glass industry statistics, two types of data can be used. One is melted glass, which is the actual output coming directly from the glass furnace. The other is packed glass, which is always a lower amount than the melted glass due to losses in the post processing. Any process losses can normally be recycled as internal cullet in the flat and hollow glass subsectors. In order to keep all the approach coherent with the EU ETS regulation already used by the glass sector in Europe, the following approach could be used:

- Concerning hollow glass and fiber glass products, for the integrated or glass melter actors, the packed glass is chosen for carbon intensity metric. If a type of product is not covered by the EU ETS (because EU ETS does not cover all products), the carbon intensity metric used could be the one currently used in the GHG emissions reporting of the company;
- Concerning the flat glass products, for the integrated or glass melter actors, the melted glass is chosen for carbon intensity metric;
- For shapers, there is no specification, tonnes of glass are chosen for carbon intensity metric.

Note for the roadtest: The carbon intensity metrics could be improved or detailed after the roadtest.

The ACT indicators are based on comparison against a benchmark:

- For quantitative indicators in Modules 1, 2 and 4, a company benchmark, derived from a sectoral benchmark, is used for defining a reference pathway for the company in terms of carbon emission intensity;
- For qualitative indicators in Modules 3, 5, 6, 7, 8 the levels have been built to reach the decarbonisation expected for 2050 of the sectoral benchmark.

5.3.2. MATURITY MATRIX

Qualitative Modules in the ACT methodology are scored using a maturity matrix. The matrix contains five maturity levels, that are associated to scores given to the company for each indicator. For some indicators, all 5 levels of the matrix are used to score the company, while for other indicators only some levels are used, in a simpler and less granular approach (e.g., only using the three levels of Basic, Advanced and Low-carbon Transition Aligned). Some of the indicators might be divided into sub-dimension that are evaluated individually before the score is aggregated to obtain the indicator score.

TABLE 7: STRUCTURE OF MATURITY MATRIX WITH ITS FIVE LEVELS AND THEIR ASSOCIATED SCORES

Evaluation level	Basic	Standard	Advanced	Next Practice	Low-carbon Transition Aligned
Score	0	0.25	0.5	0.75	1

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5.3.3. PERFORMANCE INDICATORS

The performance indicators have been conceived following the main principles described in Table 8.

Some indicators are the same across the ACT methodologies (module 1, 5, 6, 7, 8).

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TABLE 8 : PERFORMANCE INDICATORS

		GLASS SECTOR			
			Past	Present	Future
		1.TARGETS	GL 1.3 Achievement of previous targets		GL 1.1 Alignment of relevant scope emissions reduction targets GL 1.2 Time horizon of targets
Core business performance	Investment	2. MATERIAL INVESTMENT	GL 2.1 Past performance	GL 2.4 Alternative fuels and energy mix decarbonisation GL 2.5 Recycled content integration strategy	GL 2.2 Locked-in emissions GL 2.3 Trend in future emissions intensity
		3. INTANGIBLE INVESTMENT		GL 3.1 R&D in climate change mitigation technologies GL 3.2 Company low-carbon patenting activity	
		4 SOLD PRODUCT PERFORMANCE	GL 4.1 Past performance including purchased glass production assets		GL 4.2 Purchased product interventions
		5. MANAGEMENT		GL 5.1 Oversight of climate change issues GL 5.2 Climate change oversight capabilities GL 5.4 Climate change management incentives	GL 5.3 Low-carbon transition plan GL 5.5 Climate change scenario testing
Influence		6. SUPPLIER	GL 6.2 Activities to influence suppliers to reduce their GHG emissions	GL 6.1 Strategy to influence suppliers to reduce their GHG emissions	
		7. CLIENT	GL 7.2 Activities to influence customer behaviour to reduce their GHG emissions	GL 7.1 Strategy to influence customer behaviour to reduce their GHG emissions	
		8. POLICY ENGAGEMENT		GL 8.1 Company policy on engagement with trade associations GL 8.2 Trade associations supported do not have climate-negative activities or positions GL 8.3 Position on significant climate policies	
		9. BUSINESS MODEL	GL 9.1 Low-carbon business activities that aim at increasing energy efficiency and the use of low carbon energy or optimizing the process GL 9.2 Low-carbon business activities that aim at developing synergies with other industries (only for flat glass and fiber glass) GL 9.3 Low-carbon business activities that aim at developing the circular economy GL 9.4 Low-carbon business activities that aim at reducing the structural barriers to market penetration of low-carbon products without degrading the performance of the product		

With the exception of the maturity matrices used in Module 9: Business Model, (which uses a three-level matrix of Basic, Advanced and Low-carbon Transition Aligned) all matrices in the methodology make use of the full five-level matrix structure. The scores for these are: 0 for Basic, 0,25 for Standard, 0,5 for Advanced, 0,75 for Next Practice, 1 for Low-Carbon Aligned.

In order to address the relevant issues for each Glass company, the methodology has been segmented in two parts: Integrated and Glassmakers and Product shapers. Some of the quantitative indicators are specific for Integrated and Glass making actors and others for Product shapers:

- For integrated and glass making actors are not concerned by the calculation of:
  - Indicator 4.1: Past performance including purchased glass production assets
- For product shaping actors are not concerned by the calculation of:
  - Indicator 2.1: Past performance
  - Indicator 2.2: Locked-in-emissions
  - Indicator 2.5: Recycled content integration strategy
  - Indicator 9.3: Low-carbon business activities that aim at developing the circular economy

Integrated companies need to distinguish both activities in their organisation and calculate most indicators.

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TARGETS

GL 1.1 ALIGNMENT OF RELEVANT SCOPE EMISSIONS REDUCTION TARGETS

DESCRIPTION & REQUIREMENTS	GL 1.1 ALIGNMENT OF RELEVANT SCOPE EMISSIONS REDUCTION TARGETS
SHORT DESCRIPTION OF INDICATOR	A measure of the alignment of the company's emissions reduction target 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 covering the information relevant to this indicator are: The relevant data for this indicator are: ♦ Targets information for each relevant scope GHG emissions sources (Target year, emission reduction between reporting year and target year, coverage) ♦ Base year, emissions at base year ♦ % of emissions covered by the targets ♦ CDP questions concerned are C0.2, C4.1a, C4.1b External sources of data used for the analysis of this indicator are: ♦ IEA ETP (12) – background scenario data ♦ SDA (13) – specific benchmark pathway definition The benchmark indicators involved are the following:

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SEGMENT	TARGET TYPE (relevant scope)	PARAMETER	INTENSITY METRIC	BENCHMARK
Integrated and Glass melting actor	Scope 1+2 intensity	CB_{S12}	kgCO2e/tonne packed or melted glass	Adapted from IEA ETP–background scenario data (cf. chapter 6)
Product shaping only	Scope 1+2+ externalized glass melting emissions (from upstream scope 3 emissions) intensity	CB_{S12}	kgCO2e/tonne glass	Adapted from IEA ETP–background scenario data (cf. chapter 6)

HOW THE ANALYSIS WILL BE DONE

The analysis is based on a trend ratio between the company's relevant scope emissions target (T_{S12}) and the company's benchmark (CB_{S12}).

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 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 relevant scope emissions low-carbon benchmark pathway. See section 6 for details on the computation of this 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 relevant scope emissions at reporting year.

CALCULATION OF SCORE:

1) **Trend ratio**

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

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

where EIc(Yt) is the company relevant scope emissions intensity at target year, EIc (Yr) is the company direct emissions intensity at reporting year, EIb(Yt) is the company's benchmark direct emission intensity at target year and EIb (Yr) is the company's benchmark direct emission 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 there is no commitment gap (see Figure 13).

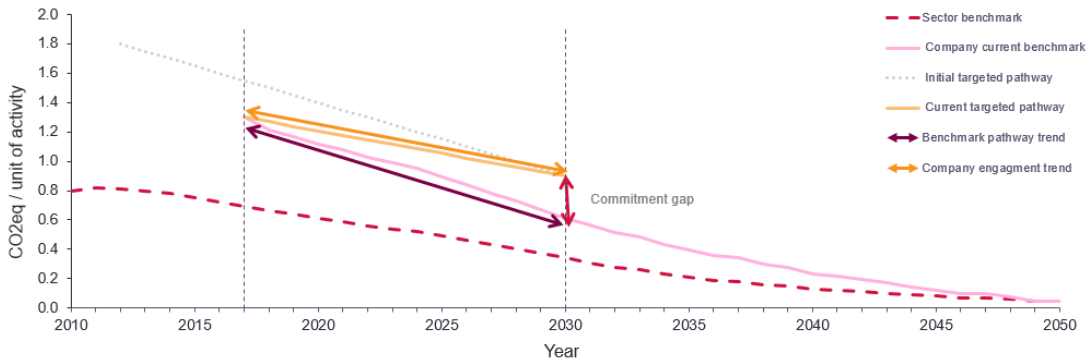

FIGURE 13: TREND RATIO AND COMMITMENT GAP

1) **Final Score**

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

Conditions	Score
$Company's\ target\ trend > 0$ Increase in company emissions intensity	0%
$Company's\ target\ trend \leq 0$ $0 \leq trend\ ratio \leq 1$ Decrease in company emissions 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 intensity and company's commitment equals or exceeds the company's benchmark ambition	100%
$Company's\ target\ trend \leq 0\ and\ EI_C(Y_R) \leq EI_B(2050)$ No increase in company emissions intensity and company's emissions intensity is already below the company's benchmark ambition for 2050	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:

$$\text{Final Score} = \text{Score x Target coverage of total company emissions (CYr))}$$

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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.

Note: Several targets can be assessed, but the analyst shall focus on targets that cover the target type (Relevant scope) defined in the methodology. Target at group or corporate level is preferred than at country or facility level.

RATIONALE	GL 1.1 ALIGNMENT OF RELEVANT SCOPE EMISSIONS REDUCTION TARGETS
RATIONALE OF THE INDICATOR	**RELEVANCE OF THE INDICATOR:** Direct emissions reduction targets are included in this ACT methodology for the following reasons: • Targets are an indicator of corporate commitment to reduce emissions and are a meaningful metric of the company's internal planning towards the transition. • 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. For the sector, direct emissions represent a high source of emissions. A GHG emissions reduction target should be assigned to them. **SCORING RATIONALE:** Targets are quantitatively interpreted and directly compared to a low-carbon benchmark build from the company's current level of emissions at reporting year and converging toward the 2050 value of the sectoral benchmark relevant for this source. 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 directly using data at target year.*

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759 **GL 1.2 TIME HORIZON OF TARGETS**

DESCRIPTION & REQUIREMENTS	GL 1.2 TIME HORIZON OF TARGETS
SHORT DESCRIPTION OF INDICATOR	A measure of the time horizons 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: ♦ Target year information for each relevant emissions source (Year for each reported, target id) ♦ Intermediate targets (Year for each reported, target id) CDP questions concerned are C0.2, C4.1a, C4.1b External sources of data used for the analysis of this indicator are: ♦ GlassGlobal database
HOW THE ANALYSIS 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). For the glass sector, LT is equal to 20 years, as it is an estimation for the higher lifetime of a furnace. The relevant time horizon of 20 years for the glass sector will be tested during the roadtest. 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 Te 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:

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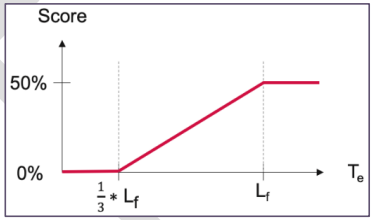
HORIZON GAP	SCORE
$Te > LT$	50%
$33\% \times LT < Te < LT$	$75\% \times \frac{Te}{LT} - 25\%$
$Te \leq 33\% \times LT$	0%



DIMENSION 2: INTERVAL TARGETS

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 to the following scoring table:

INTERMEDIATE TARGET GAP	SCORE
All the gaps during 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 are no such gaps disclosed by the company	**0%**

An example is illustrated in Figure 14 below.

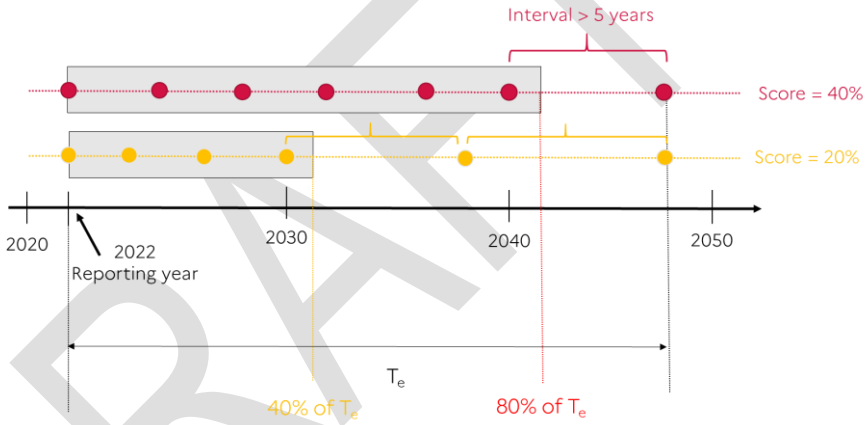


FIGURE 14 : EXAMPLES OF HORIZONS OF INTERMEDIATE TARGETS SET BY THE COMPANY AND CORRESPONDING SCORES ON DIMENSION 2 OF THE INDICATOR 1.2

AGGREGATE SCORE - DIMENSION 1: 50%, DIMENSION 2: 50%.

FOR ALL CALCULATIONS:

- If the company reports "year of target establishment" in the data request, then the calculations may be redone using this as the baseline instead of the reporting year. The company can attain up to 80% of the maximum score with this alternate calculation. The baseline that results in the higher score will be used for the final score.

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- 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	GL 1.2 TIME HORIZON 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.

760 **GL 1.3 ACHIEVEMENT OF PREVIOUS TARGETS**

DESCRIPTION & REQUIREMENTS	GL 1.3 ACHIEVEMENT OF PREVIOUS TARGETS
SHORT DESCRIPTION OF INDICATOR	A measure of the company's historic target achievements and current progress towards active emission reduction targets. All the GHG emissions 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 (depending on the target fixed): ♦ 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 relevant scope emissions covered by the targets ♦ CDP questions concerned are C0.2, C4.1a, C4.1b

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HOW THE ANALYSIS WILL BE DONE

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

DIMENSION 1: ACHIEVEMENT OF PAST TARGETS

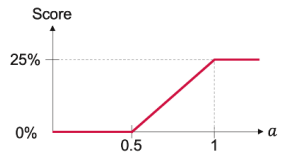
The company has achieved all previous emissions reduction targets with a target year in the past 10 years. If all past targets are indeed achieved, the highest score is obtained. If not, the achievement ratio a is computed as follows:

$$a = \frac{E(t_{ref}) - E(t_{horizon})}{E(t_{ref}) - T(t_{horizon})} \geq 0.5$$

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), and $E(t_{horizon})$ 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.

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

DIMENSION 2: EXISTING TARGET ACHIEVEMENT

The company is currently on track to meet an existing emissions reduction target, whereby the ratio between the remaining time period and the level missing to target achievement (Progress Ratio p) is not lower than 0.5:

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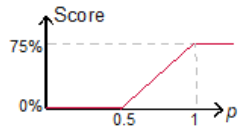
$$p = \frac{1 - \%time}{1 - \%complete} \geq 0.5$$

The highest score is attained if p is 1 or higher, and the lowest score (0%) is attained if p is 0.5 or lower. A proportional to the achievement is assigned for any value between 0.5 and 1.

Progress ratio	Score	
$p \geq 1$	75%	
$0.5 < p < 1$	$75\% \times (2 \times p - 1)$	
$p \leq 0.5$	0%	

AGGREGATE SCORE - DIMENSION 1:25%, DIMENSION 2:75%.

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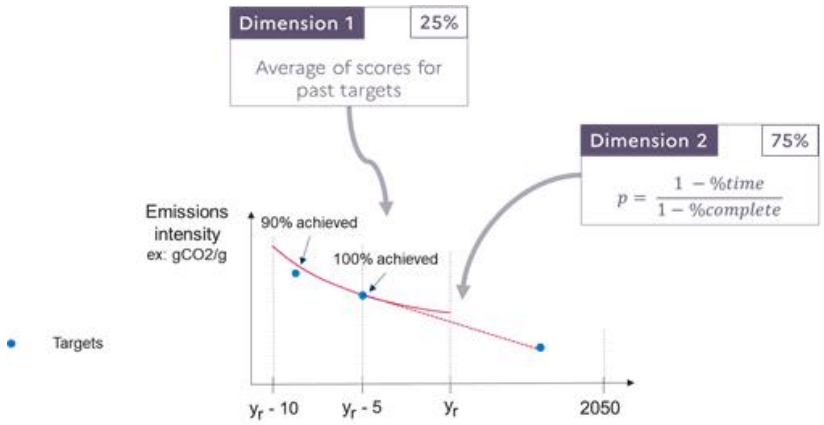

FIGURE 15: CALCULATION OF THE ACHIEVEMENT OF PREVIOUS TARGET INDICATOR

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:

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- 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	GL 1.3 ACHIEVEMENT OF PREVIOUS 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 GHG related targets in the past 10 years, as this means the company has lower credibility when setting ambitious science-based targets to reduce their GHG emissions. ♦ Dimension 2 uses a simple ratio sourced from existing CDP data points (C 3.1e) in order to compare targets. The threshold 0.5 was chosen as it allows companies some flexibility with respect to the implementation of the target, but it does have the ability to flag companies that are not on track towards achievement. When p is lower than 0.5, the company needs to achieve more than twice the reduction per unit of time than the target originally envisioned.

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MATERIAL INVESTMENT

If some assets represent less than 5% of the production in tonnes of GHG emissions relative to the overall GHG emissions or the overall glass production), to simplify the calculation, a cut off rule would be applied on this data collection related to these plants.

GL 2.1 PAST PERFORMANCE

DESCRIPTION & REQUIREMENT	GL 2.1 PAST PERFORMANCE
SHORT DESCRIPTION OF INDICATOR	Measure of the alignment of a company's past emissions intensity with its low-carbon benchmark pathway and past absolute emissions with the sectoral benchmark
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 relevant scope emissions and activity at reporting year and Y-5. ♦ CDP questions concerned are C0.2, C4.1 External sources of data used for the analysis of this indicator are: ♦ IEA ETP (12) – background scenario data (cf. chapter 6) ♦ SDA (13) – specific benchmark pathway definition ♦ IPCC (2006) (14) – Fuel emissions factors The benchmark indicators involved are:

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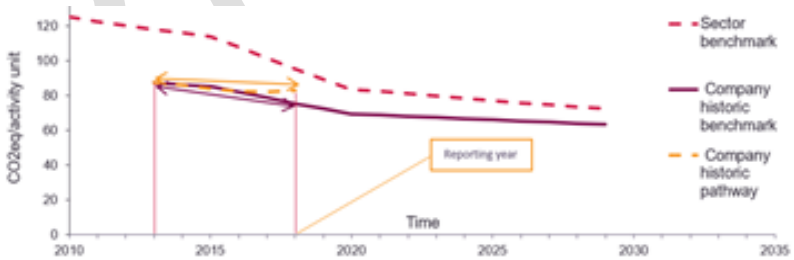
SEGMENT	TARGET TYPE (relevant scope)	PARAMETER	INTENSITY METRIC	BENCHMARK
Integrated and Glass melting actor	Scope 1+2 intensity	CB_{S12}	kgCO2e/tonne packed or melted glass	Adapted from IEA ETP–background scenario data (cf. chapter 6)
Product shaping only	Scope 1+2+ externalized glass melting emissions (from upstream scope 3 emissions) intensity	CB_{S12}	kgCO2e/tonne glass	Adapted from IEA ETP–background scenario data (cf. chapter 6)

HOW THE ANALYSIS WILL BE DONE

This indicator is assessed on two dimensions.

DIMENSION 1: TREND IN PAST EMISSIONS INTENSITY

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) emissions intensity (EI_c) from material investment trend gradient and the company's benchmark recent (reporting year minus 5 years) emission intensity (EI_B) trend gradient.



Trend in past emissions intensity from material investment between Y_{R-5} and Y_R

Trend of historic benchmark emission intensity between Y_{R-5} and Y_R

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FIGURE 16: COMPARISON OF TREND IN PAST EMISSIONS AND TREND IN COMPANY'S BENCHMARK

Past Action ratio (A_{past}) is calculated by dividing the company's emission intensity from material investment trend (between reporting year and reporting year minus 5 years) and the historic benchmark emission intensity (between reporting year and reporting year minus 5 years):

$$A_{past} = \frac{EI_C(Y_R) - EI_C(Y_{R-5})}{EI_B(Y_R) - EI_B(Y_{R-5})}$$

where $EI_C(Y_R)$ is the company emission intensity at reporting year, $EI_C(Y_{R-5})$ is the company emission intensity at reporting year minus 5, $EI_B(Y_R)$ is the historic benchmark emission intensity at reporting year and $EI_B(Y_{R-5})$ is the historic benchmark emission intensity at reporting year minus 5.

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

Conditions	Score
$Company's\ past\ trend > 0$ Increase in company emissions intensity	0%
$Company's\ past\ trend \leq 0\ and\ EI_C(Y_R) > EI_B(2050)$ Decrease in company emissions intensity but company's pathway did not go beyond the company's benchmark ambition	$A_{past} \times 100\%$
$Company's\ past\ trend < 0$ $A_{past} > 1$ Decrease in company emissions intensity and company's pathway equalled or exceeded the company's benchmark ambition	100%
$Company's\ past\ trend \leq 0\ and\ EI_C(Y_R) \leq EI_B(2050)$	

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No increase in company emissions intensity and company's emissions intensity was already below the company's benchmark ambition for 2050	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.

Relevant if the company has two types of assets: integrated or glass melting and product shaping. Assets of type 1 generate 30% of the relevant scope emissions and the asset of type 2 generate 70% of the emissions. Both types of assets are rated against a specific benchmark. The company gets two scores (1 and 2) for this indicator. Then, the final score is computed: final score= 30%*score 1 + 70%*score 2.

DIMENSION 2: ALIGNMENT OF PAST PERFORMANCE WITH SECTORAL CARBON BUDGET

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 17, multiplied by the company's activity during the corresponding years. Then, compare this area to the sectoral carbon budget during the same period.

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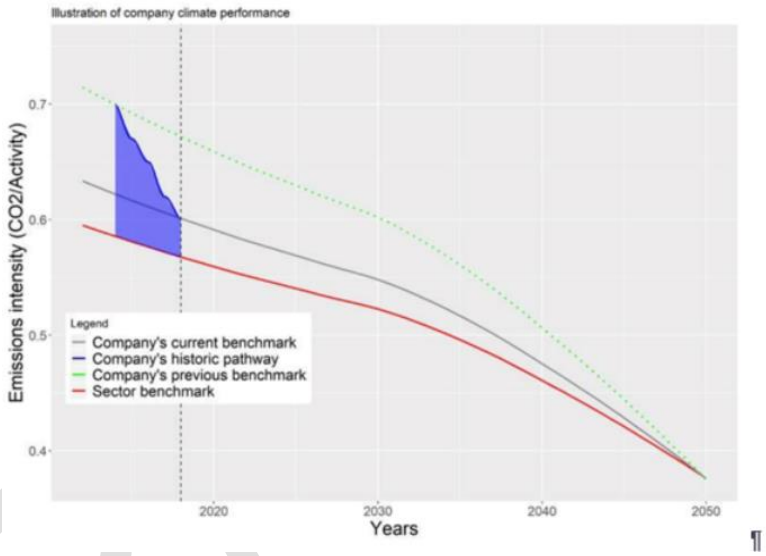


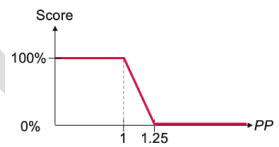
FIGURE 17: COMPARISON OF PAST PERFORMANCE AND CARBON BUDGET DEFINED BY SECTOR BENCHMARK

The past performance ratio PP is computed:

$$PP = \frac{\int_{y_r-5}^{y_r}(EI_C \times A_y)}{\int_{y_r-5}^{y_r}(EI_{SB} \times A_y)}$$

Where EI_C is the past emissions intensity of the company, EI_{SB} is the sectoral emissions intensity benchmark, and A_y is the activity.

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



AGGREGATE SCORE - DIMENSION 1:50%, DIMENSION 2:50%.

RATIONALE	**GL 2.1 PAST PERFORMANCE**
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 low-carbon benchmark pathway on the same historical period gives an indication of the scale of the change that should have been made within the company to bring it onto a low-carbon pathway. Recent emissions intensity performance indicates the company's progression towards the future emissions intensity necessary to decarbonize in-line with a low-carbon scenario.
- 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

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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

Comparing the trends gives a direct measure of the past action gap of the company. It was chosen for its relative simplicity in interpretation.

In former ACT methodologies, dimension 1 of the indicator compared the trend in past emissions to the trend of the future benchmark, comparing the past efforts of the company to what it will have to do in the near future. But as benchmarks are not linear - drops can occur when new mitigation technologies are released (e.g., massive implementation of CCS) -, it may be not relevant to compare different timeslots. Therefore, the trends are compared on the same timeslot (reporting year - 5 to reporting year).

767 **GL 2.2 LOCKED-IN EMISSIONS**

DESCRIPTION & REQUIREMENT	GL 2.2 LOCKED-IN EMISSIONS
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 emission intensity.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are:

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- Reporting year
- Company's target and target year
- For all existing and planned assets: Asset name, Geographic Location (country level), Plant type, Technology/Routes, Status, Total capacity (metric tonne), Production (metric tonne of packed or melted glass per plant), Emissions factor (kg CO2e/tonne of glass), Year of commissioning, Expected lifetime (years), Decommissioning or modernization year, if planned, Ownership stake (%), Attributable to reporting boundary (%)
- CDP questions concerned are C0.2, C4.1a, C4.1b, C7.3b, C7.6b. C6.5

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

- IEA ETP (12) – background scenario data
- SDA (13) – specific benchmark pathway definition
- IPCC (2006) (14) – Fuel emissions factors

The benchmark indicators involved are:

TARGET TYPE	PARAMETER	INTENSITY METRIC	BENCHMARK
Glass production emissions Scope 1+2)	CB_G	kgCO2e/tonne packed or melted glass	• IEA ETP – background scenario data • (cf. chapter 6)SDA – specific benchmark pathway definition

HOW THE ANALYSIS 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 [$LE_F(t)$], and the emissions budget entailed by the company's carbon budget [(t)] over the same period of time.

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$LE_F(t)$ 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.

$LE_F(t)$ is calculated as the company's locked-in carbon emissions, up until the chosen time period t, 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:

$$LE_F(t) = \int_{from\ the\ reporting\ year}^{y_r+15} A_G \times CA_G$$

Figure 18 illustrates locked-in emissions of one facility and of the whole company.

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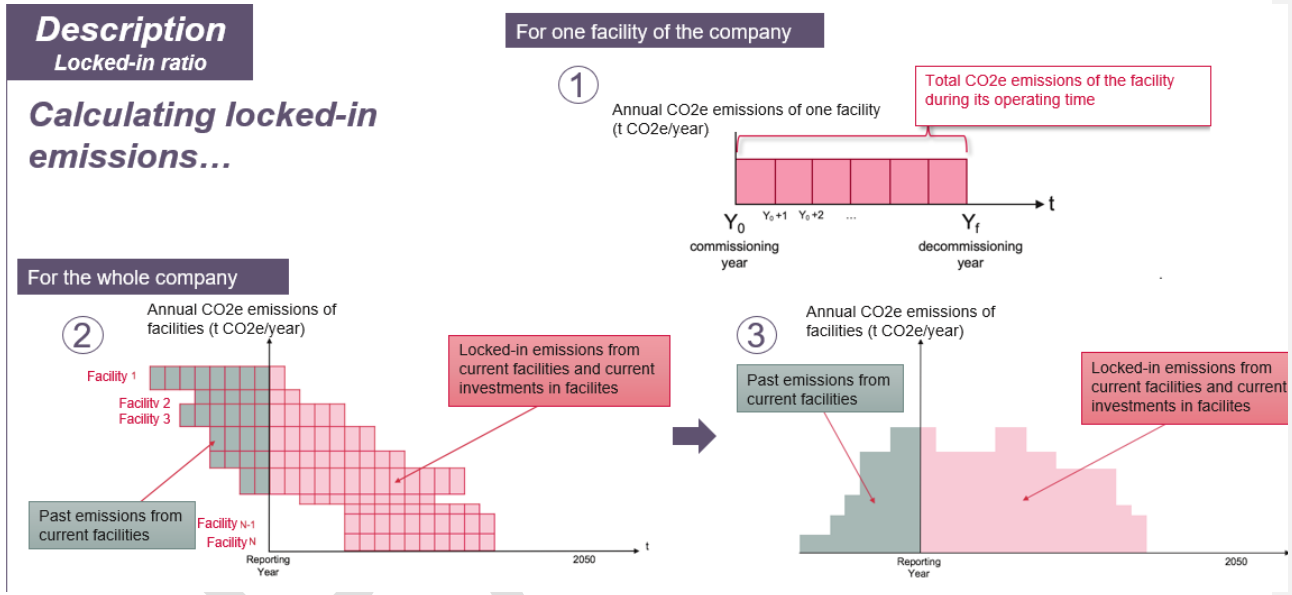

FIGURE 18 : COMPUTING LOCKED-IN EMISSIONS FROM FACILITY

$B(y_r + 15)$ 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:

$$B(t) = \int_{the\ reporting\ year}^{y_r+15} A_P * CB_{Scope12}$$

The company's benchmark is computed from the company's current emissions at reporting year and the level of carbon intensity defined by the sectoral benchmark presented in section 6. The carbon budget is illustrated in Figure 19 below.

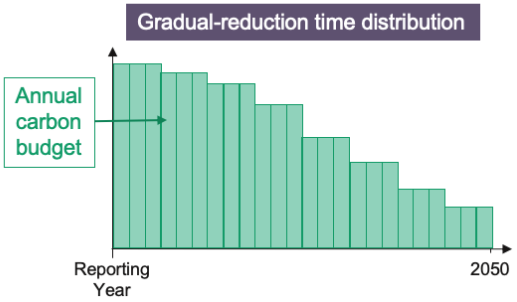

FIGURE 19 : CARBON BUDGET DERIVED FROM THE COMPANY'S BENCHMARK

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 20, and calculated as follows:

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

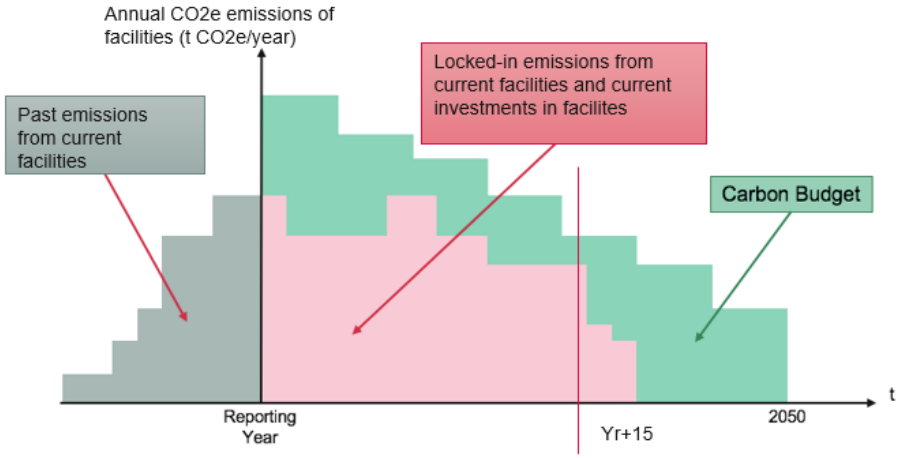

FIGURE 20 : ILLUSTRATION OF THE LOCKED-IN RATIO

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 21.

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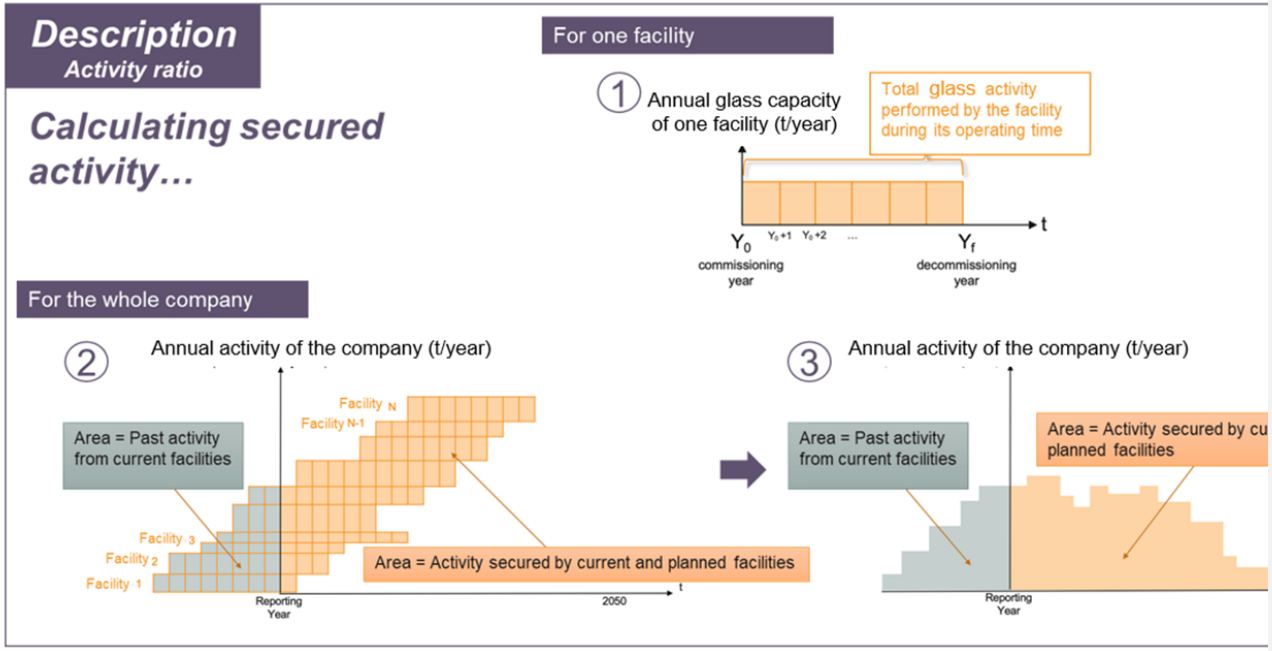

FIGURE 21 : SECURED ACTIVITY BY THE COMPANY

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 (see section 6). The company's projected activity is illustrated in Figure 22.

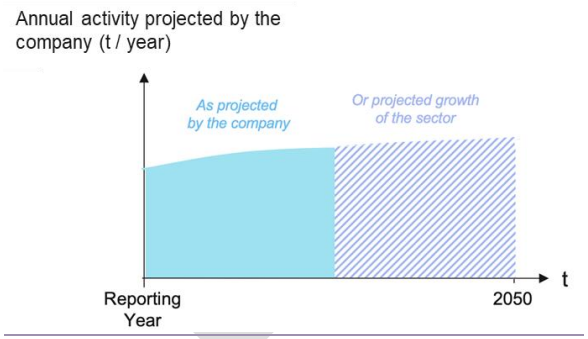

FIGURE 22: PROJECTED ACTIVITY

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 23.

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

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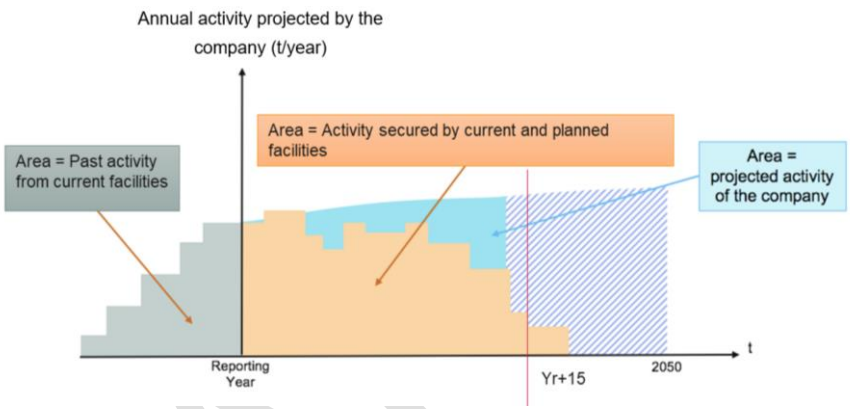

FIGURE 23 : SECURED ACTIVITY RATIO WITH PROJECTED ACTIVITY IN BLUE

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%.

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

RATIONALE	GL 2.2 LOCKED-IN EMISSIONS
RATIONALE OF THE INDICATOR	RELEVANCE 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 and 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, Glass plants not decommissioned could be more modernized with new important equipment (furnaces), so the lifetime of the asset is assumed to be the average lifetime of the process equipment which could be between 8 and 20 years.

Hence, the locked-in emissions calculated are the locked-in emissions of committed (existing and pipeline) 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.

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Unlike the ‘gap’ and ‘trend’ comparisons done in all other quantitative indicators, this indicator compares two areas: 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 to reporting year + 15 years, 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 on 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 L_G AND B_G:

Where data on plant emissions intensity is unavailable at the asset level:

- If the asset is active default factors are applied and are the values published in 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Mineral industry Table 2.6 for each type of glass product. Where plant lifetime information is unavailable, the median of known lifetimes in Glass sector will be applied.
- If the asset is not active (under construction, rehabilitation, …) default factors are applied and are the average of all existing plants of the company. Where plant lifetime information is unavailable, the median of known lifetimes in Glass sector will be applied.

The rationale for these different calculations is the level of efforts needed to collect plant emissions intensity data in each case. The goal Is to encourage companies to collect relevant data for all of their active plants by using a disadvantageous default factor.

GL 2.3 TREND IN FUTURE EMISSIONS INTENSITY

DESCRIPTION & REQUIREMENT	GL 2.3 TREND IN FUTURE EMISSIONS INTENSITY

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SHORT DESCRIPTION OF INDICATOR

Measure of the alignment of a company's future emissions intensity of assets with its low-carbon benchmark pathway.

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 relevant scope emissions at reporting year and Y+5
- CDP questions concerned are C0.2, C4.1c

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

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

- IEA ETP [10]– background scenario data (cf. chapter 6)
- SDA [11] – specific benchmark pathway definition
- IPCC (2006) [13] – Fuel emissions factors

The benchmark indicators involved are:

SEGMENT	TARGET TYPE (relevant scope)	PARAMETER	INTENSITY METRIC	BENCHMARK
Integrated and Glass melting actor	Scope 1+2 intensity	CB_{S12}	kgCO2e/tonne packed or melted glass	Adapted from IEA ETP– background scenario data (cf. chapter 6)

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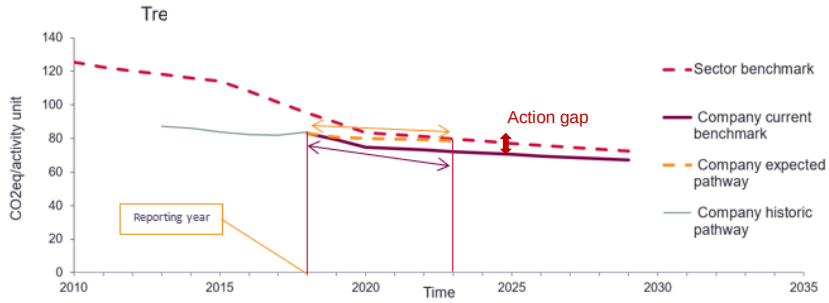
Product shaping only	Scope 1+2+ externalized glass melting emissions (from upstream scope 3 emissions) intensity	CB_{S12}	kgCO2e/tonne glass	Adapted from IEA ETP– background scenario data (cf. chapter 6)

HOW THE ANALYSIS WILL BE DONE

CALCULATION OF THE SCORE:

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 intensity from material investment trend gradient and the company's future benchmark (reporting year plus 5 year) emission intensity trend gradient.



Trend in future emissions intensity from material investment between Y_R and Y_{R+5}

Trend of current benchmark emission intensity between Y_R and Y_{R+5}

FIGURE 24: COMPARISON OF TREND IN FUTURE EMISSIONS AND TREND IN COMPANY'S BENCHMARK

CALCULATION OF SCORE:

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

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

where $EI_c(Y_R)$ is the company emission intensity at reporting year, $EI_c(Y_{R+5})$is the company emission intensity at reporting year plus 5 years, $EI_B(Y_R)$ is the benchmark emission intensity at reporting year and $EI_B(Y_{R+5})$ is the benchmark emission intensity 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 (see Figure 24).

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 intensity	0%
$Company's\ future\ trend \leq 0\ and\ EI_C(Y_R) > EI_B(2050)$ $0 \leq A_{future} \leq 1$ Decrease in company emissions intensity but company's pathway does not go beyond the company's benchmark ambition	$A_{future} \times 100\%$
$Company's\ future\ trend < 0$	

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$A_{future} > 1$ Decrease in company emissions intensity and company's pathway equals or exceeds the company's benchmark ambition	100%
$Company's\ future\ trend \leq 0\ and\ EI_C(Y_R) \leq EI_B(2050)$ No increase in company emissions intensity and company's emissions intensity is already below the company's benchmark ambition for 2050	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.

For instance, a company has two types of assets. Assets of type 1 generate 30% of the direct emissions and the asset of type 2 generate 70% of the emissions. Both types of assets are rated against a specific benchmark. The company gets two scores (1 and 2) for this indicator. Then, the final score is computed: final score= 30%*score 1 + 70%*score 2.

RATIONALE

GL 2.3 TREND IN FUTURE EMISSIONS INTENSITY

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

Trends in future emissions intensity 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 intensity 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 intensity, forms part of a holistic view of company emissions performance in the past, present, and future.

SCORING RATIONALE

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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.

770 **GL 2.4 ALTERNATIVE FUELS AND ENERGY MIX DECARBONISATION**

DESCRIPTION & REQUIREMENT	**GL 2.4 ALTERNATIVE FUELS AND ENERGY MIX DECARBONISATION** The indicator below should be tested during the sector roadtest to confirm if they are robust enough.
SHORT DESCRIPTION OF INDICATOR	This indicator is a measure of the company's energy mix decarbonisation actions at the reporting year. The indicator will evaluate the implementation of global recommendations to decarbonize the assets consuming energy with the share of alternative fuels and low-carbon electricity used at reporting year.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Reporting year ♦ % of alternative fuels and electricity: Alternative fuels covers imported heat, bioenergy and waste, other renewables and energy for low-carbon hydrogen and electricity used (CCS/CCU excluded). Use of oxygen could also be included. ♦ % of low-carbon electricity consumed (CCS/CCU excluded) ♦ Certificates of "premium" guarantees of origin, PPA, REC… ♦ CDP questions concerned are C0.2, C8.2a, 8.2c, 8.2e

The benchmark indicators involved are:

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- ETP 2020, IEA, fig 3.15 Final energy demand by fuel shares for total industry and selected sub-sectors in the SDS, 2019-70: “Alternative fuels covers imported heat, bioenergy and waste, other renewables and energy for low-carbon hydrogen and electricity: 31% in 2019 / 33% in 2030 / 41% in 2040 et 51% in 2050. (Use of oxygen could also be included).”
- IEA World Energy Outlook 2019 for SDS and ETP 2020: “For low-carbon electricity, the benchmark is based on a combined approach which gives for low-carbon electricity (renewables and coal / gas with CCUS without nuclear) at global level: 30% for 2019, 57% for 2030 and 77% for 2050.”

Commenté [CB1]: To be confirmed by Edouard with alignment with CDP questionnaire (question during TWG5)

HOW THE ANALYSIS WILL BE DONE

A company assessed by the ACT methodology could:

- Have low-carbon on site electricity generation - not possible for every company, depending on the area available (territorial constraints and environment constraints- specific weather). The EU taxonomy (2) document looks at the performance of the technologies used to produce electricity and whether these technologies are considered as low carbon.
- Purchase electricity from the grid - possible for all companies. This is where guarantees of origin could be involved.

CALCULATION OF THE SCORE:

The maturity matrix used for the assessment is the following:

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Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub-score
What is the share of alternative fuels and electricity used by the company?	Less than 20%	Between 20% and 30%	Between 31% and 40%	Between 41% and 50%	Over 50%	50%
What is the share of low-carbon electricity used by the company?	Less than 30% of electricity is low-carbon	30% of electricity is low-carbon (and at least 30% of on-site generation electricity is low-carbon as defined by the EU taxonomy for on-site generation)	45% of electricity is low-carbon (and at least 45% of on-site generation electricity is low-carbon as defined by the EU taxonomy for on-site generation)	60% of electricity is low-carbon (and at least 60% of on-site generation electricity is low-carbon as defined by the EU taxonomy for on-site generation)	At least 80% of electricity is low-carbon (and at least 80% of on-site generation electricity is low-carbon as defined by the EU taxonomy for on-site generation)	25%
Company's policy 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	25%

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RATIONALE	GL 2.4 ALTERNATIVE FUELS AND ENERGY MIX DECARBONISATION
RATIONALE OF THE INDICATOR	This indicator rewards the alternative fuels and low-carbon electricity switching path. It also valorises the fact that the glass actors are part of a territorial cohesion. The treatment of waste as the biomass use, if supervised by the policy, with applying the best practices, is one step in circular economy. Specifically on the choice of policy regarding green electricity, it was noted the purchasing electricity from the grid is easier than setting up an on-site electricity generation with several intermediate steps (GO, PPA, …). The actions of developing on site generation which is also linked with more self-sufficiency (physical risks link to climate change adaptation) are rewarded

GL 2.5 RECYCLED CONTENT INTEGRATION STRATEGY

DESCRIPTION & REQUIREMENT	GL 2.5 RECYCLED CONTENT INTEGRATION STRATEGY The indicator below should be tested during the sector roadtest to confirm if they are robust enough.
SHORT DESCRIPTION OF INDICATOR	The company demonstrates that it has a comprehensive strategy at the corporate level to integrate within its own operations.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ What are the commitments (target, timescale)? What is the applied method? How is the strategy's monitoring done? How is the transportation managed? ♦ CDP questions concerned are C4.2b, C4.3b
HOW THE ANALYSIS WILL BE DONE	All external cullet is covered: pre-consumer and post-consumer. The possibility to include other secondary raw materials in this indicator will be evaluated during the roadtest. The analyst evaluates the description and evidence of the recycled content integration strategy 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 is allocated for elements indicating a higher level of maturity.

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The matrix is provided below:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned	sub score
Commitments	No defined commitments on a defined timescale		Timescale for implementation is mentioned but no clear target, or target is mentioned but no clear timescale		Strategy includes both a clear quantitative target and includes a timescale for its implementation	15%
Transition timescale	Covers only short-term (< 3 years)	Covers only medium term (RY+ 5 years)	Should cover the short, medium, and long term. From now or near future (RY + 5 years), until at least (RY + 10 years) and preferably beyond (RY+ 15 years)	Covers the short, medium, and long term. From now until at least (RY+20 years)	Covers the short, medium, and long term. From now and beyond 2050	15%
Method	No defined strategy	Strategy implementation focuses on the largest sources of cullet but has no robust method of quantification and verification for this implementation	Company quantifies the value of cullet through a costing exercise but does not have clear prioritization or verification process.	Quantifies the value of cullet through a verifiable costing exercise and is linked to circular economy business models	Company has costed the value of cullet, links this to circular economy in the core business strategy and has applied a waste hierarchy approach to increase its integration.	25%
Monitoring	No clear monitoring approach in place	Responsibility at high level in the organisation, but no clear monitoring approach in place.	Monitoring systems in place for own operations to track progress but not for the parts of the value chain outside of control boundary	Monitoring systems in place for own operations and the value chain elements under the strategy to track progress	Includes next practice monitoring, and it is clear that there is an organizational learning process in place to continuously improve the strategy after interim evaluation of results	20%

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Coverage of the cullet integration strategy	Less than 10% of the glass produced by company is covered. Only pre-consumer cullet is covered	Less than 10% of the glass produced by company is covered. Actions concerns pre-consumer and post-consumer	At least 50% of the glass produced by company is covered	At least 50% of the glass produced by company is covered. Actions concerns pre-consumer and post-consumer	At least 90% of the glass produced by company is covered. Actions concerns pre-consumer and post-consumer	20%
Action to reduce the carbon emissions and increase efficiency linked to transport	There are no reported actions	Quantification of carbon emissions and efficiency of transports used	Actions have been taken to reduce by 20% the carbon emissions and increase the use of low-carbon vehicles and/or increase the use of local suppliers by 20%	Actions have been taken to reduce of 50% the carbon emissions and increase the use of low-carbon vehicles and/or increase the use of local suppliers by 50%	Use of low-carbon transportation and local suppliers only	5%

RATIONALE	**GL 2.5 RECYCLED CONTENT INTEGRATION STRATEGY**
RATIONALE OF THE INDICATOR	**RELEVANCE OF THE INDICATOR:**

The integration of external cullet allows to reduce the raw material extraction and reduce the energy for melting and could also increase the lifetime of furnaces. Cullet rates depending on the "quality" needed for the finished product and the cullet availability (geographical zones):

- For hollow glass and glass wool: average of 60% or more;
- For flat glass: average of 30%.

Other initiative could be implemented as increasing the reuse of products. The environmental benefit of each solution is very dependant of the geographical zone.

That are the main reason for proposing a qualitative indicator, which could be applicable to all companies in a fair way.

The post-consumer cullet is the most difficult one to integrate because he could be collected a long time after the use. The coverage of the cullet integration strategy reflects a part of this difficulty. In addition, indicator in Module 9: Business Model is looking at the collection of the cullet flow to improve the circularity of the glass.

The compatibility between types of glass and cullet is not linear too according to the document: End-of-Waste Criteria for Glass Cullet: Technical Proposals, JRC, 2011.

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SCORING RATIONALE:

This indicator is important to follow the management of the cullet. This indicator helps to valorise the circularity of the product and the decarbonization of the facilities.

INTANGIBLE INVESTMENT

The indicators below should be tested during the sector roadtest to confirm if they are robust enough.

MODULE RATIONALE

No benchmark concerning costs/investment in R&D in climate change mitigation technologies for this indicator is currently available for the glass industry. This module could be key to reach the objective of 2050 benchmark regarding the investment and the development that should be done concerning equipment and especially furnaces. Non-mature technologies could be assessed with a company exercise describing on which technologies investments are made as presented in the Figure 25:

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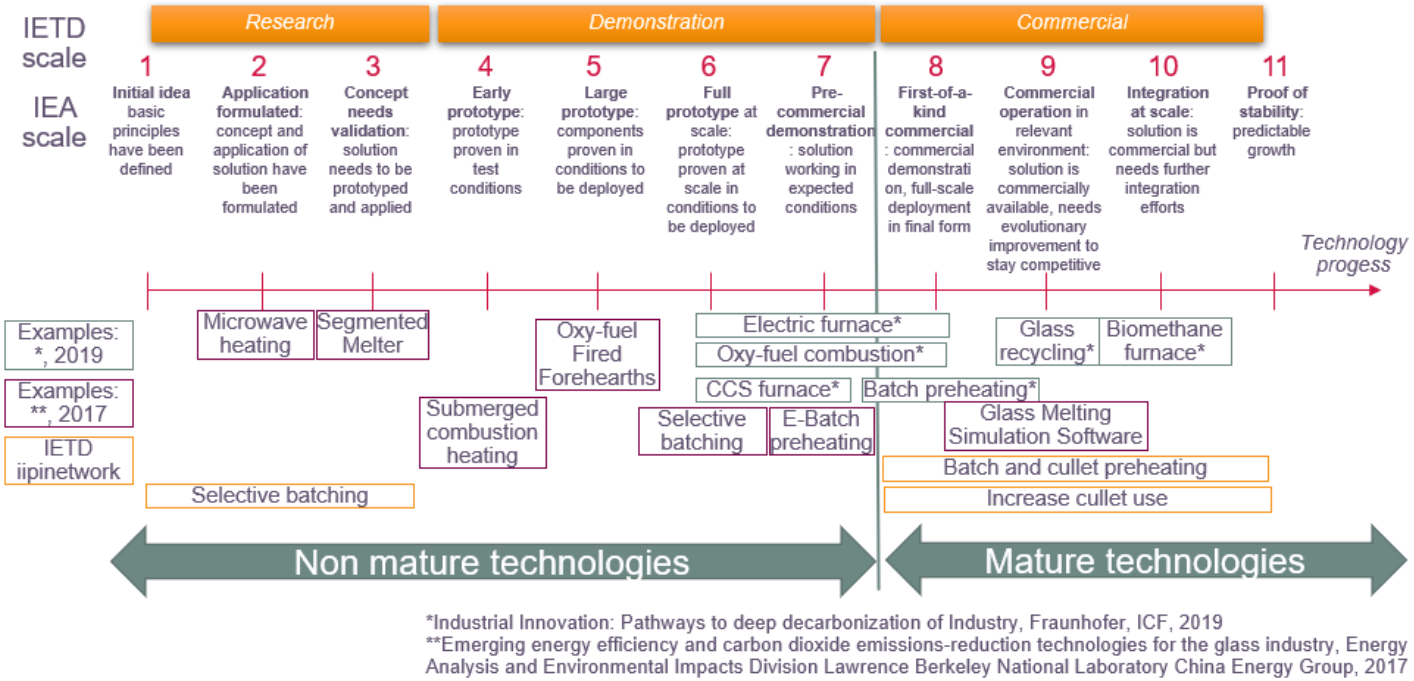

FIGURE 25: EXEMPLES OF MATURE AND NON-MATURE TECHNOLOGIES CLASSIFICATION (ACCORDING TO SOURCES AT THE BOTTOM OF THE FIGURE)

The level of maturity for each technology could be different depending on the sub-sector (flat glass, hollow glass, fiber glass) and also the size of the furnace. Patenting activity could also help them to distinguish mature and non-mature technologies.

GL 3.1 R&D IN CLIMATE CHANGE MITIGATION TECHNOLOGIES

DESCRIPTION & REQUIREMENTS	GL 3.1 R&D IN CLIMATE CHANGE MITIGATION TECHNOLOGIES
SHORT DESCRIPTION OF INDICATOR	A measure of the ratio of R&D costs/investments in low-carbon technologies. The indicator identifies the ratio between the company's R&D investment in low-carbon 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 technologies of the company. ♦ Total R&D costs/investments of the company CDP questions concerned are C3.3, C4.3a, C4.3c External sources of data used for the analysis of this indicator are: ♦ Industrial Efficiency Technology Database: http://www.iipinetwork.org/wp-content/Ietd/content/glass.html ♦ GGSD Forum (15) ♦ IEA - https://iea.blob.core.windows.net/assets/355d9b26-b38c-476c-b9fa-0afa34742800/iea_technology-guide-poster.pdf ♦ https://eta-publications.lbl.gov/sites/default/files/lbl_glass_final.pdf ♦ Glass Alliance for Europe: Common Challenge webpage: https://www.glassallianceeurope.eu/en/common-challenges Maturity of technology – Technology Readiness Levels (TRLs): ♦ IEA website: ETP Clean Energy Technology Guide
HOW THE ANALYSIS WILL BE DONE	**R&D INVESTMENT SHARE** The assessment is based on the ratio of the company's 'annual R&D expenditure on low-carbon technologies' to the company's 'total annual capital expenditure in R&D'. **DEFINING 'LOW-CARBON TECHNOLOGIES':**

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Relevant sectoral roadmaps should be used to define a list of low-carbon technologies for the sector. It may include technologies to decarbonise the production assets and improvements of sold product carbon performance. If relevant, the technologies should be classified as mature and non-mature (TRL ≤ 8).

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	sub score
What is the share of R&D costs/investments in low-carbon 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.	50%
What is the share of R&D costs in non-mature technologies within the total R&D in climate change mitigation technologies?	Below 20%	Between 21% and 35%	Between 36 % and 50%	Between 51% and 65%	Above 65%	50%

RATIONALE **GL 3.1 R&D IN CLIMATE CHANGE MITIGATION TECHNOLOGIES**

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

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

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- 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 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 benchmark is available for this sector. Therefore, thresholds have been defined accordingly.

DEFINING R&D:

Research and development (R&D): Refer to the activities of the companies undertake to innovate and introduce new products and services. It is often the first stage in the development process. Investment in R&D is a type of operating expense associated with the research and development of a company's goods or services (definition from CDP guidance).

Research and experimental development (R&D) comprise creative work undertaken on a systematic basis to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. The term R&D covers three activities (definitions from OECD website, 2012):

- Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any application or use in view.
- Applied research is original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.
- Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products, or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

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R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

DEFINING THE R&D SCOPE:

The indicator focuses on mature and non-mature technologies or construction and organizational methodologies that mitigate climate change.

Climate mitigation technologies for the Glass sector may include:

- Waste heat recovery
- Improving energy efficiency (eg: Enhanced batch preparation, Batch and cullet preheating, More energy efficient melting technologies, Enhanced process (controls), Reduction of heat losses…)
- Switching to alternative fuels (low-carbon: biogas, low-carbon hydrogen, biomass, e-gas) low-carbon) and low-carbon electricity and or oxy-fuel combustion
- Carbon capture and storage (CCS)
- Carbon capture, utilization, and storage (CCUS)
- Product efficiency that reduces glass demands
- Improvements of process to reduce process losses
- Development of low-carbon products
- Recycled materiel rate integration
- Increasing of recycling
- Substitution to lower carbon raw material
- Other relevant technologies for the sector

R&D expenditures should cover development of concepts and ideas and development of pilot projects. A first environmental balance should demonstrate that the solution reduces the overall CO2 emissions on the life cycle and does not make pollution transfers between life cycle stages impact categories or services (functional unit).

DEFINING 'MITIGATION R&D':

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The ‘mitigation R&D’ is defined by the categorization employed by IEA.

DEFINING ‘NON-MATURE R&D’:

A Technology Readiness Level (TRL) should be used to assess the maturity of a technology. Higher scoring levels of this indicator exclude research in technologies that are already considered mature in terms of market penetration, to incentivise a focus on those technologies that have a higher need for R&D investment, in order to break through technical barriers and reduce the levelized costs of deploying these technologies.

To formalize this distinction in the analysis, the company is asked for a detailed breakdown of R&D expenditure in Section 3 of the data request. Since defining what type of R&D is ‘non-mature’ is theoretically difficult, the classification is inversed, and done based on the principle of exclusion. This methodology excludes only those low-carbon technologies that are considered mature in terms of market position and levelized cost.

The status of the technologies helps to categorize technologies into mature or non-mature according to the table below:

TABLE 9: CATEGORIZATION OF MATURE AND NON-MATURE TECHNOLOGIES

Technology Readiness Level (TRL) from IEA	**IEA explaining acronyms**	
1.	Initial idea: basic principles have been defined	Non mature technologies
2.	Application formulated: concept and application of solution have been formulated	
3.	Concept needs validation: solution needs to be prototyped and applied	
4.	Early prototype: prototype proven in test conditions	
5.	Large prototype: components proven in conditions to be deployed	
6.	Full prototype at scale: prototype proven at scale in conditions to be deployed	
7.	Pre-commercial demonstration: solution working in expected conditions	
8.	First-of-a-kind commercial: commercial demonstration, full-scale deployment in final form	Mature technologies
9.	Commercial operation in relevant environment: solution is commercially available, needs evolutionary improvement to stay competitive	
10.	Integration at scale: solution is commercial but needs further integration efforts	
11.	Proof of stability: predictable growth	

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IIPI network explaining acronyms	TRL	
Research	1-3	Non mature technologies
Demonstration	4-7	
Commercial	8-11	Mature technologies

GL 3.2 COMPANY LOW CARBON PATENTING ACTIVITY

DESCRIPTION & REQUIREMENTS	GL 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 and compares it to the sectoral benchmark in the form of a maturity matrix.
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 ♦ No CDP question is concerned.
HOW THE ANALYSIS 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. **DEFINING CLIMATE CHANGE MITIGATION TECHNOLOGIES PATENTS:**

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The indicator focuses on patents that mitigate climate change. The European Patent Office (EPO) [2] and the US Patent and Trademark Office (USPTO)[3] 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:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned
What is the share of patents (number of patents) in climate change mitigation technologies 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

RATIONALE

GL 3.2 COMPANY LOW CARBON PATENTING ACTIVITY

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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 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 the 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 TRACK RECORD** 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

GL 4.1 PAST PERFORMANCE INCLUDING PURCHASED GLASS PRODUCTION ASSETS

DESCRIPTION & REQUIREMENT	GL 4.1 PAST PERFORMANCE INCLUDING PURCHASED GLASS PRODUCTION ASSETS
SHORT DESCRIPTION OF INDICATOR	A measure of the alignment of the company's past sold or purchased product / service emissions intensity 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.

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Data requirements	The relevant data for this indicator are: ♦ Sold or purchased product / service emission intensity and activity at reporting year and Y-5 CDP questions concerned are C0.2, C4.1
How the analysis will be done	The analysis is based on the Past Action ratio (Apast) which represents the ratio between the company's recent (reporting year minus 5 years) emissions intensity from product performance trend gradient and the company's benchmark recent (reporting year minus 5 years) emission intensity from product performance trend gradient. Same computation as indicator 2.1 Past performance / dimension 1
RATIONALE	**GL 4.1 PAST PERFORMANCE INCLUDING PURCHASED GLASS PRODUCTION ASSETS**
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 emissions intensity 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 emissions intensity and 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 past action gap of the company. It was chosen for its relative simplicity in interpretation. In former ACT methodologies, this indicator compared the trend in past emissions to the trend of the future benchmark, comparing the past efforts of the company to what it will have to do in the near future. However, as benchmarks are not linear - drops can occur when breakthrough

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technologies / products are released -, it may be not relevant to compare different timeslots. Therefore, the trends are compared on the same timeslot (reporting year - 5 to reporting year).

For “product shaping” actors, as the main impact of the product comes from the Glass they purchased from Glassmaking actors, this trend analysis is conducted to compare current data of the company to the past data and improvements that have been made since the past data.

789 **GL 4.2 PURCHASED PRODUCT INTERVENTIONS**

DESCRIPTION & REQUIREMENT	GL 4.2 PURCHASED PRODUCT INTERVENTIONS
SHORT DESCRIPTION OF INDICATOR	An analysis of the company’s reporting of mature interventions to reduce GHG emissions for purchased product determined as being high GHG impact as glass, soda ash (natural or synthetic), silica, limestone, chemicals, hydrogen extraction, fuel extraction … relative to the other categories of products relevant to the company. This indicator also covers glass purchased for shaping actors.

DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are:
	• Quantity of product purchased, CO2 emissions collected from these specific suppliers
	• CDP questions concerned are C4.3b, C6.5
	External sources of data used for the analysis of this indicator are:
	• Online and press news
	• EU taxonomy for transport (16) – low-carbon vehicles
	• Emissions factor for Glass, soda ash, silica, limestone, chemicals, …
	  ○ https://www.epa.gov/sites/production/files/2015-02/documents/tsd_glass_epa_1-22-09.pdf
	  ○ https://www.ipcc-nggip.iges.or.jp/EFDB/find_ef_ft.php
	  ○ LCA database

HOW THE ANALYSIS WILL BE DONE	To be ready for the transition to a low-carbon economy, Glass companies – in particular those who purchase resources that could significantly increase their carbon footprint, such as glass, soda ash, silica, limestone, chemicals, hydrogen extraction, fuel extraction - need to plan and carry out “interventions” within the value chain in order to exercise their market position and influence to reduce GHG emissions. The analyst

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will look at the significant share of CO2 emissions of product purchased. The hotspots are the high emitting products of all products purchased, for example, glass purchased for product shapers.

For all its activity, the company identifies interventions that determine the most ambitious impacts achievable and highlights the GHG hotspots in accordance with best practices.

The analyst compares the interventions reported by the company with this benchmark and against other interventions reported by sectoral practices, whereby the analyst assigns a 'maturity scoring' to the reported interventions.

Several measures are combined to assign a score to the intervention. These measures are:

- Extent size of the intervention
- Intervention maturity scoring
- Level of ambition of the intervention
- Future emissions assessment
- Transport of material

The maturity matrix used for the assessment is the following:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub-score
Extent size of the intervention	Intervention involves suppliers that together represent a marginal coverage of the hotspot (less than 40%)		Intervention involves suppliers that together represent a significant coverage of the hotspot (between 40 and 80%)		Intervention involves products that together represent the major coverage of the hotspot (more than 80%)	20%

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	Intervention maturity scoring	Intervention is common practice and not backed with success factors like planning, adequate resources, clear goals, performance tracking and measures of success.		Intervention is an advanced practice and backed with some success factors like planning, adequate resources, clear goals, performance tracking, and measures of success.		Intervention is cutting-edge innovation practice and backed with all relevant success factors like planning, adequate resources, clear goals, performance tracking and measures of success.	20%
	The company shall report on the level of ambition of the intervention	Incremental improvement with quantified actions		Improvements to achieve more than 20% of GHG reduction of the purchased product before RY + 15 years		Breakthrough innovation to achieve more than 38% of the GHG reduction of the purchased product before 2050	20%
	Future CO2 emissions intensity linked to the purchase	No knowledge of purchased product carbon intensity	No robust carbon intensity data on purchased product (i.e., not certified by a third party)	Robust CO2 data on purchased product certified by third party	Robust CO2 data on purchased product certified by third party Future CO2 emissions intensity of suppliers is forecasted but the intensity is not low-carbon aligned	Robust CO2 data on purchased product certified by third party Future CO2 emissions intensity of suppliers is forecasted, and the intensity is low-carbon aligned	35%

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Actions linked to the product purchased transport	There are no reported actions	Quantification of carbon emissions and efficiency of transports used	Actions have been taken to reduce of 20% the carbon emissions and increase the use of low carbon vehicles of 20% Use of local suppliers	Actions have been taken to reduce of 50% the carbon emissions and increase the use of low carbon vehicles of 50% Use of local suppliers	Use of low-carbon transportation and local suppliers only	5%

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.

SIGNIFICANCE AND EXTENT OF THE INTERVENTION:

Whether the intervention is large or small in scale affects its overall level of impact on GHG emissions. Large-scale interventions receive more points (e.g., significant interventions covering a high percentage of soda ash purchased…)

This assesses how advanced the intervention is relative to current practice, and other elements that can ensure its success like clear goals and measures of success, use of supporting technology, use of certification and verification.

INTERVENTION MATURITY SCORING:

This assesses how advanced the intervention is relative to current practice, and other elements that can ensure its success like clear goals and measures of success, use of supporting technology, use of certification and verification.

LEVEL OF AMBITION:

The company shall report on the level of ambition of the intervention. The first level is an incremental improvement (e.g., GHG reduction). The second level consists of a new development (e.g., new product development, eco design products or installation of a technology to achieve more than 20% of GHG reduction of the purchased soda ash). The third level is a breakthrough innovation (e.g., new business model development or installation of a technology to achieve more than 38% of GHG reduction of the purchased soda ash on the next 15 years).

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	The percentages in the matrix have been setting in accordance with the absolute-based approach of SBTI. This method requires all companies to reduce their own emissions by the same percentage of absolute emission reductions as required for a given scenario (e.g., globally or for a sector). When referring to this method at a global level, the SBTi is currently using the IPCC Special Report on Global Warming of 1.5°C (SR15) for two pathways, a well-below 2°C and a 1.5°C trajectory. This equates to at least a 2.5% absolute reduction per year for well-below 2°C alignment, or a 4.2% absolute reduction per year for 1.5°C alignment. (https://sciencebasedtargets.org/methods/). **FUTURE EMISSIONS ASSESSMENT:** This indicator assesses the communication between the company and the purchased product supplier. This indicator is looking at the data reported, concerning the carbon intensity data and the future CO2 emissions intensity. Robust and certifiable data are more appreciated. **TRANSPORT OF PRODUCT PURCHASED:** Even if the transportation is a low CO_2 hotspot, it is possible to make some actions to improve this step (frequency and mode).
RATIONALE	**GL 4.2 PURCHASED PRODUCT INTERVENTIONS**
RATIONALE OF THE INDICATOR	**RELEVANCE OF THE INDICATOR:** The raw materials purchased are very different according to the type of glass manufactured and so the relative GHG emissions are different too. For a typical recipe for flat glass (Raw materials for flat glass RER, uncoated from Ecoinvent 3.7), soda ash and silica sand represent almost 90% of GHG emissions of the product. For a typical recipe for packaging glass (Raw materials for white packaging glass RER from ecoinvent 3.7), soda ash, chemicals inorganics and silica sand represent 76% of the GHG emissions. For shaping actors, the glass purchased is a very important indicator to reduce the emissions of the sector. A key issue with the interventions approach is that if interventions have no measurable impact on GHG emissions, they are effectively “greenwashing”. However, we recognise that, when attempting to influence GHG emissions outside of direct operations, measurement may be difficult. Barriers to measurement should not be barriers to action, therefore the analysis will consider interventions where the GHG emissions mitigation has not been measured. Nonetheless, companies should describe the rationale for emissions reduction connected to the intervention so that it is clear this potential exists.

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The reporting should also include, where possible, enough detail on mitigation potential, and the scale of impact expected, to distinguish between interventions that could be considered greenwash and those with a material, negative climate change mitigation impact.

MANAGEMENT

GL 5.1 OVERSIGHT OF CLIMATE CHANGE ISSUES

DESCRIPTION & REQUIREMENT	GL 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 questions comprising the information request that are relevant to this indicator are: ♦ Details on where the highest level of direct responsibility for climate change within the organization is. ♦ 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 questions concerned are C1.1, C1.1a, C1.2
HOW THE ANALYSIS WILL BE DONE	The benchmark case is that climate change is managed within the highest decision-making structure within the company. The company situation is compared to the benchmark case, if it is similar then points are awarded. The position at which climate change is managed within the company structure is determined from the company data submission and accompanying evidence. The maturity matrix used for the assessment is the following:

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Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned
Position of individual(s)/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

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.

RATIONALE	GL 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 Glass sector, a change in strategy and potentially business model will be required and this cannot be achieved at lower levels within an organisation. 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 the low-carbon transition. Changes in strategic direction are necessarily future-oriented, which fits with this principle of the ACT project. Management oversight of climate change is considered good practice.

GL 5.2 CLIMATE CHANGE OVERSIGHT CAPABILITY

DESCRIPTION & REQUIREMENT	GL 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 consumption drivers that can disrupt current business.

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DATA REQUIREMENTS

The relevant data for this indicator are:

- Environmental policy and details regarding governance
- The reporter shall identify the 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 questions concerned are C1.2a

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

HOW THE ANALYSIS WILL BE DONE

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

The analyst determines if the company has expertise as evidenced through a named expert biography outlining capabilities. A cross check is 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.

The maturity matrix used for the assessment is the following:

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned
The presence of expertise on relevant topics to climate change and low-carbon transition within the individual or committee with overall CC responsibility	The employee/committee does not meet the following characteristics: - academic background/professional training related to energy & climate change, - former experiences on climate issues, - technical knowledge 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 knowledge 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 knowledge 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 knowledge 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 knowledge on climate (based on statements, published reports, …). Expertise is completely integrated in decision-making

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Elements of biography outlining expertise might be:

- Achievement of a course with a focus on climate change
- Training in climate change subjects by a certified organism
- Previous experience in an organization specialized in climate change (consulting companies in transition, NGO, …)
- Supervision of studies to assess climate change impact on business and business impact on climate change.

RATIONALE	GL 5.2 CLIMATE CHANGE OVERSIGHT CAPABILITY
RATIONALE OF THE INDICATOR	Effective management of the 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 both indicates company commitment to that transition and increases the chances of success. Even if companies are managing climate change at the Board level or equivalent level, a lack of expertise could be a barrier to successful management of low-carbon transition.

GL 5.3 LOW-CARBON TRANSITION PLAN

DESCRIPTION & REQUIREMENT	GL 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 relevant data for this indicator are: ♦ Environmental policy and details regarding governance ♦ The reporter should provide the following description of the transition plan including the following details: - Whether the transition plan exists in a documented form and whether that document is public

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- How the results of scenario testing influenced the transition plan
- Timescale for implementation of the transition plan
- Who has responsibility for its implementation (at the strategic, not operational, level)

How successful implementation of the plan will be measured and monitored. (Should include details of any linked targets, emissions reduction, or energy efficiency targets, or KPIs.)

- CDP questions concerned are C3.1a,b, C3.3

HOW THE ANALYSIS WILL BE DONE

The analyst evaluates 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 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.

Among the best practice elements identified to date are:

- The plan includes financial projections
- The plan should include cost estimates or other assessments of financial viability as part of its preparation
- The description of the major changes to the business is comprehensive, consistent, aligned with other indicators
- Quantitative estimates 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
- Potential “shocks” or stressors (sudden adverse changes) have been taken into consideration
- Relevant region-specific considerations are included
- The 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
- The plan’s measure of success is quantitative
- The description of relevant testing/analysis that influenced the transition plan is included
- The plan is consistent with reporting against other ACT indicators
- The scope should cover entire business, and is specific to that business
- The plan should cover the short, medium, and long terms.
- The plan contains details of actions the company realistically expects to implement (and these actions are relevant and realistic)
- The plan is approved at the strategic level within the organisation
- Discussions about the potential impacts of a low-carbon transition on the current business have been included

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- The company has a publicly-acknowledged 2°C (or beyond) science-based target (SBT)
- The company has been carrying out a diagnosis of climate change impacts and identified related physical risks.

The maximum score (100%) is assigned if all of these elements are demonstrated.

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score
Level of approval within the organisation	Not known	Operational level (CSR level)	Upper management level	Board / Strategic level	Matches highest level of responsibility as previously reported.	*16%*
Measure of success	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	*22%*
Financial content in plan	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	*10%*
Future considerations	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	*9%*

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Current considerations and plans	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	*18%*
Transition plan Scope, consistency, analysis	No clear scope to the plan, no consistency among sections and no analysis presented	The scope covers the entire business	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	*16%*
Transition timescale	Covers only short-term. (< 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)	*9%*

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.

RATIONALE	GL 5.3 LOW-CARBON TRANSITION PLAN
RATIONALE OF THE INDICATOR	All the sectors 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

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DESCRIPTION & REQUIREMENT	GL 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: ♦ Whether the company provides incentives for the management of climate change issues, including the attainment of targets? ♦ Details on the incentives provided for the management of climate change issues ♦ CDP questions concerned are C1.3a
HOW THE ANALYSIS WILL BE DONE	The analyst verifies if the company has compensation incentives set for senior executive compensation and/or bonuses, that directly and routinely reward specific, measurable reductions of metric tonne of GHG emitted by the company in the preceding year and/or the future attainment of emissions reduction targets, or other metrics related to the company's low-carbon transition plan. Monetary incentives at the executive level are an indication of commitment to successful implementation of a low-carbon transition strategy. The maturity matrix used for the assessment is the following:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned	sub score
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	100%/3

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What is the type of incentives (non-monetary/ monetary)?	Non-monetary	Recognition (non-monetary)	Other non-monetary reward		Monetary reward	100%/3
What are the targets related to CC incentives?	No targets incentivized	Behaviour changes related indicator or other specification	Efficiency project, Efficiency target, Environmental criteria included in purchases, Supply chain engagement, or other specification		Emissions reduction project, Emissions reduction target, Energy reduction project, Energy reduction target, or other specification	100%/3

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.

RATIONALE	GL 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 a low-carbon transition. This will improve the likelihood of a successful low-carbon transition. Monetary incentives at the executive level are an indication of commitment to successful implementation of a low-carbon transition strategy.

GL 5.5 CLIMATE CHANGE SCENARIO TESTING

DESCRIPTION & REQUIREMENT	GL 5.5 CLIMATE CHANGE SCENARIO TESTING
SHORT DESCRIPTION OF INDICATOR	Testing or analysis relevant to determining the impact of the transition to a low-carbon economy on the current and projected business model and/or business strategy has been completed, with the results reported to the Board or C-suite (CEO, CFO, etc.), the business strategy revised where necessary, and the results publicly reported.
DATA	The questions comprising the information request that are relevant to this indicator are:

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REQUIREMENTS

- 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 questions concerned are C3.2a, C3.2b

HOW THE ANALYSIS 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 is allocated for elements indicating a higher level of maturity.

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

- full coverage of the company's boundaries
- timescale from present to long-term
- results are expressed in value-at-risk or other financial terms
- multivariate: a range of different changes in conditions are considered together
- changes in conditions 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

The maturity matrix used for the assessment is the following:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned	sub score
What is the scope of the scenario testing?	Large element not included	Large element included	Small element not included	Small element included	Covers entire boundary of the company	35%
What is the time horizon of the scenario testing?	From present to near future	From present until 5 years	From present until 10 years	From present until 20 years	From present to 2050 and beyond	20%
Are the results in qualitative/ quantitative/ financial terms?	Expressed in qualitative terms	Expressed in qualitative terms	Expressed in financial terms	Expressed in financial terms and results are translated into value-at-risk	Expressed as value-at-risk	10%

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What are the types 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 2-degree decarbonization scenario	35%

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.

RATIONALE	GL 5.5 CLIMATE CHANGE SCENARIO TESTING
RATIONALE OF THE INDICATOR	Changes predicted to occur due to climate change could have several consequences for the Glass sector, including the risk of "stranded assets", increased costs, a dramatically changed operating environment and major disruptions to the business. There are a variety of ways of analysing 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 actions to reduce greenhouse gas emissions across the value chain (see IIGCC investor expectations document for the sector (17)), effective abatement will require a combination of action: improve energy efficiency, use alternative fuels, use raw materials substitution, develop new technologies, sell less Glass but sell services or advice to use Glass in a better way, etc. These actions should be linked with a strong governance framework to manage physical risks of the sector. The ACT methodology thus provides a broad definition of types of testing and analysis that can be relevant to this information requirement, to identify both current and best practices and consider them in the assessment. Risk management plan is an important management tool for preparing for the low-carbon transition. For businesses likely to be strongly affected by climate change impacts (both direct and indirect), and businesses with large, fixed asset bases and long management horizons, such as the Glass sector, it has even greater importance. This disclosure is in line with Disclosure c) of the TCFD: "c) Describe the resilience of the organization's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario".

SUPPLIER ENGAGEMENT

The suppliers for the Glass industry vary considerably depending on the structure of the company and its activities. This Module aims at assessing the actions of companies on their suppliers.

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No specific sub-dimensions are given for the two indicators, but a global evaluation should be used to rate the level of the company. The analyst should make sure to identify the most important suppliers in the company's supply chain. This identification is necessary to give recommendations on where emissions could be lowered.

GL 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

DESCRIPTION & REQUIREMENT	GL 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS
SHORT DESCRIPTION OF INDICATOR	The company has a strategy, ideally governed by policy, and integrated into business decision making, to influence, enable, or otherwise shift suppliers' choices and behaviour in order to reduce GHG emissions.
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 relevant Scope 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 questions concerned are C12.1a
HOW THE ANALYSIS WILL BE DONE	The assessment 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. Company responses will be scrutinized by the analyst and then placed on the level in the matrix where the analyst deems it most appropriate. No specific subdimensions are given but a global evaluation should be used to rate the level of the company. The analyst should pay attention to identify the most important suppliers in the company's global carbon emissions. This identification is necessary to give recommendations.

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Questions	Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score
To what extent GHG emissions reduction issues are integrated in engagement with suppliers?	Consideration of reduction targets	No consideration of reduction targets.	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 low carbon offer?	Use of action levers	No actions 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, etc.).	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?	Scope	No strategy applied to any suppliers.	Strategy applied to few large suppliers.	Strategy applied to most large suppliers.	Strategy applied to all large suppliers and few small suppliers.	Strategy applied to all of suppliers.	20%

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To what extent carbon issues are integrated in the selection process of suppliers?	Suppliers' selection process	No selection of suppliers based on environmental criteria. No change in suppliers' base.	Selection of suppliers based on at least one environmental criterion. No change in suppliers' base.	No change in suppliers' base. Selection of suppliers with low-carbon alternatives.	No change in suppliers' base. Selection of suppliers offering low-carbon alternatives.	Engaging suppliers over low-carbon alternatives.	30%

Examples of action levers:

- Joint R&D
- Supporting/leading industry environmental groups
- Sanctions
- Audits
- Sharing patents
- Sustainability manager involved in appointment/can veto new supplier appointments

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.

RATIONALE

GL 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

RATIONALE OF THE INDICATOR

Since the raw material being used is linked to the environmental performance of the final glass product, suppliers must be involved in the strategy action plan of the company, regardless of whether raw materials that has been bought. Due to its consideration in the target calculations, the choice of sustainable purchased product is an important lever to help the company to apply its low-carbon transition.

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

1. Given their size and their decision-making power in the value chain, integrated companies can influence the strategy and performance of suppliers regarding climate.

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2. The upstream segment represents a high source of emissions throughout the value chain and should be engaged (between 10% and 50% of the life cycle of the product, depending on the glass product, see Table 5).
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 currently. It is often challenging to quantify the emissions 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 Supplier Engagement.

GL 6.2 ACTIVITIES TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

DESCRIPTION & REQUIREMENT	**6.2 ACTIVITIES TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS**
SHORT DESCRIPTION OF INDICATOR	This indicator assesses the level of engagement that the company has with its suppliers, based on an assessment of previous initiatives that show whether or not the company engages with suppliers in various ways.
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 questions concerned are C12.1a
HOW THE ANALYSIS WILL BE DONE	The maturity matrix used for the assessment is the following:

Questions	Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score

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How the company encourage suppliers to reduce their GHG emissions?	Suppliers GHG emissions	No activity (no engagement with suppliers with respect to emissions reduction)	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 partners with large suppliers to define common GHG emissions reduction plan	Company contributes in GHG emissions reduction along its value chain through close partnerships with suppliers	60%
Does the company use its purchasing power to drive low-carbon demand?	Low-carbon offer of suppliers	No green purchase	No green purchase	Company purchases low-carbon products/equipment/services	Company purchases low-carbon products/equipment/ services. Company partners with suppliers to develop low-carbon products/services	Company purchases low-carbon products/equipment/ services. Company partners with suppliers to develop low-carbon products/services	40%

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.

RATIONALE

GL 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 GL assessment for the following reasons:

1. Given their size and their decision-making power in the value chain, integrated companies can influence the strategy and performance of suppliers regarding climate.

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2. The upstream segment represents a high source of emissions throughout the value chain and should be engaged.
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 currently feasible. It is often challenging to quantify the emissions reduction potential and outcome of collaborative activities along 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.

810 # CLIENT ENGAGEMENT

811 ## GL 7.1 STRATEGY TO INFLUENCE CUSTOMER BEHAVIOUR TO REDUCE GHG EMISSIONS

DESCRIPTION & REQUIREMENTS	GL 7.1 STRATEGY TO INFLUENCE CUSTOMER BEHAVIOUR TO REDUCE GHG EMISSIONS
SHORT DESCRIPTION OF INDICATOR	The company has a strategy, ideally governed by policy, and integrated into business decision-making, to influence, enable, or otherwise shift customer choices and behaviour in order to reduce GHG emissions.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Methods of client engagement ♦ % of customers ♦ CDP questions concerned are C12.1b
HOW THE ANALYSIS WILL BE DONE	The analyst checks if the policy or strategy exists and analyses if it targets customer behaviour through specific actions undertaken by the company. The strategy could mention whether: ♦ GHG emissions reduction are part of the goal ♦ Customers are engaged either through education or information sharing, or through collaboration & innovation.

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- Whether it is an active rather than a reactive strategy: a reactive strategy responds only to customer demand for more low-carbon systems and services, whereas an active strategy attempts to change the existing customer demand towards low-carbon alternatives.
- If it is widespread: the strategy must apply to most customers.

Maturity matrix is built as following:

Questions	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score
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 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/ services?	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	Use of several action levers (awareness campaign, compensation, purchasing rule, etc.) Contribution to shift demand towards low-carbon products/services	40%
What is the scope of the action levers used?	No strategy		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%

SCORING

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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.

RATIONALE	GL 7.1 STRATEGY TO INFLUENCE CUSTOMER BEHAVIOUR TO REDUCE GHG EMISSIONS
RATIONALE OF THE INDICATOR	**RELEVANCE OF THE INDICATOR:** Strategy to influence consumer behaviour to reduce GHG impacts is included in the analysis for the following reasons: 1. Given their size and their decision-making power in the value chain, integrated companies can influence the strategy and performance of clients regarding climate. 2. The downstream segment has a key role to play in cullet availability and quality. 3. Regarding the type of products, the transport to the final client could be non negligeable in terms of GHG emissions. **SCORING RATIONALE:** The scoring of elements in the way that it is presented is similar to the CDP scoring methodology, whereby a narrative answer that details a certain strategy is checked for whether it includes certain elements that the ACT assessment deems vital for any sound customer engagement strategy.

GL 7.2 ACTIVITIES TO INFLUENCE CUSTOMER BEHAVIOUR TO REDUCE GHG EMISSIONS

DESCRIPTION & REQUIREMENTS	GL 7.2 ACTIVITIES TO INFLUENCE CUSTOMER BEHAVIOUR TO REDUCE GHG EMISSIONS
SHORT DESCRIPTION OF INDICATOR	The company participates in activities, to influence, enable, or otherwise shift customer choices and behaviour to reduce GHG emissions, scrap reduction, sorting and recycling.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Reported activities or interventions. ♦ CDP questions concerned are C12.1b, C2.4, C6.5

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HOW THE ANALYSIS WILL BE DONE

The analyst assigns a maturity score based on the company's demonstration of engagement with its customers, expressed in a maturity matrix. This indicator takes a holistic viewpoint on the interventions reported and assesses how together they paint a picture of the company's level of active engagement with their customers.

It uses a maturity matrix to cover different types of activities under one score. The level that the company has achieved is determined by the analyst after reviewing all the information provided on the value chain interventions.

Successive levels into this matrix represent a more advanced level of engagement that works towards a collaborative effort of decarbonizing the Glass sector and assumes that the actions in the previous level are also part of the company's engagement.

The line concerning the topics *low-carbon product offers* and *support provided to clients to help them reducing their GHG emissions*, could be linked with the avoided emissions topic because it involves a partnership approach of the value chain decarbonisation between the company and its clients (most specifically those of carbon-intensive sectors).

Maturity matrix is built as following:

Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score
Clients GHG emissions reduction engagement	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	25%
Low-carbon products	No offer	The company does offer low-carbon 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.	40%

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					The brand identity of the company is based only on its range of low-carbon solutions.	
Support provided to clients to help them reducing 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%
Action to reduce the carbon emissions and increase efficiency linked to transport	There are no reported actions	Quantification of carbon emissions and efficiency of transports used	Actions have been taken to reduce of 20% the carbon emissions and increase the use of low-carbon vehicles of 20%	Actions have been taken to reduce of 50% the carbon emissions and increase the use of low-carbon vehicles of 50%	Use of low-carbon transportation and local suppliers only	5%

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.

RATIONALE — **GL 7.2 ACTIVITIES TO INFLUENCE CUSTOMER BEHAVIOUR TO REDUCE GHG EMISSIONS**

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

While measurement of strategy as in GL 7.1 is important, measuring activities and their outcome is more insightful with regards to the company's actual emissions reduction activities in the supply chain. Because of the difficulty in measuring this, the ACT assessment uses this maturity matrix approach that has been piloted by several other institutions (see scoring rationale) to fill this gap in indicators GL 6.2 and GL 7.2.

SCORING RATIONALE:

Because of data availability and complexity, a direct measure of the outcome of supply chain engagement activities is not very feasible currently. Therefore, the approach of a maturity matrix allows the analyst to consider multiple dimensions of client engagement and analyse them together

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towards a single score. This approach has been used before by several institutions that attempt to make measurements of progress in the complex and multidimensional industry sectors.

POLICY ENGAGEMENT

MODULE RATIONALE

For the Glass sector, the policy should require setting up the best existing plants emissions (Adopts Best Available Technologies (BAT)) when modernizing, purchasing, or designing a new plant.

Policy mechanisms should be established which ensure an international competitive level playing field between the different Glass producing regions in order to avoid the risk of carbon leakage. Some regulations have been set in some regions of the world, as EU-ETS in EU, but it could be criticized in some other regions because EU-ETS is looking only at direct emissions and does not help materials circularity even if circularity could be done locally.

From the IEA analysis, “governments have an outsized role to play in supporting transitions towards net-zero emissions. Long-term visions need to be backed up by detailed clean energy strategies involving measures that are tailored to local infrastructure and technology needs. Effective policy toolkits must address five core areas:

- Tackle emissions from existing assets
- Strengthen markets for technologies at an early stage of adoption
- Develop and upgrade infrastructure that enables technology deployment
- Boost support for research, development, and demonstration
- Expand international technology collaboration.

In addition, policy makers can promote CO2 emissions reduction efforts by adopting mandatory reduction policies, such as a gradually increasing carbon price or tradeable industry performance standards that require average CO2 intensity for production of each key material to decline across the economy and permit regulated entities to trade compliance credits.”

GL 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS

DESCRIPTION & GL 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS

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REQUIREMENTS

SHORT DESCRIPTION OF INDICATOR

The company has a clear policy on what action to take when industry organisations in which it has membership 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, the company shall describe this policy including the following details:
- The company should attach supporting documentation, if this exists, giving evidence
- CDP questions concerned are C12.3a, C12.3b, C12.3c

HOW THE ANALYSIS WILL BE DONE

The analyst evaluates 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 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:

- Having a publicly available policy 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
- The action carries the option to terminate membership of the association
- The action carries the option of publicly opposing or actively countering the association's position
- Responsibility for oversight of the policy lies at the top level of the organisation
- Presence of a process to monitor and review trade association positions

The maturity matrix used for the assessment is the following:

Question	Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub-score
What is the Scope covered by	Transparency and Scope	Does not cover entire company or all group	Does not cover entire company or	Covers the entire company and its activities, and all		Covers the entire company and its activities, and all	40%

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the engagement policy? Is the policy publicly available?		memberships. Is not publicly available.	all group memberships. Is publicly available.	group memberships and associations, but not publicly available		group memberships and associations. Public policy is publicly available	
Does the company have a review process of trade associations?	Oversight	No process to review trade associations positions	A process 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 is in place. Responsibility for oversight of the policy lies at top level of the organization	40%
Does the company have an action plan regarding engagement with trade associations?	Action plan	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%

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.

RATIONALE

GL 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS

RATIONALE OF THE INDICATOR

See also the Module rationale.

Trade associations are a key method by which companies can influence policy on climate indirectly. Thus, where trade associations take positions that are negative for the climate, companies need to take action to ensure that this negative influence is countered or minimised. Transparency about public policy is a specific request of the Investor Expectations report (17).

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

DESCRIPTION & REQUIREMENTS	GL 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.
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 questions concerned are C12.3c, C12.3f External sources of data shall also be used for the analysis of this indicator: ♦ RepRisk database, ♦ Climate Action 100+ ♦ Ellen Macarthur Foundation (18) ♦ 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-Partnerships-initiative
HOW THE ANALYSIS WILL BE DONE	The list of trade associations declared in the CDP data and other external sources entries relating to the company is assessed against a list of associations that have climate-negative activities or positions. The results will be compared to any policy described in GL 8.1. If the company is part of trade associations that have climate-negative activities and/or positions, this should be considered for the analysis. The maturity matrix used for the assessment is the following:

Question	Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned

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Does the company support trade associations that have climate negative activities/positions?	Membership / funding	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

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.

RATIONALE	**GL 8.2 TRADE ASSOCIATIONS SUPPORTED DO NOT HAVE CLIMATE-NEGATIVE ACTIVITIES OR POSITIONS**
RATIONALE OF THE INDICATOR	See also the Module rationale. Trade associations are a key instrument by which companies can indirectly influence policy on climate. Thus, participating in trade associations that actively lobby against climate-negative legislation is a negative indicator and likely to obstruct the low-carbon transition.

GL 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES

DESCRIPTION & REQUIREMENTS	**GL 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES**
SHORT DESCRIPTION OF INDICATOR	The company is not opposed to any significant climate relevant policies 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

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- CDP questions concerned are C12.3a, C12.3f

External sources of data shall also be used for the analysis of this indicator (e.g., RepRisk database, press news, actions in standard development).

HOW THE ANALYSIS WILL BE DONE

The analyst evaluates the description and evidence on the company's position on relevant climate policies (see Module rationale for the description of 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 are 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.

The maturity matrix used for the assessment is the following:

Question	Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned
What is the position of the company on significant climate policies?	Climate policy support	Reported direct opposition to climate policy can be found (third-party claims are found)	No reported direct 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/spokesperson of the initiative)

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.

RATIONALE

GL 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES

RATIONALE OF THE INDICATOR

See also the Module rationale.

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Policy and regulation that acts to promote transition to a low-carbon economy is key to the success of the transition. Companies should not oppose effective and well-designed regulations in these areas but should support it.

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BUSINESS MODEL

MODULE RATIONALE

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 a low-carbon transition while continuing to generate value. This can be done by developing activities outside the core business of the company.

This module aims to identify both relevant current business activities and those still at a burgeoning stage. It is recognised that transition to a low-carbon economy, with the associated change in business models, will take place over a number of years. The analysis 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.

- Focus will be on new business models
- High emissive / involved in high emissive activity companies should be benchmarked by quantitative modules (not in business model module)
- Score will be based on long-term viability of the company's business model in the low-carbon economy
- Is the company developing levers, and actioning them, to transition to low-carbon economy?
- Is there a need to change the fundamental business model? e.g., ticket agencies can just do train not air travel, engineering services no longer provided to fossil fuel companies.
- How linked to emissive activities is the business model?
- New business models vs. transitioning existing business model
- We shouldn't penalise companies who can't shift a business model because they are already low-carbon

Flat glass

It seems that the most crucial for flat glass would be the contribution to the decarbonization of other sectors, including the production of products that help energy production (PV panels for example), and products that allow less consumption (thanks to less weight in the automotive sector for example), and better performance (thanks to a better insulation of the windows in building sector for example).

Hollow glass

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General remarks on the business models:

- Hybrid / electric furnaces are only for some products (not for crystal glass & flaconnage for instance).
- The rate of cullet is limited with actual furnaces & electrified furnaces.
- There are very different technologies to produce different products.

Regarding circular economy, a work on refilled bottles can be done, as well as on external recycling value chain and recycled products (for some products only).

The design of low-carbon products is also a solution including changing the product's color, reducing the weight, reviewing the glass specification in order to find the best compromise between emissions & product performance, and producing not transparent flaconnage bottles (such as grey bottles).

Currently, due to technology non-mature yet, it does not seem to be any movement towards CCS/CCUS technologies.

Fiber glass

For fiber glass the most important elements in business model are:

- Fuel switching: oxy-fuel and electrification
- Cullet use is not an option for this sector (the technology does not accept cullet)
- Design of low-carbon products by reducing the weight of the products is the main business model action (both in their products and products from other sectors in composites)
- Low-carbon products promoted by companies are also products specifically made with low-carbon energy

Avoided emissions are also important for fiber glass, the sector contributes to lighter products and thus GHG reductions in several other sectors:

- Transport by use of fiber glass in composite materials (cars, boats, train…)
- Electricity by use of fiber glass reinforced composites in windmills for example
- Building by use of insulation products made of fiber glass

The business model shifts identified do not conflict with the changes that are implied by decarbonizing the company's production and sales.

A variety of sources have been consulted to develop a comprehensive review of the challenges facing the Glass sector in relation to the low-carbon transition. Several opportunities for the sector have been identified which the ACT initiative has formatted under a taxonomy for reporting the development of business activities connected to them. The main reference sources for building these indicators are extracted from the literature and from exchanges with the experts during the methodology development process.

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Climate scenarios can identify shifts in use of glass (transport, building, renewable energies…) that will foster the transition to a low-carbon economy. Companies committed to adapting their business to these predicted changes will be better positioned to take advantage of associated opportunities and successfully transition to a low-carbon economy.

SCORING

The company is actively developing business models for a low-carbon future by demonstrating its application of low-carbon business model pathways.

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

- 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

The analysis is based on (up to) five business activities proposed by the company. The analyst evaluates the implementation of the future business model pathways through a maturity matrix.

If several business models are developed by the company, the final score will be the one given to the most mature business model (usually the one that is best scored too). The company should not be penalized if it has built a mature business model and explores besides other tracks (which would be scored with a lower score) compared to another company having only one mature business model.

The maturity matrix used for assessing all indicators in this module is provided below:

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Question	Basic	Advanced	Low-carbon aligned	Sub score
Associated score	**0%**	**50%**	**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-year horizon or less***	***Deployment scheduled with a 2-year horizon or more***	***25%***

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

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.

GL 9.1 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT INCREASING ENERGY EFFICIENCY AND THE USE OF LOW-CARBON ENERGY OR OPTIMIZING OF THE PROCESS

DESCRIPTION & REQUIREMENTS	GL 9.1 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT INCREASING ENERGY EFFICIENCY AND THE USE OF LOW-CARBON ENERGY OR OPTIMIZING OF THE PROCESS
SHORT DESCRIPTION OF INDICATOR	The company is actively developing business models for a low-carbon future and participating in business activities that increase energy efficiency, optimize the process or the use of low carbon energy
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Business model subcategory, 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 ? ♦ CDP questions concerned are C3.1d, C3.4a, C3.5, C4.3c, C1.3a, C2.4a ♦
HOW THE ANALYSIS WILL BE DONE	The analysis is based on the company's degree of activity in one of the future business model areas using the benchmark (sectoral roadmap). Relevant business activity areas for this indicator are, for example: ♦ Improvement of conventional furnaces (end-fired/regenerative/recuperative furnaces) ♦ Develop electric melting (if relevant) or Oxy-fuel combustion or hybrid furnace ♦ Better manufacturing control (e.g., new default detection technologies) ♦ Waste heat recovery (raw-materials pre-heating, power generation, infrastructure heating) ♦ Batch pelletisation or reformulation ♦ Develop CCU/CCS ♦ Hazardous & Non-hazardous waste treatment (use as fuel) ♦ Other examples could be added after roadtest
RATIONALE	GL 9.1 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT INCREASING ENERGY EFFICIENCY AND THE USE OF LOW-CARBON ENERGY OR OPTIMIZING OF THE PROCESS

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RATIONALE OF THE INDICATOR	See the Module rationale.

899 **GL 9.2 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT DEVELOPPING SYNERGIES WITH OTHER INDUSTRIES**

DESCRIPTION & REQUIREMENTS	**GL 9.2 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT DEVELOPPING SYNERGIES WITH OTHER INDUSTRIES**
SHORT DESCRIPTION OF INDICATOR	The company is actively developing business models around circular economy, in participating in business activities related to create synergies with other industries. It also evaluates in a dimension 2 the avoided emission reported by the company if any.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Business model subcategory, 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 ? ♦ Avoided emissions study: description and calculation ♦ CDP questions concerned are C4.5a, C3.4a, C3.1.d, C4.3c External sources of data used for the analysis of this indicator are: ♦ SCORELCA report, Avoided environmental impacts and emissions, Université de Bordeaux, Vertech, 2019
HOW THE ANALYSIS WILL BE DONE	This indicator is assessed on two dimensions. The 2 dimensions are weighted at 50% each if both are reported or 100% if only one is reported. **DIMENSION 1: SYNERGIES WITH OTHER INDUSTRIES** The analysis is based on the company's development of business model related to synergies with other industries, it is evaluated though the maturity matrix presented for the module.

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Relevant business activity areas for this indicator are for example:

- Decarbonization of other sectors with innovative products (e.g., insulation for the building sector, lighter products for the transport sector, PV panels for the energy sector)
- Other actions reported
- Other general examples could be added after the roadtest

DIMENSION 2: AVOIDED EMISSIONS

The indicator will evaluate the implementation of global recommendations to account for and communicate about avoided emissions.

Avoided emissions is a calculation. It is not based on facts even if the company produces products that could contributes to reduce emissions on other sectors.

Avoided emissions may happened due to the use of company's sold products or solutions. According to ISO TR 14069 (under revision) informative annex, an avoided emission is a GHG emission that has not occurred. It is defined by the difference between the level of GHG emissions induced by the reporting organization's activity outside its organizational boundaries and the level of GHG emissions of a reference, counterfactual scenario that would have happened otherwise. In general, avoided emissions due to sold products are generated thanks to the involvement of several actors other than the reporting organization that sells the products (e.g : energy saving equipment, insulation products, recycled materials…).

The number of avoided emissions due to the use of such products is not considered by ACT methodologies to reduce the amount of the reporting company's GHG absolute emissions or intensity.

Nevertheless, such products are considered in the ACT's sold product performance module but also in the business model module as levers of the reporting company to support its low carbon transition. Such products and solution are also considered in the scoring.

The matrix is provided below:

Questions	Basic	Standard	Advanced	Next practice	Low carbon aligned	sub score
Does the company account for its scope 1, 2 and 3 GHG emissions?	The company does not account for its GHG emissions	The company accounts for scope 1 and 2 GHG emissions	The company accounts for scope 1 and 2 GHG emissions, and some scope 3	-	Company accounts for scope 1 and 2 and all relevant categories of scope 3 GHG emissions	20%

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			categories (but relevant scope 3 categories are missing)			
What are the system boundaries used to calculate the avoided emissions?	Cradle to gate	-	Cradle to grave	-	Cradle to cradle	20%
How is the baseline defined to calculate avoided emissions?	No information is available on this topic	The baseline is defined thanks to (a) product(s) from the market sales, without any rationale	Product(s) with the weighted average market sales are considered to define the baseline	Average of the existing 80% of market sales is considered to define the baseline	Best available technologies are considered to define the baseline	15%
What is the % of products involved in company portfolio in the avoided emissions calculations?	Between 10% and 50%	Between 51% and 80%	Between 81% and 95%	-	More than 95%	15%
How is the number of assessed product(s) sold calculated?	No information is available on this topic	Estimation of future Number of products sold	Number of products sold (annual reporting)	-	Number of products sold that are currently in use	10%
Are calculated avoided emissions shared between all stakeholders within the value chain?	Company is attributing all avoided emissions from the entire value chain to itself	-	Company itself defined its share of avoided emissions	Shares defined by a standard (or PCR)	Avoided emissions shares was unanimously defined by all stakeholders, and the list of stakeholders and their contribution is publicly available	5%
Is the contribution ratio of the assessed product taken into account (in	No information is available on this topic	Contribution ratio is taken into account with a unique example	Contribution ratio is taken into account with 50% at least of the use	Contribution ratio is taken into account with 80% at least of the use	Contribution ratio is taken into account, and all cases (i.e., all final products) are considered	**5%**

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the case where it is a part of one or several final product(s))?						
Is the balance between positive and negative impacts of the company's portfolio estimated ?	Only positive impact (i.e., avoided emissions) are reported	-	Only positive impact (i.e., avoided emissions) are reported, as well as the related % of portfolio coverage	-	The positive and negative impacts of all products within the portfolio are compared, following the same calculation rules	**5%**
Has the assessment been transparent?	Verified by a second party	-	Verified by an external third party	-	Verified by an external third party and publicly available	**5%**

AGGREGATE SCORE - DIMENSION 1:50%, DIMENSION 2:50% IF BOTH ARE REPORTED. 100% IF ONLY ONE DIMENSION IS REPORTED

RATIONALE **GL 9.2 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT DEVELOPPING SYNERGIES WITH OTHER INDUSTRIES**

RATIONALE OF THE INDICATOR

Collaboration helps create innovation. The synergies with other industries to help them to reduce their emissions is a necessary topic where each company could help to reach a global objective of decarbonization in 2050.

The avoided emissions are also topic which is becoming increasingly important for companies because it helps to communicate in a positive way. The method of quantification and the way of communication should follow the best practices. In addition, the avoided emissions calculation helps to promote the fact that some industry contributes to reducing emissions of other sectors with their products. Beyond that positive communication on their products and their actions, the company should focus on decarbonizing their assets.

900 **GL 9.3 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT DEVELOPPING THE CIRCULAR ECONOMY**

DESCRIPTION & REQUIREMENTS **GL 9.3 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT DEVELOPPING THE CIRCULAR ECONOMY**

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SHORT DESCRIPTION OF INDICATOR	The company is actively developing business models around circular economy, in participating in business activities associated with collecting, reuse and recycling of material. In addition, the company is actively working on improving design and use of their product that could increase the lifetime or environmental performance of the systems with equivalent or better performance
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Business model subcategory, 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 ? ♦ CDP questions concerned are C3.1d, C3.4a, C3.5, C4.3b, C4.3c
HOW THE ANALYSIS WILL BE DONE	Relevant business activity areas for this indicator are for example: ♦ Increase glass waste collection rate ♦ Increase the use of external cullet in new available products ♦ Design of products for reuse ♦ Use of mineral waste streams from other processes (e.g., carbonate free slag from metal industry) ♦ Other actions reported ♦ Other general examples could be added after the roadtest
RATIONALE	**GL 9.3 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT DEVELOPPING THE CIRCULAR ECONOMY**
RATIONALE OF THE INDICATOR	See the Module rationale.

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GL 9.4 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT REDUCING THE STRUCTURAL BARRIERS TO MARKET PENETRATION OF LOW-CARBON PRODUCTS WITHOUT DEGRADING THE PERFORMANCE OF THE PRODUCT

DESCRIPTION & REQUIREMENTS	GL 9.4 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT REDUCING THE STRUCTURAL BARRIERS TO MARKET PENETRATION OF LOW-CARBON PRODUCTS WITHOUT DEGRADING THE PERFORMANCE OF THE PRODUCT
SHORT DESCRIPTION OF INDICATOR	The company is actively developing business models for a low-carbon future and participating in business activities that reduce structural barriers to market penetration of low-carbon products.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ Business model subcategory, 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 ? ♦ CDP questions concerned are C4.5a, C3.4a, C3.5, C3.1d, C4.3c
HOW THE ANALYSIS WILL BE DONE	Relevant business activity areas for this indicator are for example: ♦ Development of new low-carbon products with similar or higher performances ○ Grey bottles for hollow glass ○ Innovative composites for fiber glass ○ Increase of the lifetime of the product (maintenance, eco-design…) ○ Low-carbon raw materials (secondary) ○ … ♦ Other actions reported ♦ Other examples could be added after roadtest
RATIONALE	GL 9.4 LOW CARBON BUSINESS ACTIVITIES THAT AIM AT REDUCING THE STRUCTURAL BARRIERS TO MARKET PENETRATION OF LOW-CARBON PRODUCTS WITHOUT DEGRADING THE PERFORMANCE OF THE PRODUCT
RATIONALE OF THE INDICATOR	See the Module rationale.

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6. Assessment

6.1. SECTOR BENCHMARK

For the quantitative Modules, a sectoral decarbonization pathway needs to be used to calculate the company's allocated decarbonization pathway. No decarbonization pathway was found for the glass sector at a global level (worldwide). In order to develop the sector benchmark, a few options were discussed with the technical working group:

1. Use an **existing generic method** such as the **Absolute Contraction Approach (ACA)** of the Science Based Target initiative (SBTi).
2. **Re-Use** one or more GHG emissions and electricity consumption **pathways for one or more sectors similar to glass**.

The fundamental target to achieve for all organizations is to contribute to not exceeding a threshold of 2ºC 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.

Consequently, low carbon scenarios used for the benchmark are Well Below 2°C scenarios or 1.5°C scenarios.

Every company shall be benchmarked according to an acceptable and credible benchmark that aligns with spatial boundary of the methodology.

6.1.1. MECHANISMS TO COMPUTE THE COMPANY BENCHMARK

In the case that a sectoral intensity benchmark is developed, the allocation mechanism chosen, as defined in the SDA, will be the convergence mechanism. This allocation takes the company's emissions intensity in the initial year and converges it to the sector's emissions intensity in 2050 at a rate that ensures that the corresponding sectoral carbon budget is not exceeded.

The next figure illustrates the mechanism.

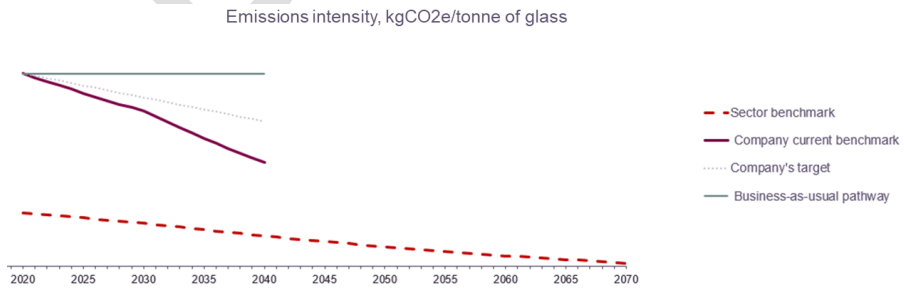

FIGURE 26 : CONVERGENCE MECHANISM ILLUSTRATION

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Thus, companies starting from a lower intensity will have a shallower decarbonization pathway than companies starting from a higher intensity. In this way, past action, or inaction to reduce intensity is taken into consideration.

According to the absolute contraction approach, all companies are expected to reduce their Scope 1+2 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 approach that corresponds to the WB2D scenario of IEA ETP and thus compatible with the Sustainable Development Scenario (SDS). The contraction approach provides the company with the amount of absolute CO2e emissions that it cannot exceed. It will be possible to compute the corresponding emissions intensity. The numerator (CO2e) will be the one provided by the absolute contraction approach, and the denominator will be the tonne of glass produced by the company. Note that there is no sector benchmark for absolute contraction. This approach is therefore relevant when no sectoral intensity benchmark is available.

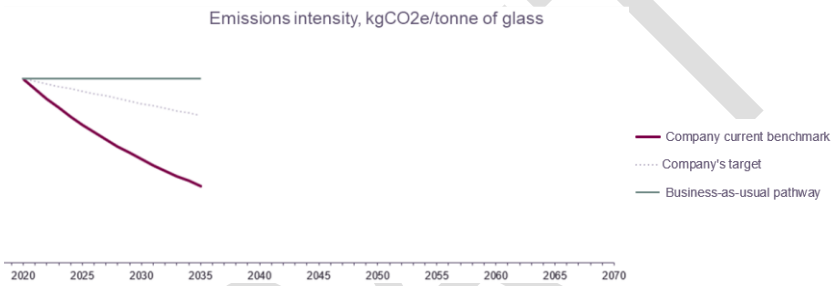

FIGURE 27: ABSOLUTE CONTRACTION MECHANISM ILLUSTRATION (IN THIS EXAMPLE, THE VOLUME OF GLASS PRODUCED BY THE FICTIVE COMPANY INCREASES, HENCE A NON-LINEAR CURVE REQUIRING THE COMPANY TO DECREASE FASTER ITS CARBON INTENSITY)

6.1.2. AVAILABLE REFERENCE PATHWAYS

The available pathways that can be used as the basis for the methodology development of the reference scenario for the glass sector are those included in the Sustainable Development Scenario (SDS) used for the International Energy Agency (IEA) Energy Technology Perspective 2020 (ETP 2020) series. In fact, these scenarios are global in scope and compatible with the temperature goals of the Paris Agreement as they achieve zero net emissions by 2070. The scale and ambition of the pathways included in the SDS scenario are therefore the same as those of the scenario to be developed.

The pathways that could be re-used are the relative evolution of scope 1 GHG emission intensity for the heavy industries (cement, iron and steel, aluminium, chemicals) (Figure 28) and the relative evolution of scope 2 absolute GHG emissions for the whole industry (Figure 29).

The glass industry is indeed a difficult industry to reduce (no mature decarbonisation technologies, long plant life) as are the heavy industries in the SDS. For scope 2 absolute GHG emissions, industry-wide data is the most accurate data available in the SDS.

For product shaping actors, there is no specific pathways identified.

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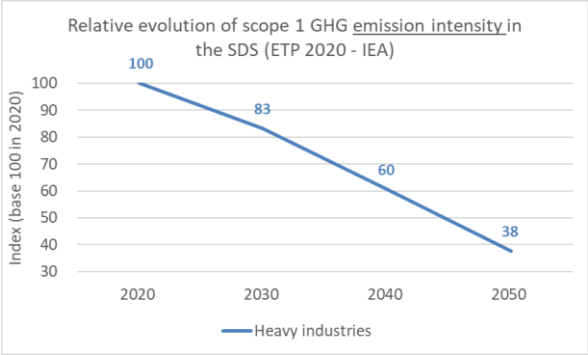

FIGURE 28: IEA DIRECT CO2 EMISSIONS IN THE SUSTAINABLE DEVELOPEMENT SCENARIO (SDS) FOR HEAVY INDUSTRIES

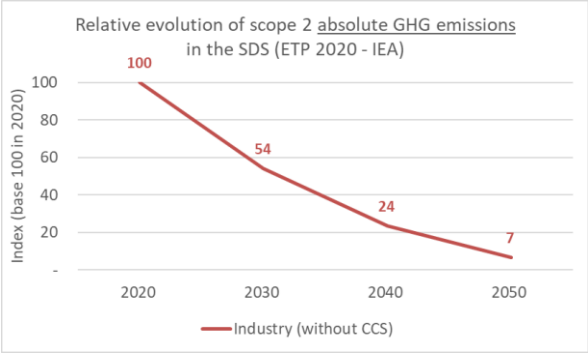

FIGURE 29: IEA INDIRECT CO2 EMISSIONS IN THE SUSTAINABLE DEVELOPEMENT SCENARIO (SDS) INDUSTRY

6.1.3. REFERENCE SCENARIO FOR THE GLASS SECTOR

According to the TWG members, at this time, the approach of reusing the existing IEA SDS pathways is the best option, although it is not fully consistent with the glass sector, due to the lack of data and scenarios for GHG emission reductions from this sector.

According to this approach, the reference scenario for the glass sector is presented in Figure 30. In this figure, the relative evolution of scope 1 GHG emission intensity (blue curve) is the same as in Figure 28. The relative evolution of scope 2 GHG emission intensity (red curve) is obtained from the following projections:

- Power consumption for all industry (SDS - IEA - ETP 2020).
- Global emission intensity of electricity generation (SDS - IEA - ETP 2020).
- Global glass production (IHS Markit study)

The first two projections are used to obtain the relative evolution of scope 2 absolute GHG emissions (Figure 29), which is then combined with the last projection of global glass production to obtain the relative evolution of scope 2 GHG emission intensity (red curve in Figure 30).

The relative evolution of scope 1 (blue curve) and scope 2 (red curve) GHG emission intensity are then combined to obtain the relative evolution of scope 1+2 emission intensity (green curve) through the projection of the ratio between scope 2 and scope 1 absolute GHG emissions for the whole industry (SDS – IEA – ETP

2020). As this ratio decreases between 2020 and 2050 (due the faster decrease of scope 2 absolute GHG emissions compared to the decrease of scope 1 absolute GHG emissions for the industry), the relative evolution of scope 1+2 emission intensity (green curve) is increasingly similar to that of scope 1 emission intensity (blue curve) between 2020 and 2050.

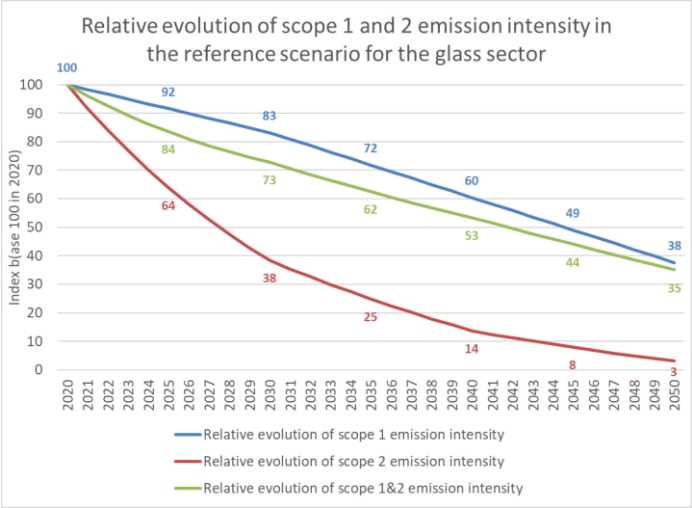

FIGURE 30 : REFERENCE SCENARIO FOR THE GLASS SECTOR

This scenario is applied to all types of actors (integrated, glass melters and product shapers) without differentiation. To be consistent, glass shapers should add the GHG emissions of glass purchased (scope 3) to their scope 1+2 emissions is called scope 1+2+externalized glass melting emissions (from upstream scope 3 emissions).

6.2. BENCHMARKS USED FOR INDICATORS

The following table lists the benchmarks used for the quantitative indicators and their sources:

TABLE 10: BENCHMARKS FOR THE INDICATORS

BENCHMARK	PARAMETER	SOURCE	INDICATOR RELEVANCE
Company and sector benchmark	Production Emissions: Scope 1+2 +3 CB_G	IEA ETP 2020 (19) adapted - background scenario data SDA (13) – specific benchmark pathway definition SBT – WB2DS https://sciencebasedtargets.org/step-by-step-process#develop-a-target	GL1 GL2 GL4

R&D benchmark for technology	TRL	Maturity of technology – TRL IEA ETP 2020 (19) and IEA website IIPI network website http://www.iipinetwork.org/wp-content/letd/content/glass.html GlobalGlass Database	GL3
Management benchmark	TCFD		GL5
Average lifetime of assets		GlobalGlass Database	GL2
Business model		Ellen Macarthur Foundation (18) Material Economics (20) IEA ETP 2020 (19)	GL9

6.3. PERFORMANCE SCORING WEIGHTINGS

The selection of weights for both the Modules and the individual indicators was guided by the principles of value of information, impact of variation, future orientation, and data quality sensitivity (see ACT framework (1)). The ACT Guidance (10) gives percentage ranges for the Modules.

For the glass sector, the scope is defined for two business segments, one concerning the integrated factories and batch house and melting actors regardless products manufactured and sold; the other one concerning the actors only active in the product shaping step (tempering, coating, decorating, …) for flat glass.

Module weightings depend on the GHG emissions of the product on the total life cycle and focus on main GHG emissions to reach a fair decarbonization of the sector.

The Glass sector has high emissions during the process of manufacturing glass. Major emissions could come also from upstream (raw material extraction). Material Investment module and Sold Product Performance module which are focusing on these two aspects will have important weights. The importance given to infrastructures (material investment) and raw material purchases (scope 3) can vary based on the type of products manufactured. These differences conduct to a proposition of setting a dynamic weighting of module 2 and module 4 depending on the share of scope 3 emissions. This metric can be used for a high variety of chemical compositions and type of products (hollow glass, flat glass with or without coating, fibres, …).

The importance given to clients and suppliers engagement can also vary based on the type of products manufactured. Hollow glass manufacturers could for example work with their clients on increasing the reuse rate of bottles or improve the collection rate for recycling while these levers will be less direct for flat glass of fibre manufacturers. These differences conduct to a proposition of also setting a dynamic weighting of module 6 and module 7 on the share of containers production.

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6.3.1. DYNAMIC WEIGHTINGS OF MODULE 2 AND MODULE 4

- **PRINCIPLE**

Modules are weighted depending on where the emissions of the assessed company are the most significant:

- The Module 2 (Material investment) is focussed on the actions of the company to reduce its Scope 1+2 emissions.
- The Module 4 (Sold product performance) is focussed on the actions of the company to reduce its Scope 3 upstream emissions (externalized glass melting emissions)

This dynamic calculation has been developed to consider the products variable CO2 emissions.

Note: For upstream Scope 3 emissions, the analyst should focus on the ones that are relevant for the company. The exercise is not to get an exhaustive list but identify main hotspots. If the company has no clear understanding of what their hotspots are, they should include all raw materials purchased to be sure not to miss an important one.

- **CALCULATION**

The $Share_{Scope3upstream}$ is defined at corporate level for the reporting year as:

$$Share_{Scope3\ upstream} = \frac{\sum(Scope\ 3\ upstream\ emissions)}{\sum(inclusive\ scope\ 1{+}2\ emissions) + \sum(Scope\ 3\ upstream\ emissions))}$$

The weights for Module 2 and Module 4 are calculated according to the formula:

$Weight_{M2}$ = 28% - 20% x $Share_{Scope3\ upstream}$

$Weight_{M4}$ = 8% + 20% x $Share_{Scope3\ upstream}$

6.3.2. DYNAMIC WEIGHTINGS OF MODULE 6 AND MODULE 7

- **PRINCIPLE**

Modules are weighted depending on where the levers of the company are the most significant:

- The Module 6 (Supplier engagement) is focussed on the actions of the company regarding their supplier (raw materials, energy, transport of raw materials).
- The Module 7 (Client engagement) is focussed on the actions of the company regarding their clients (reuse of the final product, transport of the finale product, recycling at the end of life).

This dynamic calculation has been developed to consider the different levers linked to the type of products.

- **CALCULATION**

The $Share_{Containers}$ is defined at corporate level for the reporting year as:

$$Share_{Containers} = \frac{Tonnage\ of\ containers\ produced}{Tonnage\ of\ all\ glass\ products}$$

The weights for Module 6 and Module 7 are calculated according to the formula:

$Weight_{M6}$ = 10% - 4% x $Share_{Containers}$

$Weight_{M7}$ = 6% + 4% x $Share_{Containers}$

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6.3.3. PERFORMANCE INDICATOR WEIGHTINGS AND PERFORMANCE MODULE WEIGHTINGS

For a first interpretation, indicators which are looking into the future have always higher weighting than indicator looking at the past. Some indicators are looking to the present (reporting year) situation and the strategy. This indicator could have high weightings because they will be more robust than indicators looking at the future situation.

TABLE 11: PERFORMANCE INDICATOR WEIGHTINGS

GL	Modules	Indicators	INTEGRATED AND GLASS MAKING ONLY	PRODUCT SHAPING ONLY
1.1	1.Targets	Alignment of relevant scope emissions reduction targets	10%	10%
1.2		Time horizon of targets	3%	3%
1.3		Achievement of previous targets	2%	2%
2.1	2.Material Investment (Scope 1+2)	Past performance	$Weight_{M2}$ x 10%	
2.2		Locked-in emissions	$Weight_{M2}$ x 35%	
2.3		Trend in future emissions intensity	$Weight_{M2}$ x 15%	3%
2.4		Alternative fuels and energy mix decarbonisation	$Weight_{M2}$ x 20%	5%
2.5		Recycled content integration strategy	$Weight_{M2}$ x 20%	
3.1	3.Intangible Investment	R&D in climate change mitigation technologies	6%	3%
3.2		Company low carbon patenting activity	3%	1%
4.1	4. Sold product performance (Scope 1+2+3 upstream)	Past performance including purchased glass production assets		6%
4.2		Purchased product interventions	$Weight_{M4}$ (8 – 28 %)	26%
5.1	5.Management	Oversight of climate change issues	2%	2%
5.2		Climate change oversight capability	1%	1%
5.3		Low-carbon transition plan	3%	3%
5.4		Climate change management incentives	1%	1%
5.5		Climate change scenario testing	3%	3%
6.1	6.Supplier engagement	Strategy to influence suppliers to reduce their GHG emissions	$Weight_{M6}$ x 50% (2 – 4 %)	3%
6.2		Activities to influence suppliers to reduce their GHG emissions	$Weight_{M6}$ x 50% (2 – 4 %)	4%
7.1	7. Client engagement	Strategy to influence customer behaviour to reduce their GHG emissions	$Weight_{M7}$ x 50% (2 – 4 %)	3%
7.2		Activities to influence customer behaviour to reduce their GHG emissions	$Weight_{M7}$ x 50% (2 – 4 %)	3%
8.1	8.Policy Engagement	Company policy on engagement with trade associations	1%	1%
8.2		Trade associations supported do not have climate-negative activities or positions	1%	1%
8.3		Position on significant climate policies	1%	1%

9.1	9.Business model	Low-carbon business activities that aim at increasing energy efficiency and the use of low-carbon energy or optimizing of the process	4% for hollow glass 3% for fibre glass and flat glass	4%
9.2		Low-carbon business activities that aim at developing synergies with other industries **(only for flat glass and fiber glass)**	6%	7%
9.3		Low-carbon business activities that aim at developing the circular economy (collecting, recycling and reuse)	7% for hollow glass 3% for fibre glass and flat glass	
9.4		Low-carbon business activities that aim at reducing the structural barriers to market penetration of low-carbon products without degrading the performance of the product	4% for hollow glass 3% for fibre glass and flat glass	4%
TOTAL			**100%**	**100%**

For integrated and Glassmaking only actors, the quantitatively scored Modules (Targets, Material investment, Intangible investment, Sold Product Performance) carry 61% of the final weight, and the qualitatively scored Modules (Management, Policy engagement, Business model) carry 39%.

For product shaping only actors, the quantitatively scored Modules (Targets, Material investment, Intangible investment, Sold Product Performance) carry 60% of the final weight, and the qualitatively scored Modules (Management, Policy engagement, Business model) carry 40%. The indicators within the Modules also carry their own weighting.

TABLE 12 : MODULE WEIGHTINGS

	INTEGRATED and GLASS MAKING ONLY		**PRODUCT SHAPING ONLY**	
Modules	**Weight**	**Rationale**	**Weight**	**Rationale**
1. Targets	**15%**	Fixed weight across all sectors	**15%**	Fixed weight across all sectors
2. Material Investment	**28%-8%**	Owned assets (production infrastructure) could represent a high source of emissions	**8%**	Owned assets do not represent a high source of emissions, but they need investments
3. Intangible Investment	**9%**	R&D investments for low-carbon innovation are crucial for the value chain	**4%**	R&D investments for low-carbon innovation could be important for the downstream actors.
4. Sold Product Performance	**8-28%**	Raw materials could be critical for some types of glass and product purchased could have high GHG emissions for upstream actors	**32%**	The upstream emissions represent a large part of emissions and can be assessed through the Sold Product Performance Module.
5. Management	**10%**	Fixed weight across all sectors	**10%**	Fixed weight across all sectors

6. Supplier	**4-8%**	Improvement potential by working with suppliers on raw materials substitution and transport is important	**7%**	Improvement potential by working with suppliers on raw materials substitution and transport is important
7. Client	**8-4%**	Improvement potential by working with client on the right Glass for the right application and increasing products collecting and recycling is important.	**6%**	Improvement potential by working with client on the right Glass for the right application and increasing products collecting and recycling is important.
8. Policy engagement	**3%**	Not crucial for this sector	**3%**	Not crucial for this sector
9. Business Model	**15%**	Business models are crucial to commit in a low-carbon transition	**15%**	Business models are crucial to commit in a low-carbon transition

6.3.4. RATIONALE FOR WEIGHTINGS

The selection of weights for both the Modules and the individual indicators was guided by a set of principles. These principles helped define the value of the 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 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 dimension of the transition.

According to the exchanges with the TWG and the bibliography work for the Glass sector, weightings have been defined as below:

Targets (15%)

The targets Module has a common weight for integrated and product shaping actors, weight is relatively high with 15%. Most of it is placed on the 'alignment of Scope 1+2 emissions reduction targets' with 10%. The 'time horizon of targets' have a medium weight of 3%. The 'time horizon of targets' is a proxy of how forward-looking the company is, which is very long-term oriented. Finally, the 'achievement of previous targets' indicator measures the company's past credentials on target setting and achievement, which provides more

contextual information on the company's ability to meet ambitious future targets. 2% score is attributed to this indicator.

Material Investment

Total weighting for the Module: 8-28% depending on the share of upstream scope 3 emissions. **Description of the weighting for:** • **integrated actors** • **glass melting actors**	**Total weighting for the Module: 8%** **Description of the weighting for:** • **Product shaping actors**
Manufacturing of glass requires high and long-term investments with best available technologies. Roadmaps specific to the glass sector show that resources and energy efficiency are key for low-carbon transition. **This is the primary module that assesses the development of the company's assets, and how these existing assets influence the likelihood of a low-carbon transition.** **In the short-term, the company's current portfolio and confirmed planned assets are used to generate an estimate of the company's "locked-in emissions". This indicator tries to measure the amount of GHG emissions that the company has already committed from its individual carbon budget. It is very future oriented and receives 35% of the weight of the module.** **The "trend in future emissions intensity" indicator uses the same information but is a direct measurement of the decarbonization pathway, with a high impact of variation, and which looks to the future, it receives a weighting of 15% of the weight of the module.** **The "past performance" is an indication of the 'adjustment' that the company must make to place itself on a low-carbon pathway. 10% of the weight of the module is attributed to this indicator.** **The "Alternative fuels and electric activities" indicators is a measurement of the actions**	Product shaping actors have fewer high investments and the scope 1 emissions do not represent a high source of emissions. Thus, the total weight for this module is 8%. The highest weighted indicator is "alternative fuels and electric activities", it is a measurement of the actions taken to reduce the GHG impact of fuel combustion. As fuel combustions plays a high part in scope 1 GHG emissions of the sector, this indicator is given a 5% weight. The indicator "trend in future emissions intensity" is weighted 3%. Locked-in emissions are not relevant here.

taken to reduce the GHG impact of fuel combustion. As fuel combustions plays a very important part in total GHG emissions of the sector, this indicator is given 20% of the weight of the module. **Finally, the "recycled content integration strategy" is also looking at the future improvements in resources by increasing the use of cullet. 20% of the weight of the module is attributed to this indicator.**	

Intangible Investment

Total weighting for the Module: 9% **Description of the weighting for** • **integrated actors** • **glass melting actors**	**Total weighting for the Module: 4%** **Description of the weighting for** • **product shaping only actors**
Intangible investment is focused entirely on R&D. **As decarbonization timescales in taking technologies from the laboratory to market for the Glass industry could be long. Intangible investment is a necessary condition for the sector to achieve progress in technology for a low-carbon future, and large R&D programs in climate-mitigating technologies are indicative of a strong financial commitment by the company. The analysis would like to focus on those R&D processes that contribute to climate change mitigating technologies, described in R&D in climate change mitigation technologies and patent activity in a lower action.** **"R&D in climate change mitigation technologies" reflects the R&D efforts of the company to prepare their low-carbon transition and is weighted 6%. As "low carbon patenting activity" is a new way to assess R&D involvement of a company, low weight (3%) is attributed to this indicator.**	R&D is not a key to decarbonize the sector for product shaping only actors because their assets are not high emitting. They can have R&D on Glass shaping/tempering. A low rating of 1% is attributed to the "company low carbon patenting activity" and a slightly higher rating of 3% is given to "R&D in climate mitigation technologies" indicator.

Sold Product Performance

Total weighting for the Module: 8% to 28% depending on the share of upstream scope 3 emissions. **Description of the weighting for** • **integrated actors** • **glass melting actors**	**Total weighting for the Module: 32%** **Description of the weighting for** • **product shaping only actors**
For some glass products, raw materials are one of the most important GHG emissions. This module focusses, for integrated actors, on "Purchased product interventions" by evaluating the actions regarding the most impacting raw materials. **This module in evaluated by only one indicator and the weight it is given varies from 8% to 28% depending on the share of scope 3 emissions of the company.**	As the locked-in emissions are less important for product shaping companies than for integrated actors, this module needs to encourage downstream actors to have best practices from hotspot suppliers via "purchased product interventions" indicator. This indicator is given a 26% weight. Since purchased glass is the main GHG emission for most of these actors, the "past performance including purchased glass production asset" is also evaluated. This indicator is only given a 6% weight since it focuses on past actions.

Management (10%)

Management is a multi-faceted Module. It incorporates many different smaller indicators that together draw a picture of the company's management and strategic approach to the low-carbon transition.

Going by the principle of future orientation, the main part of this weight is placed on the "*low-carbon transition plan*" and on "*climate change scenario testing"* weighted each at 3%. The transition plan provides more information on how this company will specifically deal with the transition, given its unique constraints and opportunities, and therefore provides valuable insights into the company's planning and narrative towards the final goal. The adaptation to the climate change is inevitable for now and until 2050. "C*limate change scenario testing"* provides more information on how this company will specifically deal with the transition, given its unique constraints and opportunities, and therefore provide valuable insights into the company's planning and narrative towards the final goal.

The indicators "*oversight of climate change issues"* and *"Climate change management incentives"* are weighted 1% each. This indicator provides more information on how this company is managed and if decisions are coming from the top management. They are contextual indicators the outcome of which can strengthen or undermine the company's ability to carry out the transition plan and meet ambitious science-based targets.

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Suppliers Engagement

Total weighting for the Module: 4% to 8% depending on the share of containers produced. **Description of the weighting for:** • **Integrated actors** • **glass melting actors**	**Total weighting for the Module: 7%** **Description of the weighting for** • **product shaping only actors**
In order to develop the technology required for the low-carbon transition, it is essential that all actors involve their supply chains. This indicator focuses on the global strategy and general activities that a company has in place with respect to its engagement with suppliers. Nonetheless, it is not an indicator that is easy to measure and relies heavily on data quality to make a proper analysis. **The supplier engagement module for hollow glass is less important than for other types of glass because levers of decarbonisation are more on the downstream value chain.** **For flat glass and fiber glass, the collaboration and activities with the supplier is important to produce low-carbon products and keep them performing.**	
Suppliers for upstream value chain could be strategic, compared to the rest of the value chain. Considering these aspects, this indicator is given could vary between 4 to 8%.	Product shaping actors have medium level of influence on the upstream actors. Therefore, considering these aspects, this indicator is given a weight of 7%.

Client Engagement

Total weighting for the Module: 4% to 8% depending on the share of containers produced. **Description of the weighting for** • **Integrated actors** • **glass melting actors**	**Total weighting for the Module: 6%** **Description of the weighting for** • **product shaping only actors**
The client engagement Module is focused on the company's efforts to promote low-carbon products, more efficient use of Glass (right Glass for the right use, with the right quantities) and recycling of products to their customers. This is an important characteristic to identify companies making real efforts to make low-carbon glass a significant part of their sales. **For hollow glass, the client engagement indicator is more important than the supplier engagement because levers of decarbonisation are more on the upstream value chain. This type of product is directly used by a consumer and need to be collected to be reintroduced in the process.** **For flat glass and fiber glass, the client engagement module concerns very often business and the rate of end-of-life product to be collected is lower than hollow glass.**	
Clients for some type of glass could be strategic (buildings, mobility…), compared to the rest of	Product shaping actors have medium level of influence on the upstream actors. Therefore,

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the value chain. Considering these aspects, this indicator is given could vary between 4 to 8%.	considering these aspects, this indicator is given a weight of 6%.

Policy Engagement (3%)

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. The total weight for this Module is therefore low at 3%.

Business Model (15%)

The integration of a low-carbon economy in current and future business models is a composite indicator that 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 their narrative on certain future directions that the sector can/must take to transition. As this is an important aspect of any business long-term future planning, it holds a medium weight of 15% in the analysis.

This module could be very important for the glass sector because it will drive the activities in the next years. Furthermore, synergies and collaboration with other sectors is essential to reach the objectives in 2050 because the business model might involve benefits (potentially revenues) associated with the contribution of the company to the decarbonisation of client activities (most specifically those of carbon-intensive sectors).

The indicator 'Low carbon business activities that aim at increasing energy efficiency and the use of low-carbon energy or optimizing of the process' has been developed to support the material investment and the R&D to decarbonize the assets. This is a necessary pathway to decarbonize the glass industry as described in the "Common Challenges" webpage of Glass Alliance for Europe5. This indicator is weighted between 3 and 4%.

The "*synergies with other sectors*" indicator is necessary because this can have major impacts on the company's future business model. The glass is a material that need a better use by other sectors (construction, mobility, energy…) to help them to decarbonize. This indicator, weighted at 6%, asks glass companies how they are engaging with the projected world shift under a low-carbon scenario.

The '*Business activities around the circular economy'* covers for example, waste management and integration of recycled resources into glass material. It is weighted between at 3% for flat glass and fiber glass products.

[5] https://www.glassallianceeurope.eu/en/common-challenges

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The development of business activities for reusing bottles and jars in hollow glass sub-sector could create new ways of living if proofs of heir environmental benefits are demonstrated.

The '*Business activities that reduce barriers to market penetration of low-carbon glass'* indicator includes those aspects that are relevant to innovative low-carbon glass adoption but are not directly a part of the primary manufacturing activities. Glass manufacturing is the core activity of the companies and with rising populations, continued manufacture of glass will be necessary, giving this indicator a weighting between 3 and 4%.

7. Integration of Physical risks and Adaptation in ACT

7.1. INTRODUCTION AND CONTEXT

There is a lack of standardized framework for analyzing 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.

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- 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 analyzed.
- A **glossary** of climate physical risks and adaptation terms is available at the end of this document.

7.2. PHYSICAL CLIMATE RISKS AND ADAPTATION MATURITY MATRIX

The two dimensions of the maturity matrix are climate physical risks and adaptation.

Two sub-scores for the physical risks and adaptation part will be computed, following the maturity matrix calculation in 5.3.2.

- **PHYSICAL CLIMATE RISKS**

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).

- **ADAPTATION**

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

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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 (21).

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1218 **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 eventually 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 analyzed 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 analyzed 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 analyzed 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 analyzed along the complete value chain performance

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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 analyzed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analyzed, 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, analyzed, 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 analyzed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analyzed, 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, analyzed, 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 analyzed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analyzed, 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, analyzed, 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 (e.g.: 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 (e.g.: 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, analyzed, and quantified for the main hazards identified (e.g.: 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.	The most relevant impacts and vulnerabilities were considered, analyzed, quantified, and monitored (regularly updated) for the main hazards identified (e.g.: 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	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 (e.g.: 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 (e.g.: 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 (e.g.: 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/partnerships 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 (e.g.: 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 (e.g.: 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 resources Financing available to implement actions					
7	The company has not engaged any adaptation strategy regarding its financial resources 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 (e.g.: 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 analyzed 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 (e.g.: 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 analyzed in the first module in terms of hazards, scenarios, data and value chain. Identification of climate-related opportunities and development

Technological resources Technologies, techniques, and new solutions					
8.1 Technical tools and solutions	The company has not engaged any adaptation strategy regarding its technological resources or took any measure	Start/beginning 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 (e.g.: 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 (e.g.: 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 resources The specific skills and working time that the company mobilizes					
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 responsibility 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 responsibility for climate change (i.e., module 6.1) It concerns between 60% and 80% of team's 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 responsibility for climate change (i.e., module 6.1) It concerns above 80% of team's 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

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7.3. PHYSICAL RISKS AND ADAPTATION 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%	

8. Rating

The ACT rating shall comprise of:

→ A Performance Score

→ A Narrative Score

→ A Trend Score

→ A Climate Physical Risks and Adaptation 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.
d. **Climate Physical Risks and Adaptation score** as a number from 1 (lowest) to 20 (highest)

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 13: 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.
	A **climate physical risks and adaptation rating** of **20**: the company received high scores in its assessment against the maturity matrixes assessment

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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.

8.1. PERFORMANCE SCORING

A detailed description of the Performance indicators and of their weightings for the Glass sector is presented in 5.3 Performance indicators and 6.3 PERFORMANCE SCORING Weightings.

TO BE COMPLETED with figure after road test phase.

Performance scoring shall be performed in compliance with the ACT Framework.

8.2. NARRATIVE SCORING

Narrative scoring shall be performed in compliance with the ACT Framework, assessing the company on the 4 following criteria:

- Business model and strategy
- Consistency and credibility
- Reputation
- Risk

For modules 5, 6, 7, 8, the CDP questionnaire could integrate all the activities (and not only the glass activities) of the company. This should be considered in the narrative scoring.

The organisation of the company – type of actors and assets – shall be considered in the narrative assessment and narrative scoring for the glass sector.

The information reported in modules 2, 4 and 9 shall be considered with peculiar attention for the narrative analysis and narrative scoring for the glass sector because they assess most parts of CO2 emissions due to glass melting. Especially in indicators:

- 2.4; Purchasing electricity from the grid is easier than setting up an on-site electricity generation. The actions of developing on site generation which is also linked with more self-sufficiency (physical risks link to climate change adaptation) should be rewarded in the narrative scoring.
- 4.2; Raw materials management that could be hotspots or free of impacts should be justified.
- 8:2 It should also be considered if the company is supporting trade associations with climate-positive activities and/or positions.
- 9.2; the analyst should look at the way avoided emissions are reported (indicator). Avoided emissions should not prevent efforts from a company to reduce its direct and indirect emissions. The analyst should make sure that avoided emissions reporting are linked to an improvement on the material investment, making sure that a lack of improvement of GHG scopes emissions is not linked to an increase of the sold product performance (avoided emissions) that finally benefit the emission reduction level as a whole. GHG emissions should not be the only life cycle assessment category

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covered (in order to avoid pollution transfer). Avoided emissions shall never be deduced from current emissions of a given company.

Finally, the analyst should also look at the way that the industry is integrating circular economy actions in their strategy (module 4 and module 9).

With this information, the analyst can take a holistic view on the company's actions to perform deep decarbonization of its process and assess the consistency of actions taken with respect to targets, business model and engagement with other stakeholders.

No other sector-specific issue impacting the narrative scoring for this sector has been identified to date.

8.3. 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 14 : RELEVANT PERFORMANCE INDICATORS FOR TRENDS IDENTIFICATION FOR THE I&S SECTOR

MODULE	INDICATOR
1.TARGETS	GL 1.1 Alignment of relevant scope emissions reduction targets GL 1.2 Time horizon of targets
2. MATERIAL INVESTMENT	GL 2.2 Locked-in emissions GL 2.3 Trend in future emissions intensity GL2.4 Alternative fuels and energy mix decarbonisation
3. INTANGIBLE INVESTMENT	GL 3.1 R&D in climate change mitigation technologies
4. SOLD PRODUCT PERFORMANCE	GL 4.2 Purchased product interventions
5. MANAGEMENT	GL 5.3 Low-carbon transition plan GL 5.5 Climate change scenario testing
6. SUPPLIER	GL 6.1 Strategy to influence suppliers to reduce their GHG emissions
7. CLIENT	GL 7.1 Strategy to influence customer behaviour to reduce their GHG emissions
9. BUSINESS MODEL	GL 9.1 Low-carbon business activities that aim at increasing energy efficiency and the use of low carbon energy or optimizing he process GL 9.2 Low-carbon business activities that aim at developing synergies with other industries (only for flat glass and fiber glass) GL 9.3 Low-carbon business activities that aim at developing the circular economy

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GL 9.4 Low-carbon business activities that aim at reducing the structural barriers to market penetration of low-carbon products without degrading the performance of the product

8.4. CLIMATE PHYSICAL RISKS AND ADAPTATION SCORING

A detailed description of the indicators and of their weightings for the Glass sector is presented in section 7.2 physical Climate risks and adaptation maturity matrix.

The final score for the physical risks and adaptation part will be a rate between 1 and 20, based on a weighted average of the corresponding modules. Thus, this score will be computed in the same way as the performance score rating computation method, but it will be separate and independent from it, in order to have a mitigation and an adaptation rating. In order to give deeper recommendations to the company, the analyst could have a look to climate physical risks scoring and to adaptation scoring separately.

TO BE COMPLETED after public consultation and road test phase.

9. Aligned state

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

→ 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 these plans and actions fit together? **[Consistency]**

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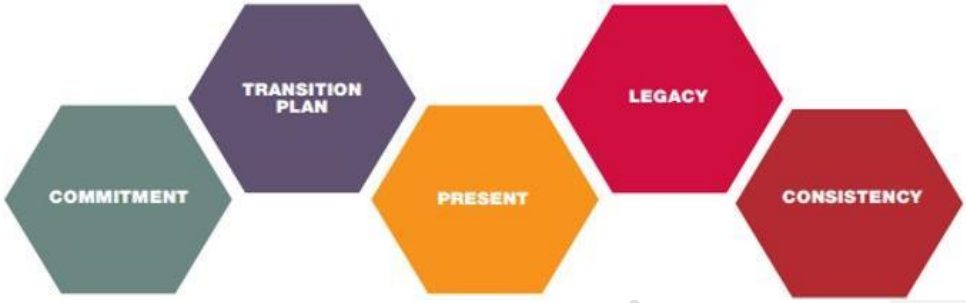

The company has set emissions reduction targets on the major segments of its value chain (highly intensive production processes) without degrading performance of the products. These objectives are aligned with a relevant time horizon which reflects the lifetime of the company assets, its products, and services.	The company understands where in the value chain the majority of its embedded emissions are. Therefore, the company discloses a transition plan that explains operation steps to achieve their objectives.	Current strategies and actions (in the R&D, with suppliers and clients) 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 a strong actor in the circular economy during all the life cycle stages of the product.

FIGURE 31: ALIGNED STATE FOR COMPANIES IN THE GLASS SECTOR

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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.
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.
ACTIONS THAT DO NOT (SIGNIFICANTLY) HARM MITIGATION, BIODIVERSITY, 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 is not made at the expense of others and recognises the reinforcing relationships between different environmental objectives. (2)
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

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definitions).

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. (21)

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. (21)

ADEME

Agence de la Transition Ecologique; The French Agency for Ecological Transition (ADEME webpage).

ADVANCED VEHICLE

Advanced vehicles include:

- Plug-in hybrid vehicles (PHEV)
- Battery electric vehicles (BEV)
- Fuel cell electric vehicles (FCEV)
- Conventional hybrids
- Other high-efficiency ICE vehicles

Conventional hybrids and other high-efficiency ICE vehicles are advanced vehicles, but they are not low-carbon vehicles.

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.

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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, based on a principle of convergence or contraction of emissions intensity.
Board	Also the “Board of Directors” or “Executive Board”; the group of persons appointed with joint responsibility for directing and overseeing the affairs of a company.

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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 Capture, Use and Storage (CCU/S)	Carbon Capture, Use and Storage (CCU/S) is a process in which CO2 is captured and then used to produce a new product. If the CO2 is stored in a product for a climate-relevant time horizon, this is referred to as carbon dioxide capture, utilization, and storage (CCUS). Only then, and only combined with CO2 recently removed from the atmosphere, can CCUS lead to carbon dioxide removal. CCU is sometimes referred to as carbon dioxide capture and use
Carbon Dioxide Removal technologies (CDR)	Carbon Dioxide Removal technologies (CDR) are anthropogenic activities removing CO2 from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products. It includes existing and potential anthropogenic enhancement of biological or geochemical sinks (afforestation, reforestation, land management, bio-energy carbon capture and storage, enhanced weathering, etc.) and direct air capture and storage (DAC).
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

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	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).
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. (21)
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)
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.

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Company pathway	A company's past emissions intensity performance pathway up until the present.
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.
Conservativeness	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.
Conventional (technology)	In relation to automobiles and emissions, conventional internal combustion engines (ICE) are those that generate motive power by burning fossil fuels, as opposed to advanced (low-carbon) vehicle engines such as battery electric vehicles or hydrogen fuel cells.
COP21	The 2015 United Nations Climate Change Conference, held in Paris, France from 30 November to 12 December 2015 (COP21 webpage).
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)).
Decarbonization	Benchmark pathway (See 'Benchmark')

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PATHWAY	
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. (21)
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.
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. (21)
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). (21)
FINANCIAL RESSOURCES	It is the funds available to implement its adaptive capacity. (ADEME, 2019)
FLEET	A group of vehicles (e.g., all the automobiles manufactured by an automotive manufacturing company and currently in use by private individuals).
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.

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Greenhouse gas (GHG)	Greenhouse gas (e.g., carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and three groups of fluorinated gases (sulphur hexafluoride (SF6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs)) which are the major anthropogenic GHGs and are regulated under the Kyoto Protocol. Nitrogen trifluoride (NF3) 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).
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. (21) A climate hazard should be appreciated in function of its likelihood, magnitude and duration.
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.
Human ressources	It is the internal skills and working time that the company uses to improve its adaptive capacity. (ADEME, 2019)
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

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	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	The low-carbon transition is the transition of the economy according to a low-carbon

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TRANSITION	scenario.
LOW-CARBON VEHICLE	Vehicles described as low-carbon (LCV) are defined as vehicles that have a drivetrain that have the potential to operate on non-fossil energy sources for at least > 50% of their common use phase. This includes: ♦ Plug-in hybrid vehicles (PHEV) ♦ Battery electric vehicles (BEV) ♦ Fuel cell electric vehicles (FCEV) Conventional hybrids are excluded from the definition of low-carbon vehicles. Because conventional hybrids do not eschew fossil fuels (aside from the minor addition of biofuels into the fuel mix), they are not qualified for the definition of an LCV.
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).
ORGANIZATIONAL CAPACITY	It is the governance bodies, exchanges, decision-making processes and the management mode that contribute to its adaptive capacity. (ADEME, 2019)
PATHWAY	A way of achieving a specified result; a course of action (e.g., an emissions reduction

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(EMISSIONS)	pathway).
PERFORMANCE	Measurement of outcomes and results.
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). (21) 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.

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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 (CO2) 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 movements	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

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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 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.
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

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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).

(21)

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.

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. (21)

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

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	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

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	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, the Sectoral Decarbonization Approach (SDA) was developed. The SDA takes a sector-level approach and employs scientific insight to determine the least-cost pathways of mitigation and converges all companies in a sector towards a shared emissions target in 2050.
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).
Sustainable biofuels and sustainable Biogas	If produced from the advanced bioenergy feedstock listed in Annex IX of Directive (EU) 2018/2001. Only production of advanced biofuels as per Art2(34), and certified low-ILUC fuels, in line with the requirements of RED II, is eligible. If primary forest-related feedstock (item (o) of Annex IX, Part A of Directive (EU) 2018/2001) is used, it must be produced in economic activities fulfilling the Afforestation & Reforestation, and/or

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	Rehabilitation & Existing Forest Management criteria. If crop feedstock is used, it must be produced in economic activities fulfilling the Growing of Perennial Crops or the Growing of Non-perennial Crop's criteria. Green EU taxonomy alignment
Sustainable electricity storage equipment	All electricity storage is eligible except storage technology which uses hydrocarbons as a medium of storage is not eligible; for hydrogen storage: Direct CO2 emissions from manufacturing of hydrogen: 0.95 tCO2e/t Hydrogen; electricity use for hydrogen produced by electrolysis is at or lower than 50 MWh/t Hydrogen; average carbon intensity of the electricity produced that is used for hydrogen manufacturing is at or below 100 gCO2e/kWh. Green EU taxonomy alignment
Sustainable hydrogen	Hydrogen which meets the following requirements: • Direct CO2 emissions from manufacturing of hydrogen: 0.95 tCO2e/t Hydrogen • Electricity use for hydrogen produced by electrolysis is at or lower than 50 MWh/t Hydrogen • Average carbon intensity of the electricity produced that is used for hydrogen manufacturing is at or below 100 gCO2e/kWh Green EU taxonomy alignment
Sustainable renewable electricity	Facilities operating at life cycle emissions lower than 100gCO2e/kWh, declining to 0 gCO2e/kWh by 2050, are eligible; this is applicable to production of electricity from solar PV, concentrated solar power, wind power, ocean energy, hydropower, geothermal and bioenergy – production of electricity from gas combustion is not included. Green EU taxonomy alignment
Target	A quantifiable goal (e.g., to reduce GHG emissions). ♦ The following are examples of absolute targets: → metric tonnes CO2e or % reduction from base year → metric tonnes CO2e or % reduction in product use phase relative to base year → metric tonnes CO2e or % reduction in supply chain relative to base

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year

- The following are examples of intensity targets:
  - → metric tonnes CO2e or % reduction per passenger. Kilometre (also per km; per nautical mile) relative to base year
  - → metric tonnes CO2e or % reduction per square foot relative to base

metric tonnes CO2e or % reduction per MWh

TECHNICAL RESSOURCES	The technologies, techniques and new solutions that contribute to improving its adaptive capacity. (ADEME, 2019)
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).
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 risk's thresholds in space and time then allows to prioritize and sequence incremental adaptation solutions. (ADEME, 2020)
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).
TRANSFORMATION	A change in the fundamental attributes of natural and human systems. (21)
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).

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TRANSPORT	To take or carry (people or goods) from one place to another by means of a vehicle, aircraft, or ship.
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.
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. (22)
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. (22)
WEIGHTING	The allowance or adjustment made in order to take account of special circumstances or compensate for a distorting factor.

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Annex

10.1. TWG MEMBERS

Commenté [DZ2]: Do we want to remove the names and just keep the company names, and perhaps the position of the TWG members in their organisation? Perhaps this should be checked against what we have done in the past.

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 15: LIST OF TWG MEMBERS

ORGANISATION	NAME
AGC Glass	Rémi BAGARD
AGC Glass	Okimura CHIAKI
Ardagh group	Annelene IKEMANN
CANDRIAM	Alix CHOSSON
French Glass Association	Xavier CAPILLA
Glassglobal Group	Bettina HEUTER
IEA	Tiffany VASS
International Cookware (Pyrex)	Johann BRUNIE
International Cookware (Pyrex)	Cécile SONGORO
Novasirhe	Idriss KATADRA
O-I	Beatrice JAMOT
O-I	Rodolphe VALLIENNE
O-I	Sutapa BHADURI
O-I	John Nordmeyer
Owens Corning	John AUGUSTINE
Owens Corning	Emmanuel CECILLE
Owens Corning	John McVEY
Owens Corning	Josh STRAKE
Pochet Group	Pierre DEHE
Saint-Gobain	Emmanuel ABT
Saint-Gobain	Nicolas BAGLIN

Saint-Gobain (Placoplatre)	Sandrine JACQUET
Saint-Gobain (Placoplatre)	Valentin ROUSSEAU
Stoelzle Glass Group	Stéphane BODIN
Stoelzle Glass Group	Birgit SCHALK
Verallia	Sophia ELASRI
Verallia	Laetitia FABRE
Verallia	Cécile FAGES
Welya SAS	Olivier PONS y MOLL
Abividro	Caroline MORAIS
Abividro	Carlos MAZZOTTI OLIVEIRA

10.2. COMPANIES INVOLVED IN THE ROADTEST (TO BE COMPLETED AFTER ROADTEST)

TABLE 16: LIST OF COMPANIES INVOLVED IN THE ROADTEST

COMPANIES

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10.3. PEDAGOGICAL GRAPHS FOR INDICATORS USING TREND RATIO

Illustration of the different cases

CASE 1

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

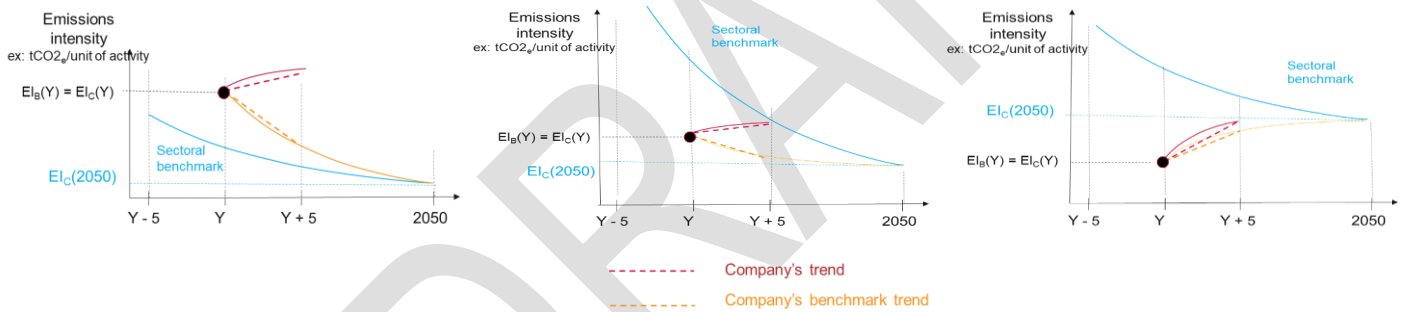

FIGURE 32: TREND RATIO - CASE 1

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CASE 2

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

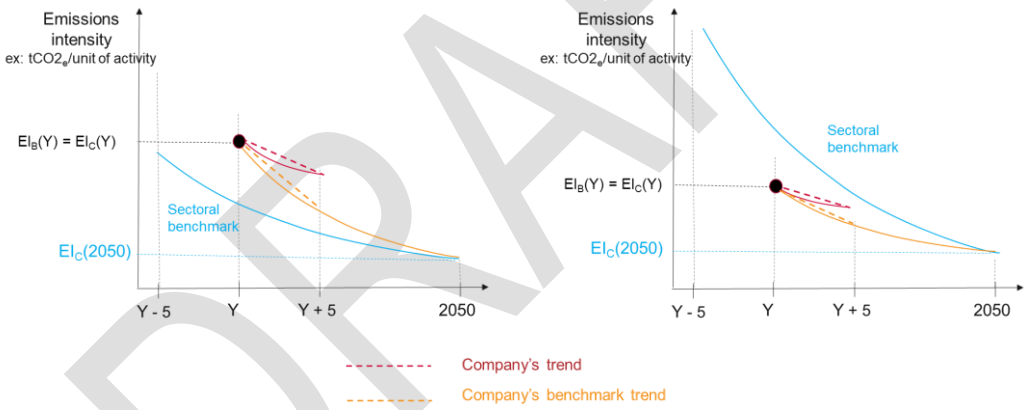

FIGURE 33: TREND RATIO - CASE 2

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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%

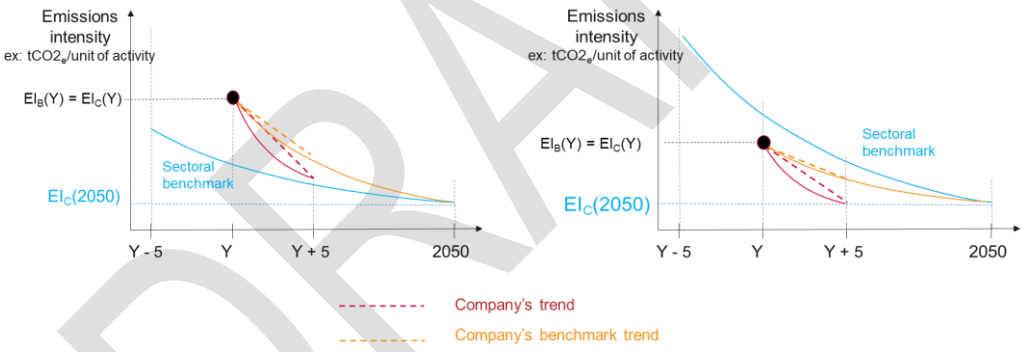

FIGURE 34: TREND RATIO - CASE 3

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CASE 4

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

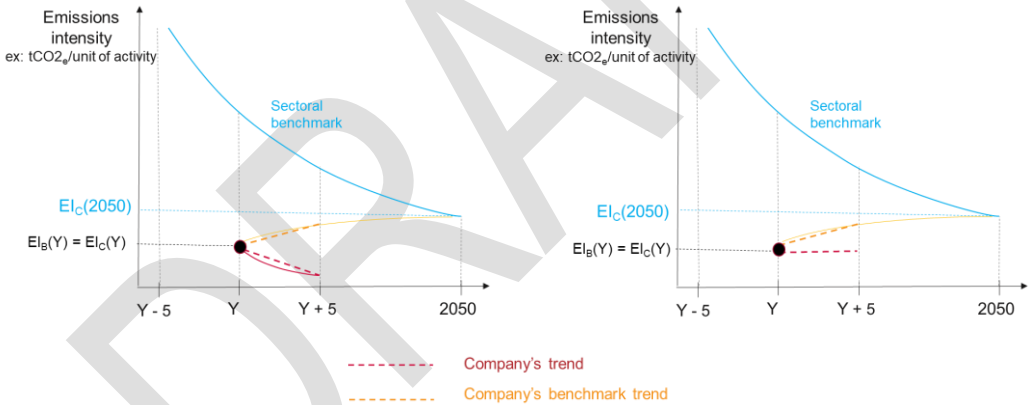

FIGURE 35: TREND RATIO - CASE 4

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