ACT

ACT | ASSESSING LOW CARBON TRANSITION®

Assessing low-Carbon Transition

Aluminium

(version 1.1 – September 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 Aluminium methodology aligns with other reporting frameworks where applicable (e.g. CDP, TCFD, EU Taxonomy).

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.

Why do we need to develop a methodology for aluminium sector?

Aluminium is the second most-used metal in the world in terms of metric tonnes produced after iron, hence the most used non-ferrous metal worldwide [2]. **The aluminium industry is currently responsible for 2% of global GHG emissions** and generates about 1.1 billion tonnes of CO_{2e} annually [3]. Primary aluminium production is highly energy-intensive, with electricity making up a large share of the energy consumed.

Aluminium is a key metal, especially in the context of the energy transition thanks to its qualities (lightness, strength, durability, electrical and thermal conductivity, formability and recyclability). Aluminium can be used for lightweight vehicles, solar energy (solar energy systems use aluminium for various components, including for mounting and framing solar PV panels and for reflectors in concentrating solar power systems) and in the electric power grid and electrical cables along with copper [4]. **Aluminium demand is thus expected to grow** and reach 174 Mt of aluminium in 2050 (86 Mt for primary aluminium production, 88 Mt for recycled aluminium production) [5].

A low-carbon world therefore requires a low-carbon transition of the aluminium sector.

Even though aluminium can be recycled almost infinitely [6], the recycled aluminium production route, which consumes around 5% of the total energy consumption compared to the primary aluminium production route [7], will not be sufficient to meet the growing demand for aluminium, all the more that aluminium also has the particularity to have an important expected lifetime. Indeed, of the estimated 1,5 billion metric tonnes of aluminium that have been produced since 1880, three quarters are still in use [8]. In 2019, 36% are located in buildings, 25% in electrical cables and machinery, and 30% within transport applications [5]. However, demand met from scrap is expected to grow from around one third of the current aluminium production to 50-60% in 2050 [6].

Alongside material efficiency strategies, R&D is needed on innovative alternative production methods that reduce primary production process and combustion emissions, and more energy-efficient equipment and operations would be beneficial.

Given the considerable amount of electricity consumed in the aluminium sector, decarbonizing the power sources would help reduce indirect emissions and is thus a key complement to reducing direct aluminium emissions. Moreover, the aluminium can play a role in providing flexibility to the power grid as aluminium smelters consume a great amount of electricity. This might be a key topic especially in a context of an increasing share of intermittent electricity production means (photovoltaic and wind turbines).

All of these diverse levers of the Aluminium sector transition will be addressed by the ACT assessment methodology.

1.1. INTRODUCTION TO ALUMINIUM

Two main routes are currently used to produce aluminium:

- Primary aluminium production. It starts with the mining of bauxite, which is then refined to obtain the alumina (aluminium oxide). The alumina is then smelted through the electrolysis process to produce aluminium that is cast to obtain aluminium ingot. Aluminium smelting produces aluminium dross (similar to iron slag), which can be recycled into aluminium metal and aluminium oxide. Aluminium oxide has a variety of industrial uses which includes being used in paint, dye, concrete, explosives, and fertilizer. Anode production is also included in the primary route, as it will be used during the electrolysis and its associated CO_2e emissions are included in the low carbon pathways selected.
- Secondary aluminium production or recycled aluminium production. The aluminium is produced entirely from scrap in this route. There are two different types of scrap that can be recycled in the secondary route: pre-consumer scrap and post-consumer scrap. Both remelters and refiners will be involved in the secondary routes. Refining is different from alumina extraction, which can also be called alumina refining. Pre-consumer scrap is the scrap generated during the processes to produce aluminium. Companies can process the scrap they generated themselves (internal scrap remelting) or buy it from scrap traders. Post-consumer scrap is recycled aluminium from end use products (e.g. vehicles, buildings etc.). It often requires chemical treatment to remove impurities through refining. Aluminium companies can purchase scraps from others and traders (recycling step of the value chain) or process the scrap the generated themselves (internal scrap remelting step of the value chain).

A more detailed description of the aluminium production is presented in the figure below. At the top of the figure, the primary production route is described with the bauxite mining and the anode fabrication, which are the two main inputs before the smelting step of aluminium through electrolysis. At the right of the figure, the scrap is

represented and will be used in the recycled aluminium production route. Both routes will enable to create semi-finished aluminium products [7].

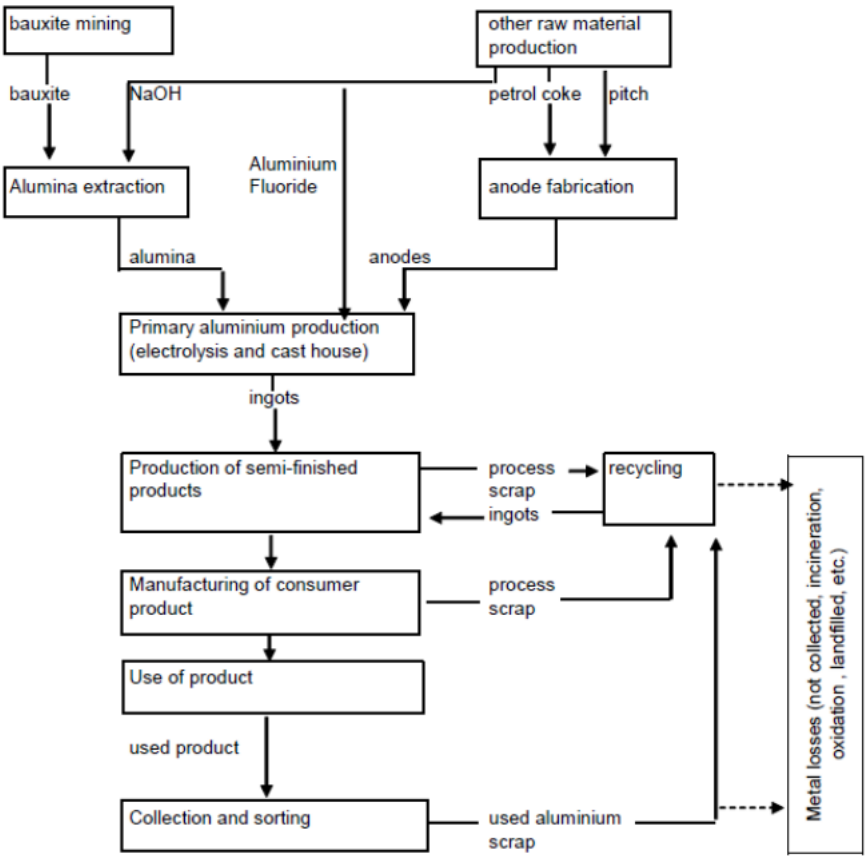

FIGURE 1: OVERVIEW OF THE ALUMINIUM PRODUCTION PROCESSES

The figure below shows the overview of the aluminium recycling process [9].

FIGURE 2: THE RECYCLING PROCESS OF ALUMINIUM

The aluminium recycling industry is comprised of remelters and refiners that will not process the same type of scrap. Remelting and refining will be considered as “routes” to produce aluminium.

- Remelters will process new scrap, which is a surplus of materials arising during the production of aluminium before being sold to end consumer, to produce aluminium alloy ingots. This remelting takes place at cast houses of primary aluminium smelters. Remelters will also process a small share of old scrap, which is the aluminium material recovered after an aluminium product has been recycled at the end of its lifetime.
- Refiners will produce also aluminium alloy ingots from the bulk of the old scrap collected. Refining is necessary as the aluminium content of old scrap is often lower than of new scrap, which requires then additional efforts to remove impurities. Refiners will also process new scrap [7].

To summarise, remelting and refining do not concern the same scrap used as inputs in terms of proportion, they do not have the same processes, and they do not produce the same type of aluminium outputs. The following figure provides more details on the different outputs and different next processes for the remelting and refining routes [10]. In ACT Aluminium, and according to International Aluminium Institute, the segmentation retained will be recycling (mixing both remelting and refining from pre and post-consumer scrap) versus internal scrap remelting.

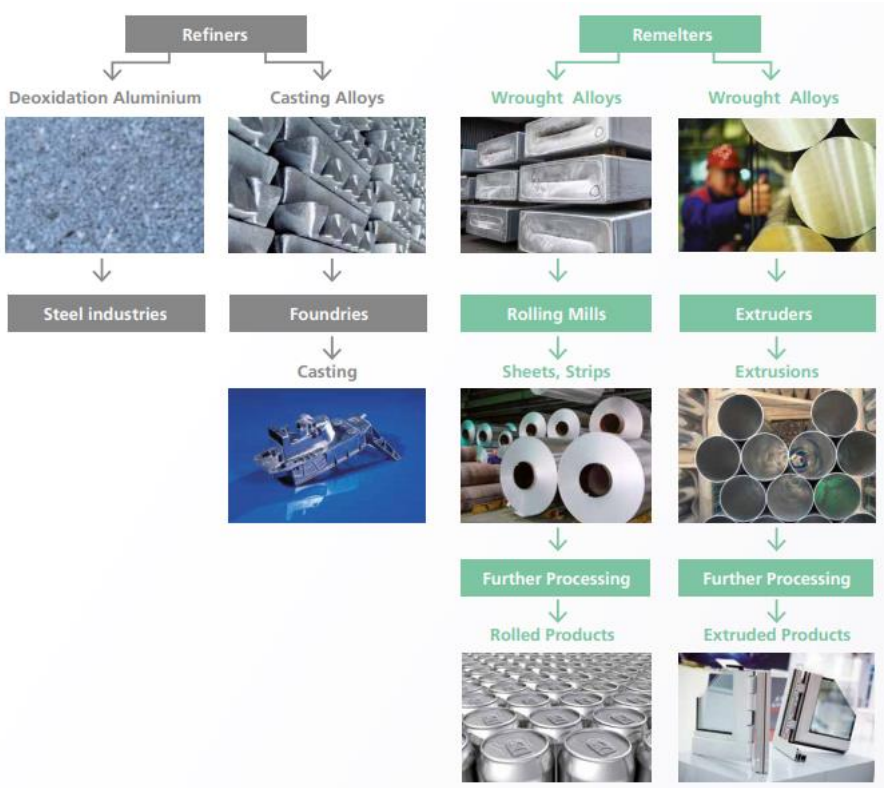

FIGURE 3: FOCUS ON THE REMELTING AND REFINING ROUTES AND PROCESSES

Even if aluminium can be recycled almost infinitely, a lack of available scrap limits the potential of this route. Indeed, secondary aluminium materials, or scrap, are not available in sufficiently high quantities or lack of quality [11]. The recycled aluminium production route, comprised of both the remelting and refining routes, accounted for more than 50% of the total aluminium production worldwide in 2019 [12].

Aluminium is used in a wide range of applications and industries. The following figure highlights the global end use of aluminium as of 2019 [6]. The Transport and Construction industries account for more than the half of all aluminium consumption in the world.

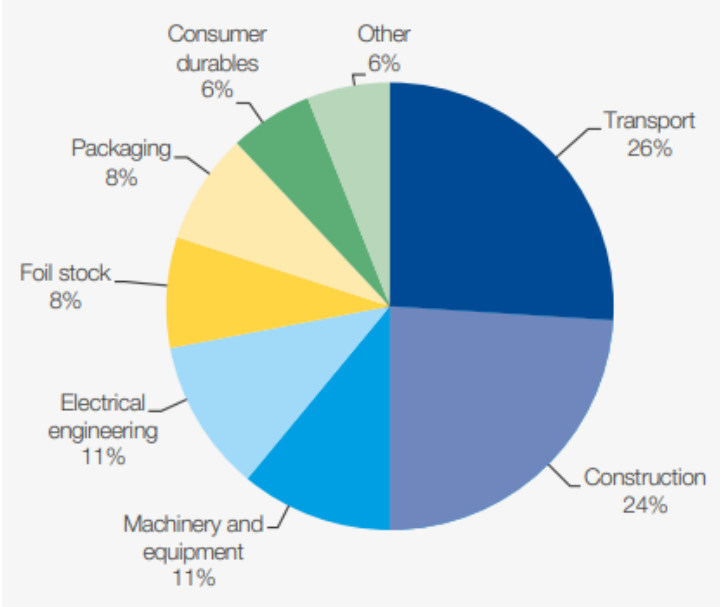

FIGURE 4: GLOBAL ALUMINIUM FLOW

Some definitions of the end use highlighted above:

- Consumer durables: as any type of products purchased by consumers that are manufactured for long-term use. As opposed to many goods that are intended for consumption in the short term, consumer durables are intended to endure regular usage for several years or longer before replacement of the consumer product is required. Just about every household will contain at least a few items of this nature.
- Foil stock: aluminium prepared in thin metal leaves with a thickness < 0,2mm

1.2. GHG EMISSIONS IN THE ALUMINIUM SECTOR

The International Aluminium Institute provides a comprehensive table (see Figure 5) highlighting all CO_2e emissions of the aluminium value chain. The columns of the following graph are the eight steps of the value chain – and this is the value chain segmentation that will be kept for ACT Aluminium - and each line is a CO_2e emissions post to cover the global carbon footprint of the aluminium sector accounting for more than 1,1 gigatonne of CO_2e emissions per year [13].

	Bauxite mining	Alumina refining	Anode production	Electrolysis	Casting	Recycling*	Semis production	Internal scrap remelting	Total
Electricity (indirect)	0.6	16.9	-	670.6	-	3.1	9.5	2.5	703
Non CO_2 GHGs (direct)	-	32.2	-	35.4	-	-	-	-	68
Process CO_2 (direct)	-	-	6.4	92.6	-	-	-	-	99
Ancillary materials (indirect)	-	14.8	19.3	6.4	-	-	-	-	41
Thermal energy (direct/indirect)	2.6	124.3	6.4	-	6.4	15.6	19.0	8.4	183
Transport (indirect)	-	15.4	-	18.7	-	-	-	-	34
Total (cradle to gate)	3	204	32	824	6	19	29	11	1,127

FIGURE 5: 2018 TOTAL ALUMINIUM SECTOR EMISSIONS (MT CO2E) HEAT MAPPED, BY PROCESS AND SOURCE (*RECYCLING OF PRE- AND POST-CONSUMER SCRAP)

Furthermore, the carbon footprint of the aluminium production depends on the route. Indeed, the secondary route requires much less energy and does not use carbon anodes that are responsible for direct CO_2e emissions during the electrolysis for example; therefore, this route emits less CO_2e.

PRIMARY ROUTE

In the primary production route, the bulk of the CO_2e emissions comes from the electricity CO_2e emissions of the electrolysis process and its electricity consumption, as well as from the alumina extraction step of the value chain. Electrolysis requires a great amount of electricity, and about 60% of the power consumed by the aluminium industry is self-generated and not purchased from the grid [4]. When the electricity is bought from the grid, the emissions of CO_2e of the electrolysis step can vary a lot depending on the electricity carbon intensity of the country where the plants are located.

The following figure provides an overview of the different CO_2e emissions at each step of the value chain for the primary route [6].

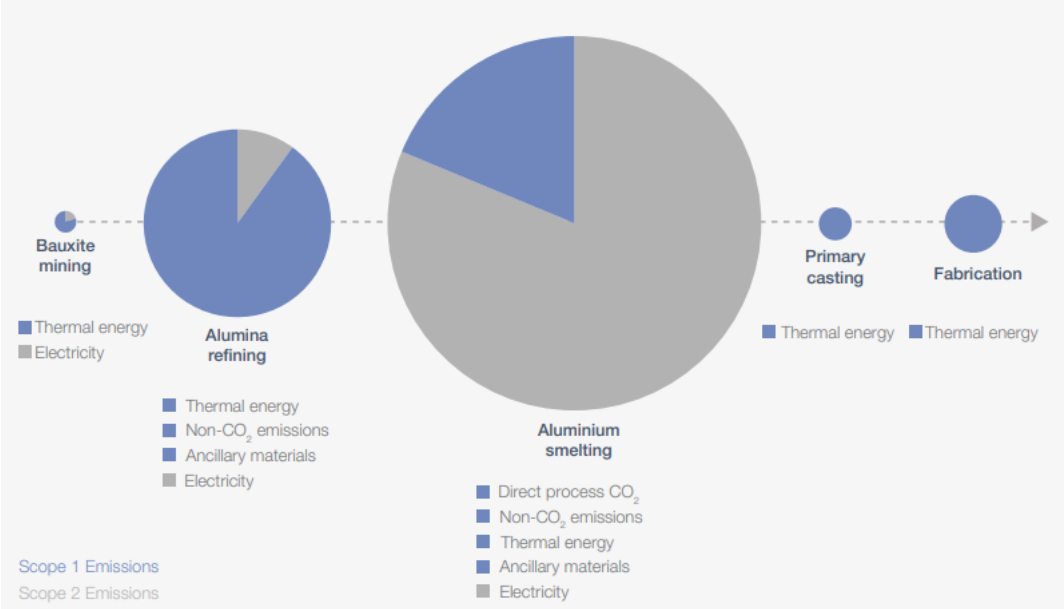

FIGURE 6: MAIN CO_2E EMISSIONS OF THE ALUMINIUM PRIMARY PRODUCTION ROUTE

Alumina extraction

Alumina is the aluminium oxide coming from bauxite. In the Bayer process, bauxite is washed with a hot solution of sodium hydroxide at 250 °C, dissolving aluminium hydroxide. The other components of bauxite do not dissolve and can be filtered out as solid impurities (red mud). Afterwards, the hydroxide solution is cooled and the aluminium hydroxide precipitates out. When heated to 1050°C, the aluminium hydroxide decomposes to alumina, giving off water vapour in the process [7].

The main CO_2e emissions come from:

- The combustion of fossil fuel to produce heat/steam to carry extraction of alumina in autoclaves or digesters
- The calcination of aluminium hydroxide to aluminium oxide above 1 050°C

Anode fabrication

With alumina, carbon anodes are the second main raw materials needed to produce primary aluminium. The production of anodes consists in baking a mixture of hard calcined petroleum coke, recycled anode butts, and coal tar pitch at 1150°C. The most common case for primary aluminium producers is to have an on-site anode plant, but some smelters also procure carbon anodes externally. The anode production process requires a consumption of about 2,8 GJ of thermal energy (mostly natural gas) / tonne of anode and 0,4 GJ of electricity / tonne of anode [7].

The main CO_2e emissions come from:

- The baking of anode (thermal energy and electricity)
- The coke calcination to produce these anodes

Aluminium smelting

The process of aluminium smelting is called Hall-Héroult and involves dissolving the alumina (Al_2O_3) in molten cryolite (Na_3AlF_6), and electrolysing the molten salt. The presence of cryolite reduces the melting point of the alumina, facilitating electrolysis. In the operation of the cell, aluminium is deposited on the cathode, while the oxygen from the alumina is combined with the carbon from the anode to produce CO_2 [7].

The electrolysis process is therefore based on the electrical reduction of aluminium oxide to pure aluminium and uses electricity as the main energy carrier. Fossil coal in the form of carbon anodes is used to facilitate the electrical reduction, resulting in CO_2 and CO emissions. In addition, there are disturbances in the process, so-called 'anode effects', where an insufficient amount of aluminium oxide is dissolved in the electrolyte bath, resulting in the emission of perfluorocarbons (PFCs). Therefore, the climate impact from electrolysis maybe divided into three parts [14]:

- GHG emissions due to the use of electricity
- The emission of CO2 and CO due to the consumption of anodes
- The emission of PFCs during anode effect

However, PFC emissions have greatly reduced. Overall contribution to emissions intensity globally has fallen from ~30% in 1990's to ~5% today. Figure 7 indicates that the mean PFC emissions intensity was of 0,55 tCO_2e/t aluminium in 2019.

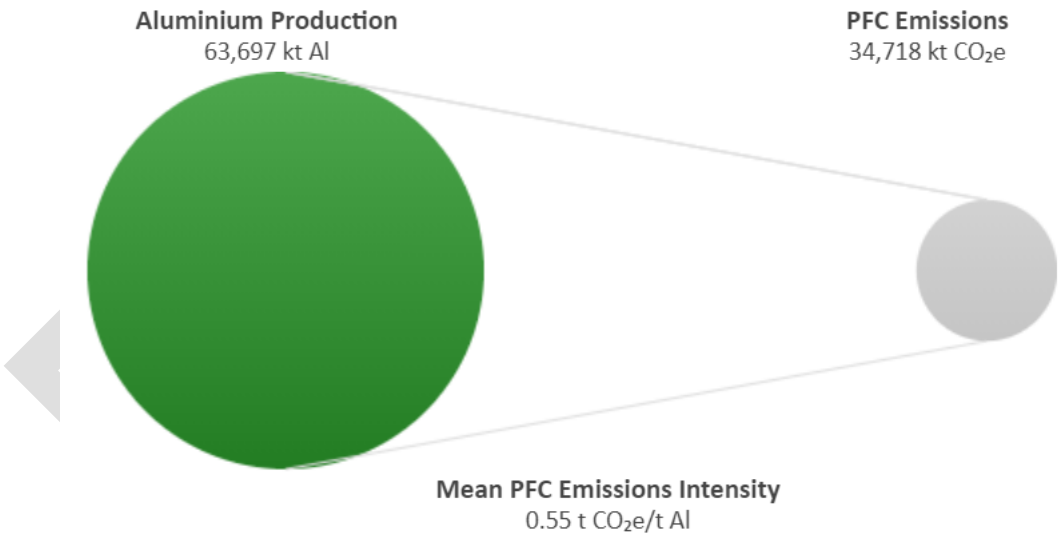

FIGURE 7: TOTAL PFC CO_2E EMISSIONS ALL TECHNOLOGIES INCLUDED [15]

With regards to Europe and PFC's, substantial progress has been made over the past years to reduce the CO_2e emissions of PFC to a low level of tCO_2e/T aluminium, as shown in Figure 8 [9].

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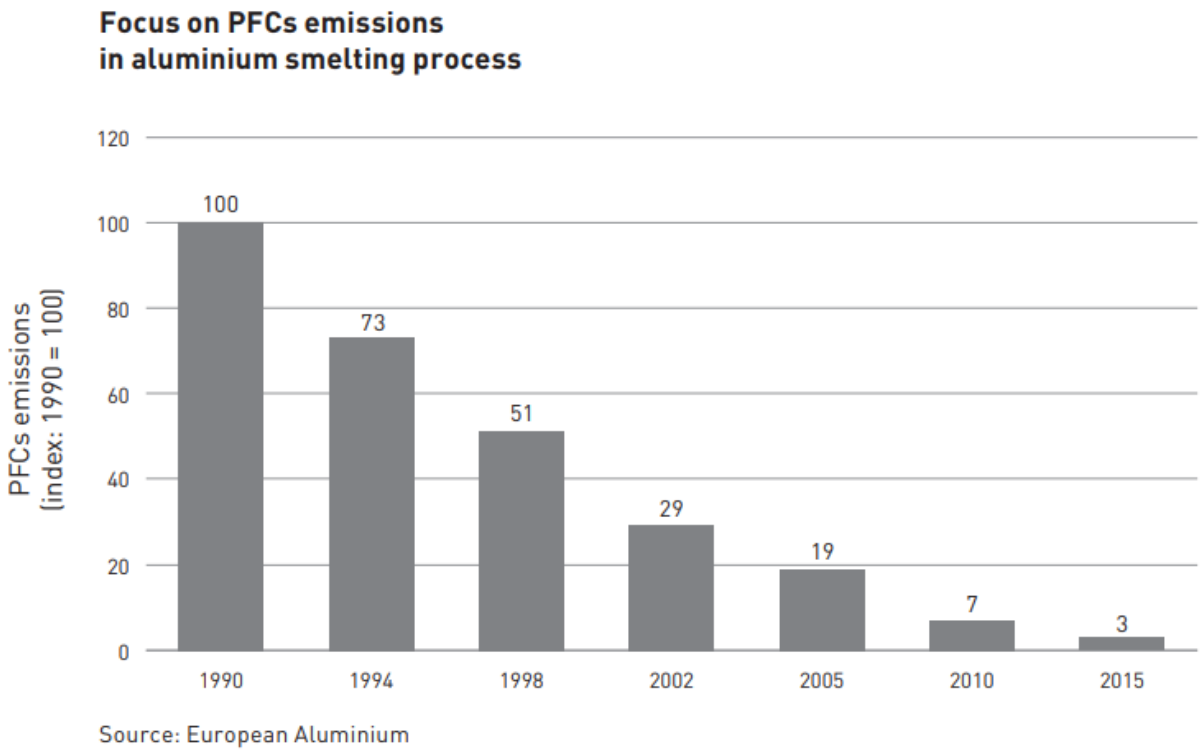


FIGURE 8: TOTAL EUROPEAN ALUMINIUM CO_2E EMISSIONS REDUCTION [9]

Primary casting

Thermal energy is required to produce aluminium ingot from liquid aluminium that is the output of the smelting step, as well as a small quantity of electricity. The CO_2e emissions come therefore from this energy consumption.

RECYCLED ALUMINIUM PRODUCTION ROUTE

Aluminium production (remelting and refining)

Two sub routes can be defined in the secondary routes, as they are different in terms of process and in terms of actors involved.

- Remelting: it concerns the aluminium production mainly from new scrap, but also a small part from old scrap. It consumes around 3,8 GJ of thermal energy / metric tonne of aluminium ingot and 0,45 GJ / metric tonnes of electricity, which is far less compared to the 37 GJ of thermal energy and 58 GJ of electricity as for the primary aluminium production route [7]. Overall, the secondary route consumes therefore around 5% of the total energy consumption compared to the primary aluminium production route.
- Refining: the bulk of the old scrap will be recycled through refining, but new scrap will also be refined. Refining is necessary to remove impurities, and the downstream of the refining sub route will not be the same as the remelted one (e.g. casting and secondary casting for the refining sub route, and it will produce different types of manufacturing products than the ones of the remelted sub route).

In ACT Aluminium, and according to International Aluminium Institute, the segmentation retained will be recycling (mixing both remelting and refining) versus internal scrap remelting.

2. Principles

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

TABLE 1: PRINCIPLES FOR IMPLEMENTATION

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

3. Scope

3.1. SCOPE OF THE DOCUMENT

This document presents the ACT assessment methodology for the aluminium (AL) sector. It includes the rationales, definitions, indicators and guidance for the sector-specific aspects of performance, narrative and trend scorings. It also includes an experimental scoring on physical risks and climate change adaptation. It was developed in compliance with the ACT Guidelines for the development of sector methodologies, 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 aspects of the methodology that are not sector specific.

3.2. SCOPE OF THE SECTOR

This section aims to specify which type of companies the ACT aluminium methodology can assess.

ALUMINIUM SECTOR VALUE CHAIN

This part aims to highlight all the steps of the aluminium value chain that exist.

The aluminium value chain can be divided into eight main steps as highlighted by IAI [13]:

- Bauxite mining
- Alumina extraction
- Anode production
- Electrolysis
- Casting
- Recycling (that could be split in to remelting vs refining)
- Semis production
- Internal scrap remelting

A simplified version of this value chain into five steps proposed by ACT is:

- Mining (of bauxite)
- Alumina extraction
- Aluminium smelting (recycled aluminium production route through remelting and refining included here)
- Aluminium product shaping. It matches with semis production)
- Manufacturing. It concerns finished products

The main processes involved in these activities are presented in the figure below that provides a simplified version of the aluminium value chain with links between the different steps.

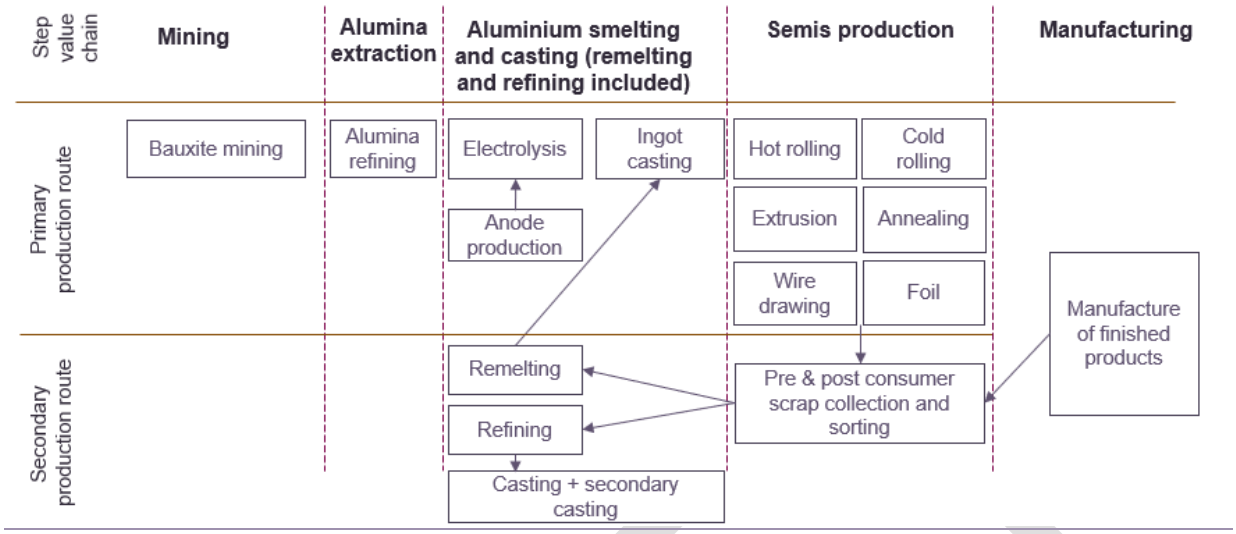


FIGURE 9: SIMPLIFIED ALUMINIUM VALUE CHAIN

ACTORS INCLUDED IN THE SCOPE OF THE SECTOR

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

All companies involved in producing aluminium or alumina will be covered by ACT Aluminium methodology.

The only companies of the aluminium value chain that will not be covered by ACT are:

- pure player bauxite mining,
- pure player anode producers
- manufacturer of finished products.

The rational is that these players do not account for a substantial part of the CO_2e emissions of the aluminium value chain.

The next figure highlights the total list actor's types covered by ACT. ACT will not ask companies to which type of actor they correspond, but at which step of the value chain they operate (or plan to operate) in order to simplify and not have too many types of actors. This will also enable to assess all kind of aluminium companies that are present at different steps of the value chain, and to capture the fact that not all aluminium companies focus their business activities at the same steps of the value chain. The graph below provides the aluminium value chain in a simplify way (smelting and casting have been put together). Moreover, aluminium product shaping refers to semis production (different sources give different wording).

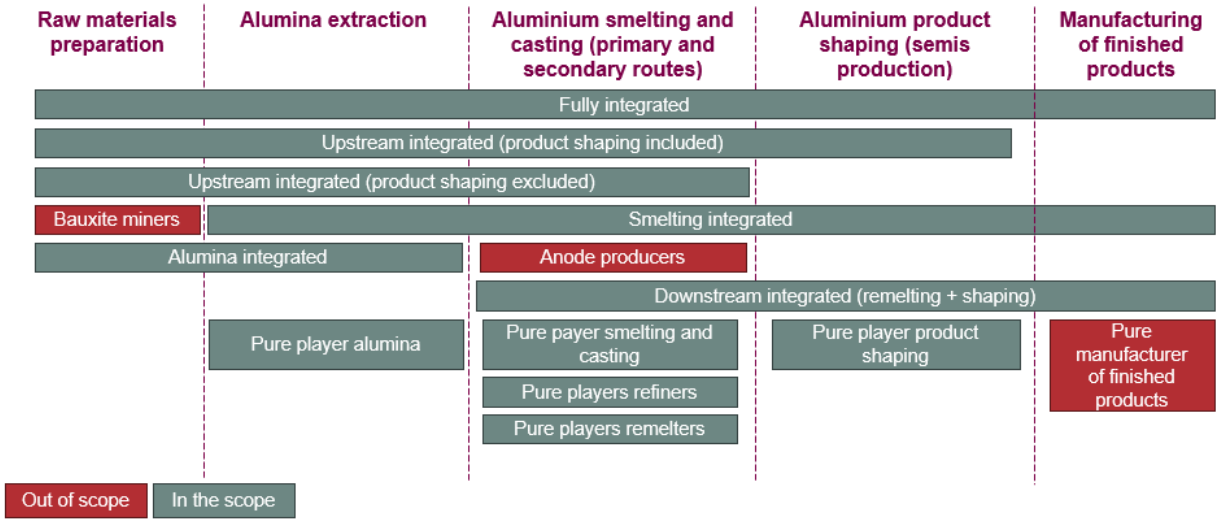


FIGURE 10: COMPANIES THAT CAN BE ASSESSED BY THE ACT ALUMINIUM METHODOLOGY

There are mainly two types of activity classification: NACE (Europe) and ISIC (International). NACE and ISIC codes will enable to understand which activities are covered by the ACT methodology, and therefore which type of actors. A company can have multiple activities and be assessed with this methodology if one of those is in the scope.

NACE

Activities covered by the scope of the ACT aluminium sector

The following NACE codes are included in the scope of the ACT Aluminium sector:

- 24.42: Aluminium production:
  - Production of aluminium from alumina
  - Production of aluminium from electrolytic refining of aluminium waste and scrap
  - Production of aluminium alloys
  - Semi-manufacture of aluminium
- 24.53: Casting of light metals:
  - Casting of semi-finished products of aluminium, magnesium, titanium, zinc etc.
  - Casting of light metal castings

Activities outside the scope of the ACT aluminium sector

- 25: Manufacture of fabricated metal products, except machinery and equipment
- 27: Manufacture of electrical equipment
- 28: Manufacture of machinery and equipment
- 29: Manufacture of motor vehicles, trailers and semi-trailers
- 30: Manufacture of other transport equipment
- 07.29: Mining of other non-ferrous metal ores
  - Mining and preparation of ores chiefly valued for non-ferrous metal content:

        - Aluminium (bauxite), copper, lead, zinc, tin, manganese, chrome, nickel, cobalt, molybdenum, tantalum, vanadium etc.
        - Precious metals: gold, silver, platinum
- 38.32: Recovery of sorted materials
- Wholesale of metals and metal ores (46.72)

ISIC

Activities covered by the scope of the ACT aluminium sector

The following ISIC codes are covered by the scope of the ACT Aluminium sector:

- 2420: Manufacture of basic precious and other non-ferrous metals
    - Production of aluminium from alumina
    - Production of aluminium from electrolytic refining of aluminium waste and scrap
    - Production of aluminium alloys
    - Semi-manufacturing of aluminium
    - Production of aluminium oxide (alumina)
    - Production of aluminium wrapping foil
    - Manufacture of aluminium (tin) foil laminates
- 2432: Casting of non-ferrous metals
    - Casting of semi-finished products of aluminium, magnesium, titanium, zinc etc.

Activities outside the scope of the ACT aluminium sector

- 0728: Mining of other non-ferrous metal ores
    - Aluminium (bauxite), copper, lead, zinc, tin, manganese, chrome, nickel, cobalt, molybdenum, tantalum, vanadium etc.
- 2394: Manufacture of cement, lime and plaster
    - Manufacture of clinkers and hydraulic cements, including Portland, aluminous cement, slag cement and superphosphate cements
- 2732: Manufacture of other electronic and electric wires and cables
    - Manufacture of insulated wire and cable, made of steel, copper, aluminium

RATIONALE FOR THE SCOPE

- Bauxite miner pure players are excluded as
    - Bauxite mining accounts for only 0,2% of the CO_2e emissions of the aluminium sector [11]
    - The emissions reduction levers are very different for bauxite miners than for other players such as alumina players and smelters
    - Integrated companies involved in the mining step will be assessed on the mining part
- Anode producer pure players are excluded as
    - Anode manufacturing does not account for a large part of the CO_2e emissions in the aluminium value chain (3%) [11]

    - The emissions reduction levers are very different for anode producers than for other players
- Integrated companies involved in the anode step will be assessed on the anode part. Manufacturer of semi-finished and finished products are excluded as
    - Manufacturing is negligible in terms of CO_2e emissions for the aluminium sector
    - Manufacturing is excluded from low-carbon scenarios for aluminium sector (International Aluminium Institute, IEA…)
    - Even integrated companies involved in the manufacturing will not be assessed on their manufacturing activities

4. Boundaries

The Boundaries Section specifies which emission sources this methodology takes into account.

4.1. REPORTING BOUNDARIES

The reporting boundaries for the aluminium sector are presented in the following diagram:

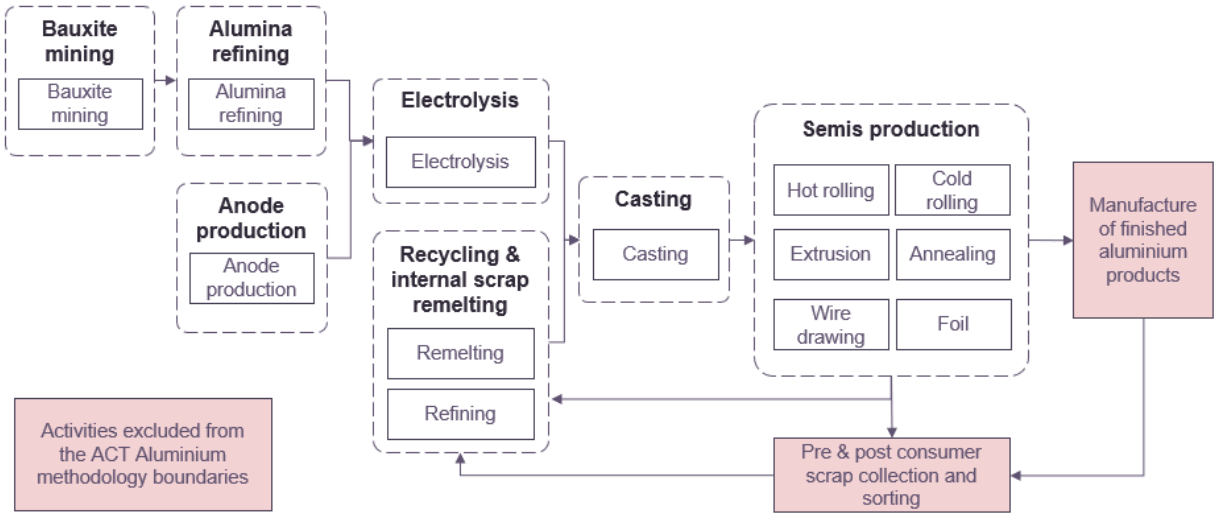


FIGURE 11: ALUMINIUM SECTOR REPORTING BOUNDARIES

Aluminium companies will be assessed for each type of activity where they are involved in. Scope 1+2 emissions shall be reported separately for each of the 8 steps of the value chain, and process-specific pathways will be used as benchmarks for calculating some indicators. Moreover, upstream Scope 3 (purchased alumina or aluminium, ancillary materials, transport etc.) will be included for some indicators for the upstream steps of the aluminium value chain where the company does not operate. Those 8 steps are the following ones, as described in the diagram above from IAI:

- Bauxite mining
- Aluminium refining
- Anode production
- Electrolysis
- Casting
- Recycling
- Semis production
- Internal scrap remelting

All modules and indicators will not use the entire reporting boundaries, depending on which actions / levers they have to capture:

- For example, Module 2 (Material Investment) will not consider ancillary materials and transport CO_2e emissions as they will be Scope 3 for the aluminium companies, and as Module 2 focuses on company's own processes, and therefore Scope 1+2 of the company.
- However, Module 4 (Sold product performance) will assess the global carbon footprint of the aluminium products sold by the company, including all steps of the aluminium value chain and all CO_2e emissions posts including here the ancillary materials and transport CO_2e emissions. Refer to the details of each indicator for further details.

Getting the data (carbon intensity and activity volume) per step of the value chain might be difficult when doing the data collection (e.g. smelting and casting CO_2e emissions might be reported together). When this will be the case, the company is to select the step that emits the majority of the CO_2e (smelting if smelting and casting are reported together for example). It concerns the indicators 2.1, 2.2, 2.3. This case will not be an issue for indicators 1.1 and 4.1 since the tool will sum of all CO_2e emissions for all steps of the value chain concerned, and use the activity volume of the last step of the value chain where the company operates for the denominator of the carbon intensity.

Regarding the electricity consumed, especially at the electrolysis step, it can be either self-generated by the aluminium company or purchased from the grid. If the electricity is self-generated, ACT will ask the Scope 1 emissions of the power plants for the electricity without including the electricity that will be sold to external customers or to the grid. And for the purchased electricity, ACT will ask Scope 2 CO_2e emissions. This data will be asked for calculating the Scope 1+2 of the company for the corresponding modules.

4.2. RATIONALE

The bulk of the CO_2e emissions in the aluminium sector occurs at the alumina refining and the smelting steps of the value chain. The boundaries could have been set to include only these high-emitting processes. Nevertheless, the methodology takes into account that:

- CO_2e emissions comes mainly from the alumina refining and the smelting steps for now; but when progress will be made in the future by decarbonizing the aluminium industry, especially by decarbonizing electricity, the other steps will become a greater share of the emissions of the sector
- There are decarbonisation levers that can be triggered on other steps of the aluminium value chain
- The sector makes efforts to disclose the CO_2e burden of aluminium using a life-cycle assessment approach, enhancing the fact that the whole value chain of aluminium should collaborate and take its part in the decarbonisation of the aluminium sector
- Unlike most of other industrial sectors, current CO_2e emissions are available for each stage of the value chain through the work of IAI. The IAI studies emissions at a unit process level, which allows for greater granularity on the opportunities for decarbonisation across the value chain. [13]

Therefore, a cradle-to-gate approach has been chosen to cover the emissions and thus the reduction emissions levers broadly.

The value chain has been split into 8 steps, in accordance with the work undertaken by the International Aluminium Institute to develop low carbon pathways for each of these steps. Therefore, the ACT development team was able to build on this work.

5. Construction of the data infrastructure

5.1. DATA SOURCES

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

5.2. PERFORMANCE INDICATORS

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

TABLE 2: PERFORMANCE INDICATOR OVERVIEW

		ALUMINIUM			
			Past	Present	Future
Core business performance		1.TARGETS	AL 1.3 Achievement of previous targets		
				AL 1.1 Alignment of scope 1+2 and scope 1+2+3 emission reduction targets AL 1.2 Time horizon of targets	
Core business performance	Investment	2. MATERIAL INVESTMENT	AL 2.1 Past performance of aluminium assets, per step of the value chain	AL 2.2 Locked-in emissions AL 2.3 Future performance of aluminium assets, per step of the value chain AL 2.4 Contribution to low-carbon electricity generation AL 2.5 Reducing process-scrap generation	
Core business performance	Investment	3. INTANGIBLE INVESTMENT	AL 3.1 R&D spending in low-carbon technologies AL 3.2 Company low-carbon patenting activity		
Core business performance		4 SOLD PRODUCT PERFORMANCE	AL 4.1 Cradle-to-gate aluminium carbon footprint AL 4.3 Recycled scrap traceability		AL 4.2 Purchased product intervention
Core business performance		5. MANAGEMENT		AL 5.1 Oversight of climate change issues AL 5.2 Climate change oversight capability AL 5.4 Climate change management incentives	AL 5.3 Low-carbon transition plan AL 5.5 Climate change scenario testing
Influence		6. SUPPLIER	AL 6.2 Activities to influence suppliers to reduce their GHG emissions		AL 6.1 Strategy to influence suppliers to reduce their GHG emissions
Influence		7. CLIENT	AL 7.2 Activities to influence customer behaviour to reduce their GHG emissions		AL 7.1 Strategy to influence customer behaviour to reduce their GHG emissions
Influence		8. POLICY ENGAGEMENT		AL 8.1 Company policy on engagement with trade associations AL 8.2 Trade associations supported do not have climate-negative activities or positions AL 8.3 Position on significant climate policies AL 8.4 Collaboration with local public authorities	

9. BUSINESS MODEL	AL 9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid AL 9.2 Low carbon business models that aim at switching to low carbon-processes AL 9.3 Low carbon business models that aim at taking part in aluminium circular economy

The companies will be assessed against the indicators corresponding to the steps of the value chain where they operate. **The indicators that are specific to ACT Aluminium are indicated in dark grey in the follow table, and the ones that are cross to all ACT methodologies are in light grey. A cross indicates that this step of the value chain is assessed by the corresponding indicator (if it is relevant for the company, see Table 3 and Table 4).** For many indicators, all steps of the value chain have a cross since they will be assessed by ACT provided that the company is present at these specific steps.

TABLE 3: PERFORMANCE QUANTITIATIVE INDICATORS

	Indicators	Bauxite mining	Alumina refining	Anode production	Electrolysis	Casting	Recycling	Semis production	Internal scrap remelting
1.1	1.1 Alignment of Scope 1+2 and Scope 1+2+3 targets	X	X	X	X	X	X	X	X
1.2	1.2 Time horizon of targets for aluminium production	X	X	X	X	X	X	X	X
1.3	1.3 Achievement of previous targets	X	X	X	X	X	X	X	X
2.1	2.1 Past performance for aluminium assets, per step of the value chain	X	X	X	X	X	X	X	X
2.2	2.2 Locked-in emissions		X		X				
2.3	2.3 Future performance of aluminium assets, per step of the value chain	X	X	X	X	X	X	X	X
2.4	2.4 Contribution to low carbon electricity generation				X				
2.5	2.5 Reducing process-scrap generation				X	X	X	X	X
3.1	3.1 R&D spending in low-carbon technologies	X	X	X	X	X	X	X	X
3.2	3.2 Company low-carbon patenting activity	X	X	X	X	X	X	X	X
4.1	4.1 Cradle-to-gate aluminium carbon footprint	X	X	X	X	X	X	X	X
4.2	4.2 Purchased product intervention			X	X	X	X	X	X
4.3	4.3 Recycled scrap traceability						X		X

TABLE 4: PERFORMANCE QUALITATIVE INDICATORS

	Indicators	Bauxite mining	Alumina refining	Anode production	Electrolysis	Casting	Recycling	Semis production	Internal scrap remelting
5.1	5.1 Oversight of climate change issues	X	X	X	X	X	X	X	X
5.2	5.2 Climate change oversight capability	X	X	X	X	X	X	X	X
5.3	5.3 Low-carbon transition plan	X	X	X	X	X	X	X	X
5.4	5.4 Climate change management incentives	X	X	X	X	X	X	X	X
5.5	5.5 Climate change scenario testing	X	X	X	X	X	X	X	X
6.1	6.1 Strategy to influence suppliers to reduce their GHG emissions	X	X	X	X	X	X	X	X
6.2	6.2 Activities to influence suppliers to reduce their GHG emissions	X	X	X	X	X	X	X	X
7.1	7.1 Strategy to influence customer behaviour to reduce their GHG emissions	X	X	X	X	X	X	X	X
7.2	7.2 Activities to influence customer behaviour to reduce their GHG emissions	X	X	X	X	X	X	X	X
8.1	8.1 Company policy on engagement with trade associations	X	X	X	X	X	X	X	X
8.2	8.2 Trade associations supported do not have climate-negative activities or positions	X	X	X	X	X	X	X	X
8.3	8.3 Position on significant climate policies	X	X	X	X	X	X	X	X
8.4	8.4 Collaboration with local public authorities	X	X	X	X	X	X	X	X
9.1	9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid				X				
9.2	9.2 Low carbon business models that aim at switching to low carbon-processes	X	X	X	X	X	X	X	X
9.3	9.3 Low carbon business models that aim at taking part in aluminium circular economy				X	X	X	X	X

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

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

5.3. COMPANY DATA REQUEST

The following data will be requested. This description is high-level, for further details please refer to section 6.3:

Data requested to the company
GHG emissions intensities (on scope defined in module 1,2 & 4 in quantitative indicators), for each step of the aluminium value chain where the company operates, and the relevant upstream steps Scope 1+2 if the company is operating, Scope 3 upstream if this is an upstream step (Scope 3 downstream is not assessed as data might be too difficult to collect) Target coverage (%)
Activity data (e.g. metric tonnes of alumina refined, of primary as an output of the casting step etc.) for each step of the aluminium value chain where the company operates For module 1 and 4, in reporting year and target year For module 2, for each asset including self-generated electricity assets (average of the nominal production per year over the total lifetime of the asset)
Reduction targets in intensity, including the project activity data. Milestones and past targets are also to be provided
Assets/plants data (asset name, geography, step of the value chain, total capacity per year, ownership stake, production rate to get nominal production, Scope 1+2 emissions factor, year of commissioning, expected lifetime in years, comment)
Quantitative and qualitative data on the contribution to low carbon electricity generation (action to use low-carbon electricity, policy regarding the development of low-carbon electricity, self-generated electricity assets)
Qualitative data to reduce process-scrap generation, both pre- and post-consumer scrap
R&D in low-carbon technologies (share of low carbon R&D in mature and non-mature technologies, average over the last 3 years)
Low-carbon Patenting Activity (% of low carbon patents over all patents, average over the last 5 years)
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.)
Collaboration with local authorities regarding aluminium scrap collection and sorting and/or on contribution to the low-carbon transition of the grid of the territory
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

TARGETS

- **AL 1.1 ALIGNMENT OF SCOPE 1+2 AND SCOPE 1+2+3 EMISSIONS REDUCTION TARGETS**

Description & Requirements

AL 1.1 ALIGNMENT OF SCOPE 1+2 AND SCOPE 1+2+3 EMISSIONS REDUCTION TARGETS

SHORT DESCRIPTION OF INDICATOR

A measure of the alignment of the company's Scope 1+2 and Scope 1+2+3 emissions reduction targets with their low-carbon benchmark pathway. The indicator will compare the trend of company's target pathway to the trend of company's benchmark and thus identify the gap between both pathways at the target year, which is expressed as the company's commitment gap. The score for Scope 1+2 is limited to 75% and cannot reach 100% to encourage and reward companies including Scope 3 in their targets. Moreover, the best score between the Scope 1+2 and the Scope 1+2+3 will be kept, hence the fact that Scope 1+2+3 targets are not mandatory but might improve the score of this indicator. At last, the company can provide several targets for both Scope 1+2 and Scope 1+2+3. Only the best score will be kept.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Targets information for each relevant scope 1+2 GHG emissions sources (Target year, emission reduction between reporting year and target year, target coverage % of total emissions).
- Targets information for each relevant scope 1+2+3 GHG emissions sources (Target year, emission reduction between reporting year and target year, target coverage % of total emissions), and information on what is included in the Scope 3 (which steps of the value chain, which CO_2e emissions posts). Only the upstream steps will be taken into account for Scope 3, as it is difficult to get data from customers. Moreover, there might be some sales and purchases gaps between several steps of the value chain (e.g. you might sell a part of the bauxite ores you mine and carry on processing the rest, or you might buy some alumina from suppliers). Basic calculation (meaning not removing or adding any CO2e emissions) is valid as long as you do not purchase / sell too many products alongside the value chain. If not, please use the calculation your company does with its own methodology and assess if the calculation is right and matches with the two bullet points above. One way to proceed would be: to have consistent figures, please be consistent with the volume indicated at the denominator (e.g. ask for suppliers Scope 1+2 data and add it in your Scope 3 upstream if you purchased alumina, remove some of your Scope 1+2 CO_2e emissions if you sold bauxite ores to others etc.).
- Activity data (e.g. metric tonnes) for the last step of the aluminium value chain where the company operates

- Data for base year to be included as well

The benchmark indicators involved are the following:

Target type	Parameter	Intensity metric	Methodological sources
Scope 1+2	$EI_{B\text{-}S12}$	tCO_2e/metric tonnes of aluminium products (last step of the value chain where the company operates)	IAI (see 6.1 for further details on the low carbon pathway source and computation)
Scope 1+2+3 (only upstream for Scope 3)	$EI_{B\text{-}S123}$	tCO_2e/metric tonnes of aluminium products (last step of the value chain where the company operates)	IAI (see 6.1 for further details on the low carbon pathway source and computation)

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on a trend ratio between the company's Scope 1+2 (or Scope 1+2+3) emissions target and the company benchmark (see 4.1 to know what ACT takes into account in scope 3, only Scope 3 upstream of the steps of the aluminium value chain from IAI). Trends are computed between reporting year and the longest time horizon of the target.

The company's target pathway is the decarbonization over time, defined by the company's Scope 1+2 (or Scope 1+2+3) emissions reduction target. To compute it, a straight line is drawn between the starting point of the analysis and the company's target endpoint.

The company benchmark pathway is the company specific Scope 1+2 and Scope 1+2+3 emissions low-carbon benchmark pathway. See section 6.1 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 scope 1+2 (or scope 1+2+3) emissions at reporting year.

CALCULATION OF SCORE:

1) Trend ratio

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 Scope 1+2 (or Scope 1+2+3) emissions intensity at target year, EIc (Yr) is the company Scope 1+2 (or Scope 1+2+3) emissions intensity at reporting year, EIb(Yt) is the company's benchmark Scope 1+2 (or Scope 1+2+3) intensity at target year and EIb(Yr) is the company's benchmark Scope 1+2 (or Scope 1+2+3) intensity at reporting year.

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

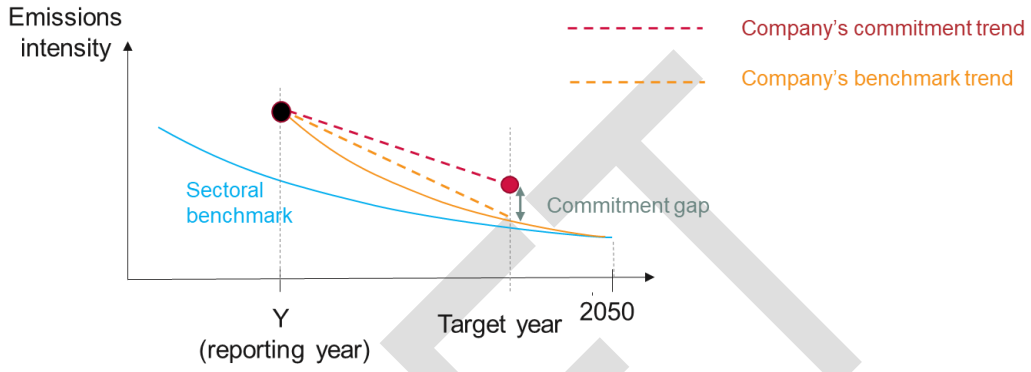


FIGURE 12: TREND RATIO AND COMMITMENT GAP

2) Final Score

The final score assigned to the indicator is calculated as follows (see Annex 4 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%
$Company's\ target\ trend \leq 0\ and\ EI_C(Y_R) < EI_B(2050)$ 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 Scope 1+2 (same for Scope 1+2+3 targets) emissions are not preferred in the calculations. If only such targets are available, then the score will be adjusted downwards in proportion with % coverage. If the target coverage of total company emissions at reporting year (C_{Yr}) represents less than 95%, the final score is equal to:

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

Scope 1+2 targets at global level and covering the required emissions are preferred for this indicator. Should several targets be assessed (e.g. per geography), the consolidation of the scores assigned to each target will be based on the share of emissions covered by the targets. Moreover, the target with the longest time horizon is also preferred in the calculation compared to short-term targets. This is the same for Scope 1+2+3 targets.

A score will be computed for Scope 1+2 targets, and another one for Scope 1+2+3 targets. Then, the best score between the Scope 1+2 and the Scope 1+2+3 will be kept, hence the fact that Scope 1+2+3 targets are not mandatory but it will reward companies setting Scope 1+2+3 targets (if the score is better than the Scope 1+2 score). To reward companies setting Scope 1+2+3 targets and therefore including Scope 3 in their targets, the score for Scope 1+2 targets will be capped at a maximum of 75% while the score for Scope 1+2+3 targets will be set at 100%. Therefore, companies that set at least one target for Scope 1+2+3 will be rewarded for doing so.

Rationale

RATIONALE OF THE INDICATOR

AL 1.1 Alignment of scope 1+2 and Scope 1+2+3 emissions reduction targets

RELEVANCE OF THE INDICATOR:

Scope 1+2 and scope 1+2+3 emissions reduction targets are included in this ACT methodology for the following reasons:

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

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

3. For the sector, scope 1+2 emissions represent a high source of emissions depending on which steps of the value chain the company operates. A GHG emissions reduction target should be assigned to them.

Scope 3 emissions are also included to assess the whole aluminium value chain and all CO_2e emissions posts, which enable to have an indicator focusing on decarbonizing the whole aluminium value chain. However, as not all companies have Scope 3 targets, this is not mandatory to have one. Scope 3 emissions include Scope 3 upstream emissions only, as the collection of emissions data from clients is more delicate.

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 avoid this assumption by using directly data at target year.

Scope 3 is considered by the methodology in target setting, as it is the greatest CO2e emissions post for downstream actors.

- **AL 1.2 TIME HORIZON OF TARGETS**

DESCRIPTION & REQUIREMENTS **AL 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:

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

The benchmark indicator involved are the following:

	Parameter	Intensity metric	Benchmark
Average plant lifetime	LT	Years	30 years as a proxy [16]

HOW THE ASSESSMENT WILL BE DONE

The analysis has two dimensions:

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

DIMENSION 1 - TARGET ENDPOINT: The company's target endpoint (T_e) is compared to LT, a relevant time horizon for the sector- 30 years is proposed by the Technical Working Group for the aluminium sector, as it may be used as a proxy of aluminium plants average lifetime.

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

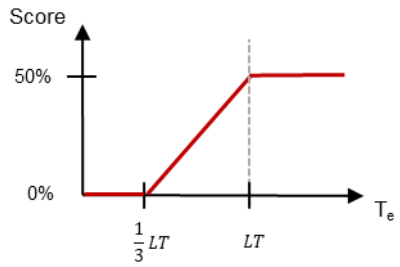
$$T_e = Longest\ target\ time\ horizon - reporting\ year$$

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:

HORIZON GAP	SCORE
$\boldsymbol{T_e} > LT$	50%
$\mathbf{33\%} * \boldsymbol{LT} < \boldsymbol{T_e}$ <Lt	$75\% * \frac{T_e}{LT}$-25%
$\boldsymbol{T_e} \leq \mathbf{33\%} * \boldsymbol{LT}$	0%



Dimension 2 - Intermediate horizons: All company targets and their endpoints are calculated and plotted. The ideal scoring company does not have intervals between target endpoints larger than 5 years from the reporting year.

Measurements are done in five-year intervals between the reporting year and LT.

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

Intermediate target gap length	Score
All the gaps 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 is no such gaps disclosed by the company	0%

An example is illustrated in the figure below.

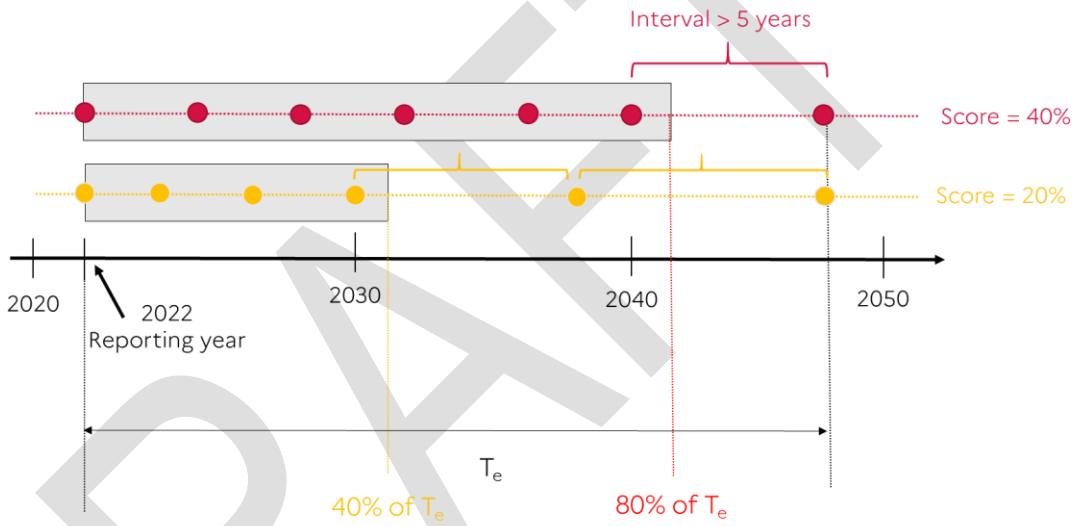


FIGURE 13: EXAMPLES OF HORIZONS OF INTERMEDIATE TARGETS SET BY THE COMPANY AND CORRESPONDING SCORES ON DIMENSION 2 OF THE INDICATOR 1.2

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

FOR ALL CALCULATIONS:

- 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

RATIONALE OF THE INDICATOR

AL 1.2 TIME HORIZON OF TARGETS

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.

• AL 1.3 ACHIEVEMENT OF PAST AND CURRENT TARGETS

DESCRIPTION & REQUIREMENTS

AL 1.3 ACHIEVEMENT OF PAST AND CURRENT TARGETS

SHORT DESCRIPTION OF INDICATOR

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

DATA REQUIREMENTS

The relevant data for this indicator are:

For each target set in the past 10 years:

- Base year
- Start year
- Target year
- Percentage of reduction target from base year in absolute emissions
- Percentage of reduction target achieved in absolute emissions

- Percentage of reduction target from base year in emissions intensity
- Percentage of reduction target achieved in emissions intensity
- Percentage of scope 1+2 or scope 1+2+3 emissions covered by the targets

HOW THE ASSESSMENT WILL BE DONE

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

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

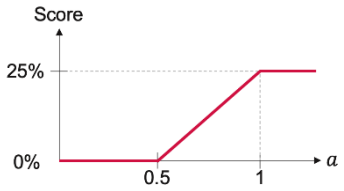
$$a = \frac{E(t_{ref}) - E(t_{horizon})}{E(t_{ref}) - T(t_{horizon})} \geq 0.5$$

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)
$a \leq 0.5$	0%



DIMENSION 2: The company is currently on track to meet an existing emissions reduction target.

The assessment is based on the progress ratio p:

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

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

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

Where t_{ref} is the year during which the target was set, $t_{reporting}$ is the reporting year and $t_{horizon}$ is the year of horizon of the target.

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

Progress ratio	Score
$p \geq 1$	100%
$p < 1$	$\mathrm{p} = \frac{a}{\%\ time}$

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

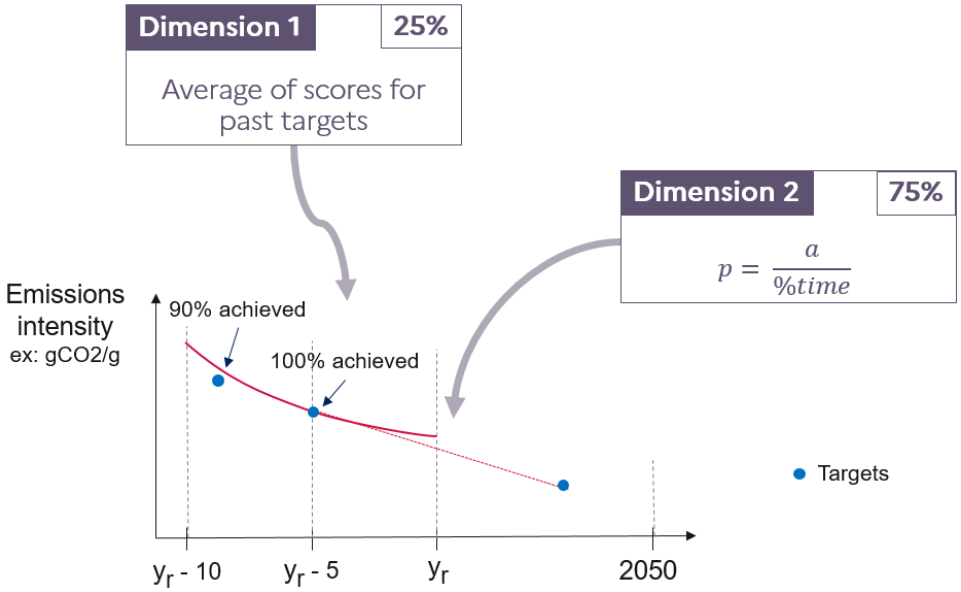


FIGURE 14: CALCULATION OF THE ACHIEVEMENT OF PREVIOUS TARGET INDICATOR

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 1+2 or scope 1+2+3 are not preferred in the calculation of dimension 2, but are not penalized, as other indicators already penalize for not having a large coverage in the target.
- If the company has multiple targets in different scopes that can be assessed according to the above criteria, then the score is an average score based on the progress ratios of all targets assessed.

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

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

Rationale

RATIONALE OF THE INDICATOR

AL 1.3 Achievement of past and current targets

RELEVANCE OF THE INDICATOR:

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

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

SCORING RATIONALE:

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

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

lower than expected, then the score is as impacted as the gap between reality and expectancies is high too. This way, staying on track of initial objectives is rewarded.

Material Investment

- **AL 2.1 PAST PERFORMANCE FOR ALUMINIUM ASSETS, PER STEP OF THE VALUE CHAIN**

Description & Requirements	AL 2.1 Past performance for aluminium assets, per step of the value chain
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. Each step of the value chain where the company is involved will be assessed against a specific low carbon pathway. When it is too difficult to have a data for each step of the value chain separately (e.g. smelting and electrolysis are sometimes merged in the carbon accounting), we can select the step that emits the most of the CO_2e (electrolysis)
Data requirements	The relevant data for this indicator are the following ones, for each asset, and this should be exhaustive for each asset that worked from Y-5 to Y: ♦ Asset name ♦ Geography ♦ Step of the value chain ♦ Total capacity per year (tonnes of aluminium products) ♦ Ownership stake (%) ♦ Production rate to get nominal production (%) ♦ Scope 1+2 emissions factors (tCO_2e/tonne of aluminium product/per year) ♦ Year of commissioning ♦ Expected lifetime This is the same data as for indicators 2.2 and 2.3, but here we need to take into account all assets from Y-5 to Y Overall Y-5 data for each step of the value chain can also be used (scope 1+2 emission intensity, activity).

The benchmark indicators involved are the following:

Type	Parameter	Intensity metric	Methodological sources
Scope 1+2 emissions intensity benchmark, per step of the value chain	EI_B	tCO_2e/metric tonnes of aluminium products	IAI (see 6.1 for further details on the low carbon pathway source and computation)

HOW THE ASSESSMENT WILL BE DONE

This indicator is assessed on two dimensions:

DIM 1: TREND IN PAST EMISSIONS INTENSITY (50%)

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

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

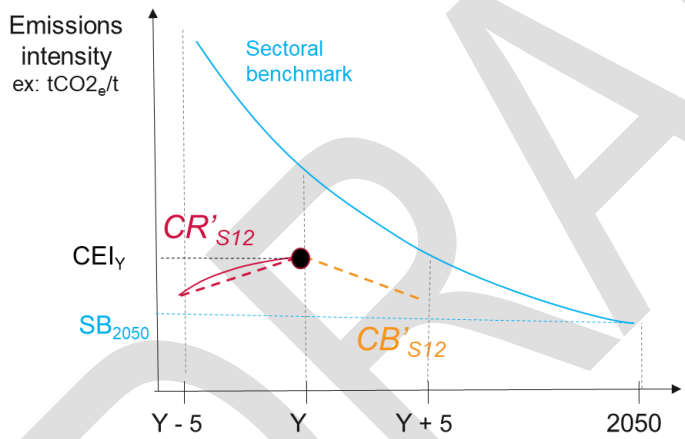
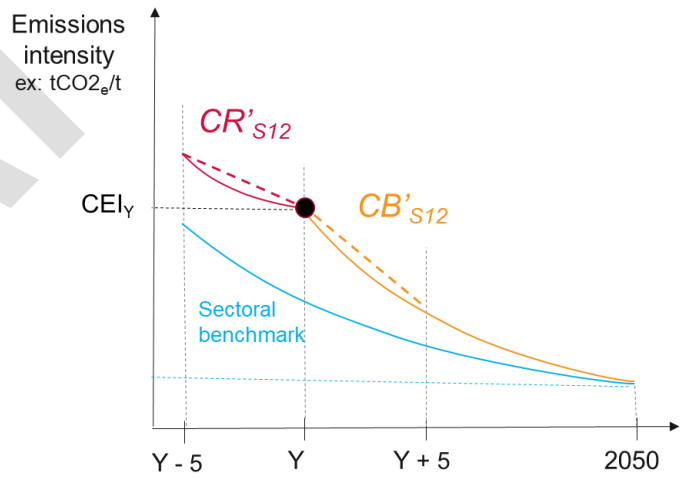
CB'_{S12} is the gradient of the linear trend-line of the company benchmark pathway for emissions intensity ($kgCO_2$/ton) (CB_{S12}). See section 6.1 for details on the computation of the company specific decarbonization pathway.

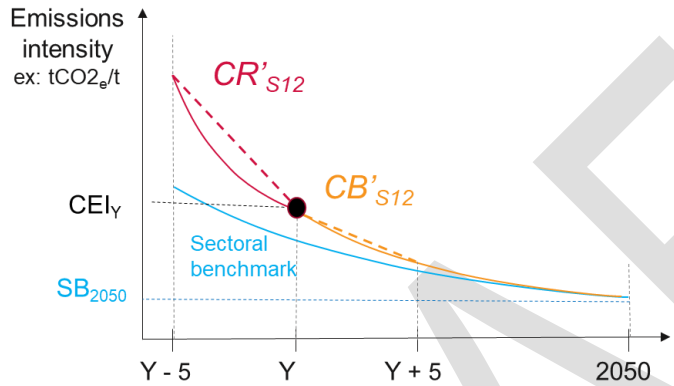
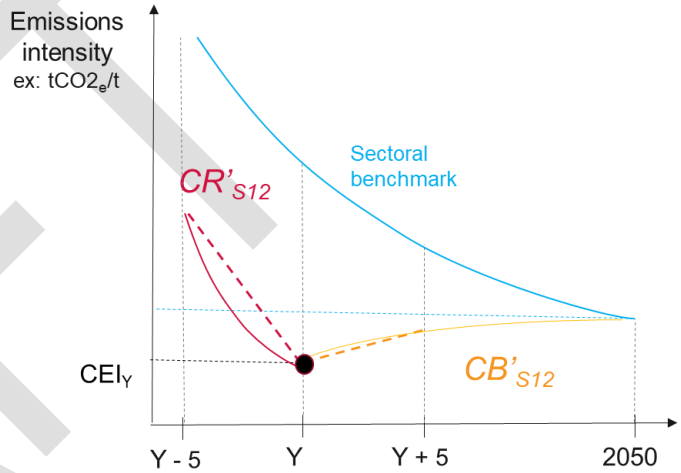
The difference between CR'_{S12} and CB'_{S12} will be measured by their ratio (r_{S12}). This is the scope 1+2 emissions Transition ratio, which is calculated by the following equation, with the symbol 'used to denote gradients:

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

Four different cases are to be taken into consideration:

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

Case #1	Case #2
	
$CR'_{S12} > 0$ Whatever the r_{S12} value Whatever the CEI_Y value	$CR'_{S12} < 0$ $0 < r_{S12} < 1$ $CEI_Y > SB_{2050}$
Score = 0	**Score = r_{S12} (%)**

Case #3	Case #4
	
$CR'_{S12} < 0$ $r_{S12} \geq 1$ $CEI_Y > SB_{2050}$	$CR'_{S12} < 0$ $CEI_Y < SB_{2050}$ whatever the r_{S12} value
Score = 100 %	**Score = 100 %**

As each step of the value chain will be assessed, a weighted average based on the CO_2e emissions corresponding to each step will be done to get the final score of dimension 1.

DIM 2: ALIGNMENT OF PAST PERFORMANCE WITH SECTORAL CARBON BUDGET (50%)

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 grey area of the graph in the figure below, multiplied by the company's activity during the corresponding years. Then, compare this area to the sectoral carbon budget during the same period.

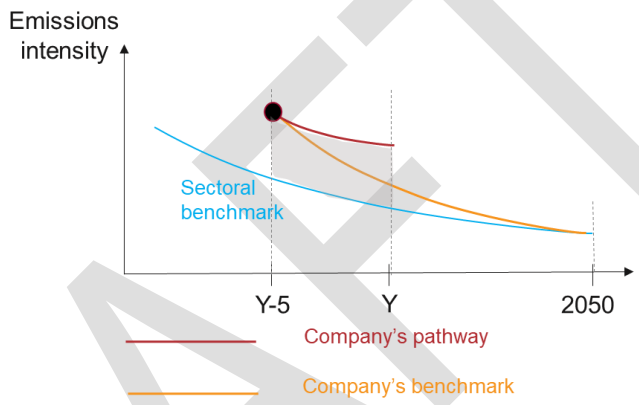


FIGURE 15: COMPARISON OF PAST PERFORMANCE AND CARBON BUDGET DEFINED BY SECTOR BENCHMARK

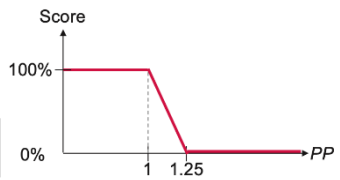
The past performance ratio PP is computed:

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

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

Past performance ratio	Score

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



The same calculation and weighted average between all steps of the value chain where the company operates will be applied for dimension 2.

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

RATIONALE

RATIONALE OF THE INDICATOR

AL 2.1 PAST PERFORMANCE FOR ALUMINIUM ASSETS, PER STEP OF THE VALUE CHAIN

RELEVANCE OF THE INDICATOR:

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

- Dimension 1 (trend in past emissions intensity) shows the speed at which the company has been reducing its emissions intensity over the recent past. Comparing this to the decarbonization pathway gives an indication of the scale of the change that needs to be made within the company to bring it onto a low-carbon pathway.
- Dimension 2 (Alignment of past performance with sectoral carbon budget) helps the company having an overview of its emissions exceedance in the recent past. This dimension also intends to remind that the carbon budget is set for the global economy and that each sector and each company has a defined carbon budget that cannot be exceeded to reach the overall long-term objective of limiting global warming. The sector benchmark is defined for the next years, assuming it was respected for the past years where it was already defined. The emissions overshooting the benchmark in the past correspond to accumulated CO_2 that will remain in the atmosphere for decades. Hence, a company having already exceeded the benchmark should further its efforts to decrease its emissions in the near and remote future. This dimension is a ratio of the values of the emissions over a period of time in the past, as companies are very unlikely to provide data for the same period. What is considered here is the emission excess compared to the sectoral carbon budget, proportionally to the period of time.

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

• AL 2.2 LOCKED-IN EMISSIONS

DESCRIPTION & REQUIREMENTS	AL 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. The only assets to be assessed for this indicator are for the alumina extraction and electrolysis steps of the value chain as they are the most carbon intensive ones in the aluminium value chain.
DATA REQUIREMENTS	The relevant data for this indicator are the following ones, for each alumina and electrolysis asset, and this should be exhaustive for each asset that will work from Y to Y+15: ♦ Asset name ♦ Geography ♦ Step of the value chain ♦ Total capacity per year (tonnes of aluminium products) ♦ Ownership stake (%) ♦ Production rate to get nominal production (%) ♦ Scope 1+2 emissions factors (tCO_2e/tonne of aluminium product/per year) ♦ Year of commissioning

- Expected lifetime

This is the same data as for indicators 2.1 and 2.3, but here we need to take into account all alumina and electrolysis assets from Y to Y+15

The benchmark indicators involved are the following:

Type	Parameter	Intensity metric	Methodological sources
Scope 1+2 emissions intensity benchmark, per step of the value chain	$CB_{scopes12}$	tCO_2e/metric tonnes of aluminium products	IAI (see 6.1 for further details on the low carbon pathway source and computation)

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 [B(t)] over the same period of time.

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

$LE_F(t)$ 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:

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

The next figure illustrates locked-in emissions of one facility and of the whole company.

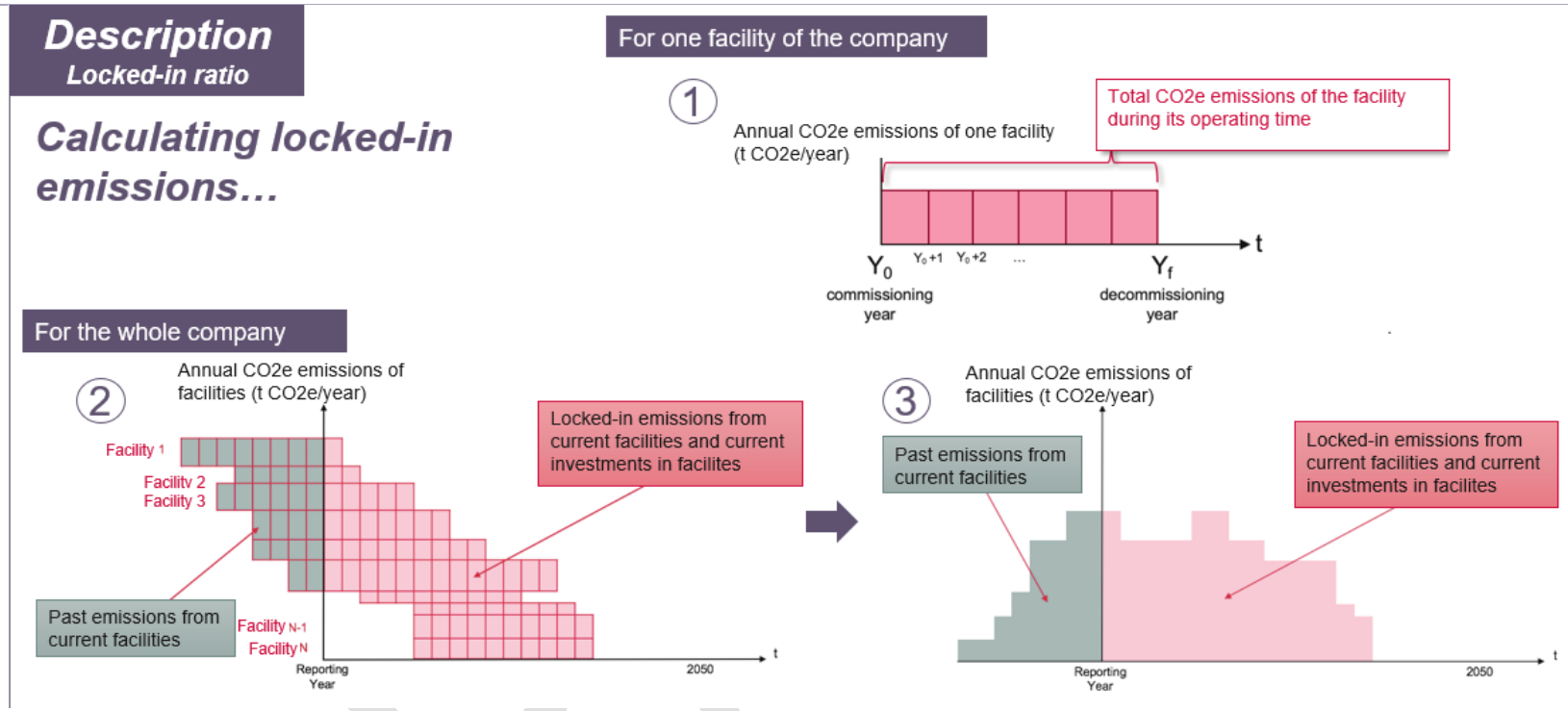


FIGURE 16: COMPUTING LOCKED-IN EMISSIONS FROM FACILITY

$B(y_r + 15)$ 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 6.1. The carbon budget is illustrated in the figure below.

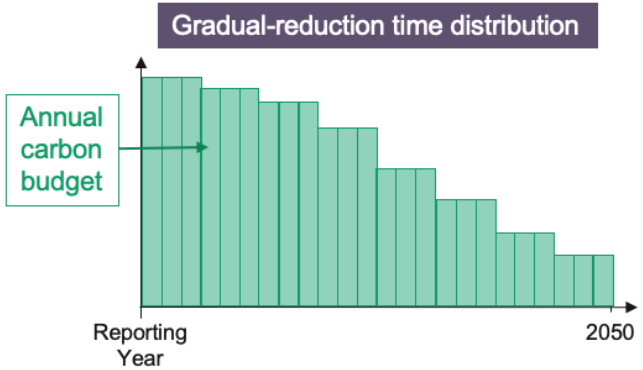


FIGURE 17: CARBON BUDGET DERIVED FROM THE COMPANY'S BENCHMARK

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 the next figure, and calculated as follows:

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

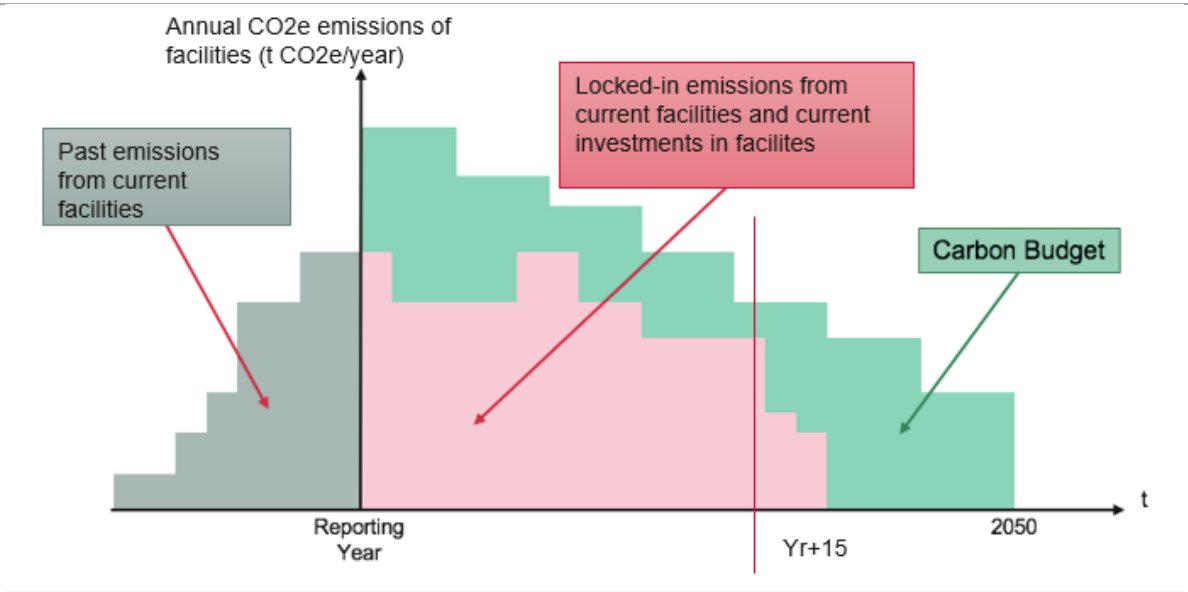


FIGURE 18: ILLUSTRATION OF THE LOCKED-IN RATIO

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 the figure below.

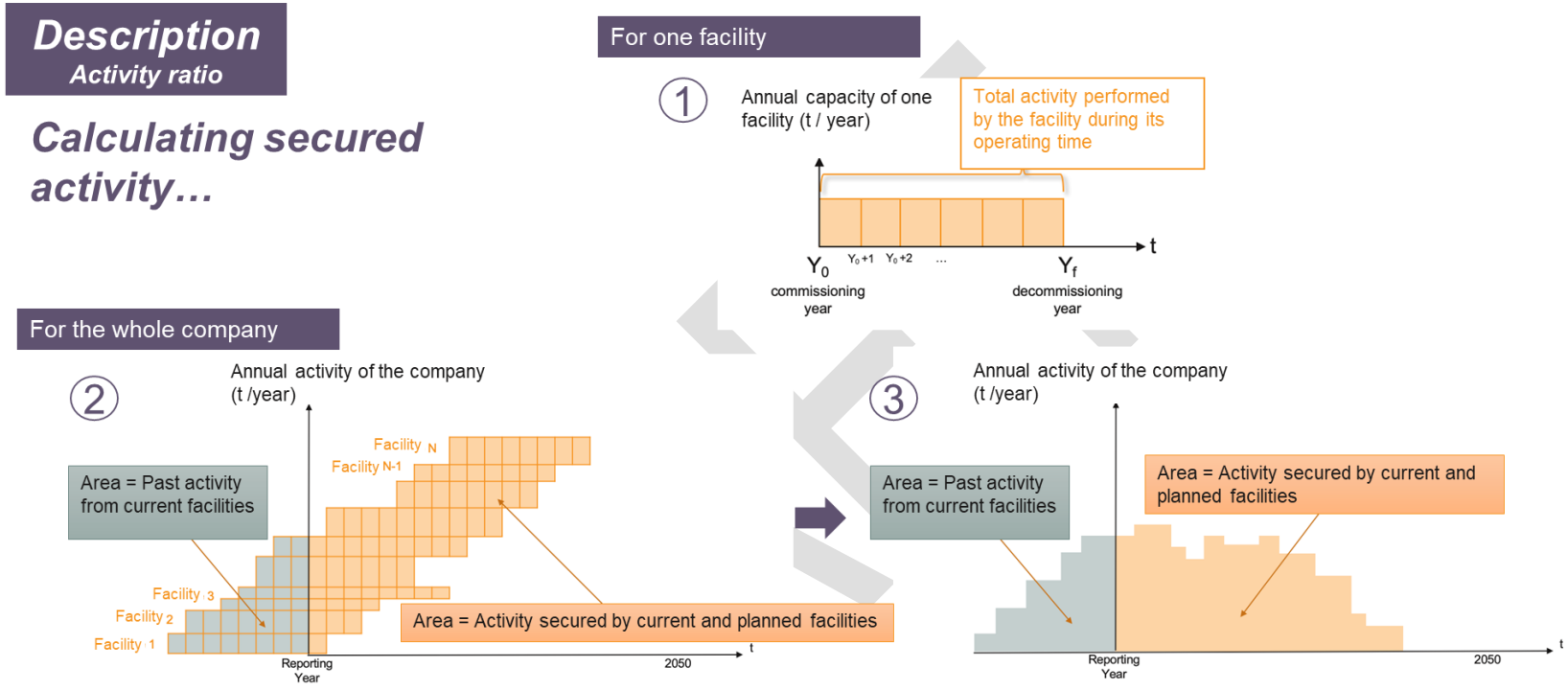


FIGURE 19: SECURED ACTIVITY BY THE COMPANY

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 6.1). The company's projected activity is illustrated in the figure below.

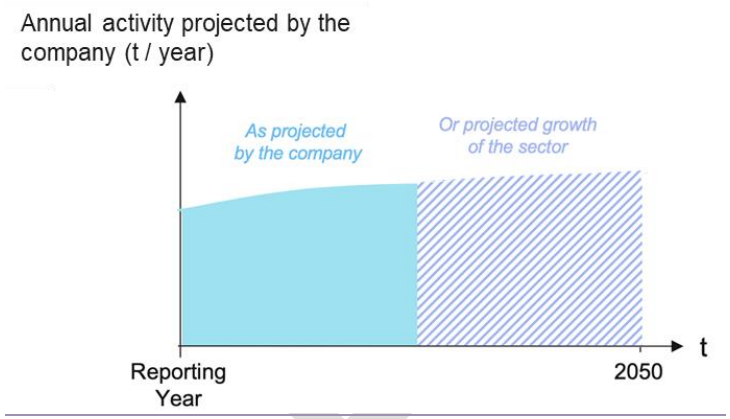


FIGURE 20: PROJECTED ACTIVITY

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 the following figure.

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

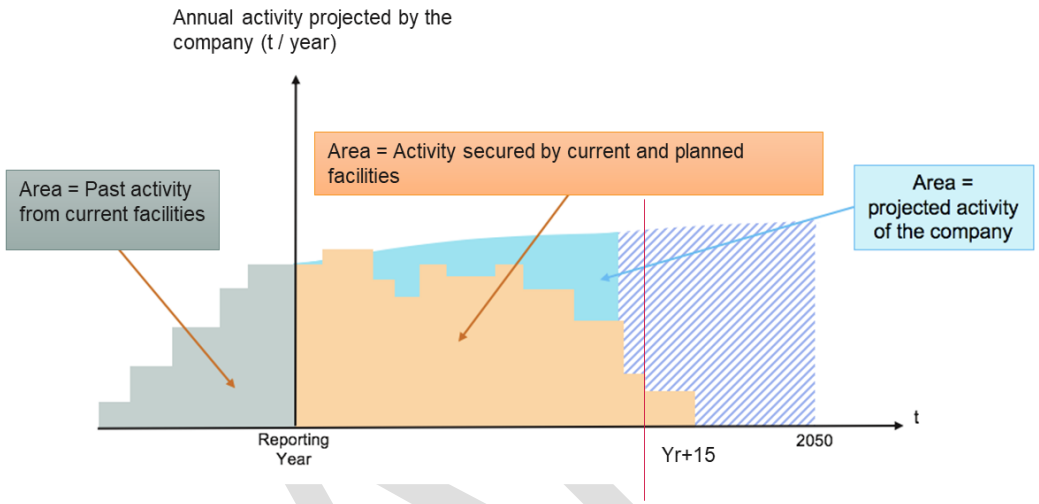


FIGURE 21: SECURED ACTIVITY RATIO

CALCULATION OF THE SCORE:

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

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

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

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

RATIONALE	**AL 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.

The only assets to be assessed for this indicator are for the alumina refining and electrolysis steps of the value chain as they are the most carbon intensive ones.

- **AL 2.3 FUTURE PERFORMANCE OF ALUMINIUM ASSETS, PER STEP OF THE VALUE CHAIN**

DESCRIPTION & REQUIREMENTS	AL 2.3 FUTURE PERFORMANCE OF ALUMINIUM ASSETS, PER STEP OF THE VALUE CHAIN
SHORT DESCRIPTION OF INDICATOR	Measure of the alignment of a company's future emissions intensity of assets with its low-carbon benchmark pathway. Each step of the value chain where the company is involved will be assessed against a specific low carbon pathway. When it is too difficult to have a data for each step of the value chain separately (e.g. smelting and electrolysis are sometimes merged in the carbon accounting), we can select the step that emits the most of the CO_2e (electrolysis)
DATA REQUIREMENTS	The relevant data for this indicator are the following ones, for each alumina and electrolysis asset, and this should be exhaustive for each asset that will work from Y to Y+5: ♦ Asset name ♦ Geography ♦ Step of the value chain ♦ Total capacity per year (tonnes of aluminium products) ♦ Ownership stake (%) ♦ Production rate to get nominal production (%) ♦ Scope 1+2 emissions factors (tCO_2e/tonne of aluminium product/per year) ♦ Year of commissioning ♦ Expected lifetime This is the same data as for indicators 2.1 and 2.2, but here we need to take into account all assets from Y to Y+5 Note that all the data need have already been filled for the locked-in emissions indicator. The benchmark indicators involved are the following:

Type	Parameter	Intensity metric	Methodological sources
Scope 1+2 emissions intensity pathway, per step of the value chain	EI_B	tCO_2e/metric tonnes of aluminium products	IAI (see 6.1 for further details on the low carbon pathway source and computation)

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on the Future Action ratio (Afuture) 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.

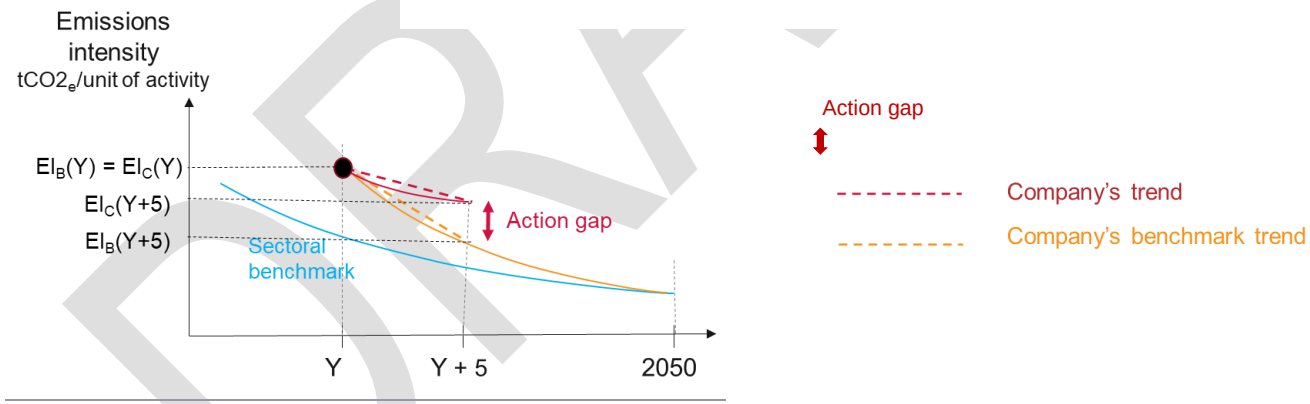


FIGURE 22: COMPARISON OF TREND IN FUTURE EMISSIONS AND TREND IN COMPANY'S BENCHMARK

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.

The final score assigned to the indicator is calculated as follows (see Annex 4 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	$A_{future} \times 100\%$
$Company's\ future\ trend < 0$ $A_{future} > 1$	100%

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

As each step of the value chain will be assessed, a weighted average based on the CO2e emissions corresponding to each step will be done to get the final score of indicator 2.3.

RATIONALE

RATIONALE OF THE INDICATOR

AL 2.3 FUTURE PERFORMANCE OF ALUMINIUM ASSETS, PER STEP OF THE VALUE CHAIN

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

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.

- **AL 2.4 CONTRIBUTION TO LOW CARBON ELECTRICITY GENERATION**

DESCRIPTION & REQUIREMENTS

AL 2.4. CONTRIBUTION TO LOW CARBON ELECTRICITY GENERATION

SHORT DESCRIPTION OF INDICATOR

An analysis of the contribution of the company to increase low carbon electricity generation and to decommission fossil fuel-based electricity generation assets. The weighting of the 3 dimensions of indicator 2.4 will vary depending on whether the company self-generates electricity or not (see the weighting table for indicator 2.4 below).

DATA REQUIREMENTS

The relevant data for this indicator are:

- Actions and policies related to low carbon electricity generation and purchase
- Emission intensities and self-generated electricity volume (tCO_2e/MWh of self-generated electricity) in Y and Y+15, by listing all self-generated electricity assets (same type of data as for indicators 2.1, 2.2 and 2.3).

HOW THE ASSESSMENT WILL BE DONE

The assessment will assign a maturity score based on the company's contribution to low-carbon electricity assets.

DIMENSION 1 – ACTION TO USE LOW CARBON ELECTRICITY

This indicator aims at assessing the share of low-carbon electricity generated from power stations, which are aligned with the European Union taxonomy of green activities. [17]

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned

Associated score	*0%*	*25%*	*50%*	*75%*	*100%*
Does the company take actions to use low-carbon electricity?	No knowledge of carbon content of electricity used or less than 30% of electricity used is low-carbon electricity, generated from a power station aligned with the EU taxonomy (purchase and/or on-site generation)	30% of electricity used is low-carbon electricity, generated from a power station aligned with the EU taxonomy (purchase and/or on-site generation)	45% of electricity used is low-carbon electricity, generated from a power station aligned with the EU taxonomy (purchase and/or on-site generation)	60% of electricity used is low-carbon electricity, generated from a power station aligned with the EU taxonomy (purchase and/or on-site generation)	At least 80% of electricity used is low-carbon electricity, generated from a power station aligned with the EU taxonomy (purchase and/or on-site generation)

DIMENSION 2 – POLICY REGARDING THE DEVELOPMENT OF LOW CARBON ELECTRICITY

This indicator aims at rewarding companies which contribute to the development of new low-carbon electricity generation assets, either because they have invested in their own low-carbon electricity generation assets* or through a long-term Corporate Power Purchase Agreement (CPPA) with local or co-located renewable energy generators [11].

* Low carbon electricity generation is defined according to the European Union Taxonomy [17]

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

What is the policy of the company regarding the development of low-carbon electricity?	No certification for electricity (grid) or fossil-fuel-based on-site generation	Guarantee of Origin (GO) or other Renewable Energy Certificates (REC)	Power Purchase Agreement (PPA)	PPA that guarantees the development of a new renewable electricity source without public funding (additionality)	PPA that guarantees the development of a new renewable electricity source without public funding And onsite production of renewable electricity that covers at least 10% of the electricity consumption of the company

DIMENSION 3 – SELF-GENERATED ELECTRICITY

This indicator aims at ensuring that companies which own electricity generation assets are taking action to reduce the carbon intensity of their self-generated electricity. It measures the alignment of a company's future emissions intensity of self-generated electricity assets with its low-carbon benchmark pathway.

The benchmark indicators involved are the following:

Type	Parameter	Intensity metric	Methodological sources
Scope 1+2 emissions intensity benchmark, per step of the value chain	EI_B	tCO_2e/MWh of self-generated electricity generated (or purchased electricity, see the 4 cases that might happen below)	IEA ETP 2017 B2DS scenario (Sectoral Decarbonization Approach from Science-Based Targets)

Future Action ratio (A_{future}) is calculated by dividing the company's future emission intensity trend for self-generated electricity (between reporting year and reporting year plus 15 years) and the future benchmark emission intensity for power production that is based on the SDA from Science-Based Targets (between reporting year and reporting year plus 15 years):

$$A_{future} = \frac{EI_c(Y_R) - EI_c(Y_{R+15})}{CB_{LCT}(Y_R) - CB_{LCT}\ \ (Y_{R+15})}$$

where $EI_c(Y_R)$ is the company self-generated electricity emission intensity at reporting year, $EI_c(Y_{R+15})$ is the company self-generated electricity emission intensity at reporting year plus 15 years, $CB_{LCT}(Y_R)$ is the power production benchmark emission intensity at reporting year and $CB_{LCT}(Y_{R+15})$ is the power production benchmark emission intensity at reporting year plus 15 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.

Four cases are possible:

- The company is already generating electricity at reporting year and plans to self-generate at reporting year plus 15 years.
- If the company self-generated electricity at the reporting year, but plans to decommission and to not to self-generate anymore at reporting year plus 15 years, then $EI_c(Y_{R+15})$ is undefined. In this case, the GHG intensity of the purchased electricity at reporting year will be used for $EI_c(Y_{R+15})$.
- If the company did not self-generate electricity at reporting year, but plans to self-generate electricity at reporting year plus 15 years, then $EI_c(Y_R)$ is undefined. In this case, the GHG intensity of the purchased electricity at reporting year will be used for $EI_c(Y_R)$.
- If the company does not self-generate electricity at reporting year and does not plan to at reporting year plus 15 years, this indicator is neither assessed nor weighed in the final score.

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

Conditions	Score
$Company's\ future\ trend > 0$ Increase in company emissions intensity	0%
$Company's\ future\ trend \leq 0$ $0 \leq A_{future} \leq 1$ Decrease in company emissions intensity but company's pathway does not go beyond the company's benchmark ambition	$A_{future} \times 100\%$
$Company's\ future\ trend < 0$ $A_{future} > 1$ Decrease in company emissions intensity and company's pathway equals or exceeds the company's benchmark ambition	100%
$Company's\ future\ trend \leq 0\ and\ EI_C(Y_{R+5}) < CB_{LCT}(2050)$ No increase in company emissions intensity and company's emissions intensity is already below the company's benchmark ambition for 2050	100%

CALCULATION OF FINAL SCORE

The final score will be calculated as follows:

Dimension	Weighting (Company self-generating electricity or is planning to do so within 15 years)	Weighting (no self-generation in Y nor within Y and Y+15)

Dimension 1 – Action to use low carbon electricity	25%	50%
Dimension 2 – Policy regarding the development of low carbon electricity	25%	50%
Dimension 3 – Self-generated electricity	50%	0%

RATIONALE

RATIONALE OF THE INDICATOR

AL 2.4. CONTRIBUTION TO LOW CARBON ELECTRICITY GENERATION

Electricity consumption is the main CO_2e emissions of the aluminium value chain, and 60% of the electricity consumed by the aluminium sector in the world is self-generated. As a consequence, aluminium companies should be rewarded when:

- Reducing carbon intensity of self-generated electricity
- Purchasing electricity with guaranty of origin (GO) or Renewable Energy Certificates (REC)
- Purchasing low carbon electricity through a CPPA with Energy attribute certificate
- Directly investing in additional low carbon electricity generation

Additional low-carbon electricity generation assets will be needed in every country, even in countries with already low carbon electricity mix. As big electricity consumers, aluminium companies shall contribute to enable more low-carbon electricity generation assets being connected to the grid, by direct or indirect investment.

Moreover, investing in low-carbon electricity assets imply important Capex investments. As a consequence, rewarding companies making these investments in low carbon electricity assets is key. Y+15 has been chosen as the target year for the carbon intensity of the self-generated electricity, as it requires some time to invest in low-carbon power plants.

- **AL 2.5 REDUCING PROCESS-SCRAP GENERATION**

DESCRIPTION & REQUIREMENTS

AL 2.5 REDUCING PROCESS-SCRAP GENERATION

SHORT DESCRIPTION OF INDICATOR

The company demonstrates that it has a comprehensive strategy at corporate level to reduce scrap within its own operations. It is therefore a future-oriented indicator. Only companies present at either the electrolysis, casting, semis production, recycling or internal scrap remelting steps will be assessed for this indicator.

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?

Those questions refer to both internal scrap (run-around scrap which is remelted within the facility which produced it) and pre-consumer scrap (process scrap which is sold to be remelted externally).

HOW THE ASSESSMENT WILL BE DONE

The analyst evaluates the description and evidence of the scrap reduction 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.

Best-practice elements to be identified in the scrap reduction strategy include:

- Basing it on an exercise costing of the value of scrap
- Commitment to reduce scrap in direct operations (covers all operations and whole organisational boundary)
- Using targets with end dates for scrap reduction
- Having interim targets
- Management at a high level within the organisation
- Monitoring, reporting and verification processes included to track progress
- Continuous improvement/learning feedback mechanisms
- Commitments to employee education
- Linking the scrap reduction strategy to the development of circular economy business models
- Linking the scrap reduction strategy to the core business strategy

- Linking the scrap reduction strategy to core business operations (procurement, product design)

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

The maturity matrix used for the assessment is the following:

Subdimension	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	***100%/ 3***
Method	No defined strategy	Strategy implementation focuses on the largest sources of scrap but has no robust method of quantification and verification for this implementation	Company quantifies the value of scrap through a costing exercise, but does not have clear prioritization or verification process.	Quantifies the value of scrap through a verifiable costing exercise and uses this exercise to prioritize actions.	Company has costed the value of scrap, and links this to circular economy in the core business strategy.	***100%/ 3***

Monitoring	Not any responsibility at high level in the organisation No clear monitoring approach in place	Responsibility at high level in the organisation No clear monitoring approach in place.	Responsibility at high level in the organisation Monitoring systems in place for own operations to track progress but not for the parts of the value chain outside of control boundary	Responsibility at high level in the organisation Monitoring systems in place for own operations and the value chain elements under the strategy to track progress	Responsibility at high level in the organisation 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	***100%/ 3***

RATIONALE

RATIONALE OF THE INDICATOR

AL 2.5 REDUCING PROCESS-SCRAP GENERATION

RELEVANCE OF THE INDICATOR:

Any pre-consumer scrap which can be avoided should be avoided in order to reduce the global carbon emission intensity of aluminium final products. Reducing pre-consumer scrap is a key lever to improve the material efficiency of the aluminium value chain. In 2019, pre-consumer scrap represented about 15,2% of the global production of aluminium semi-products [8]. As aluminium transformation processes are very diverse, it is not possible to define a common objective of scrap reduction in terms of percentage. Therefore, the maturity matrix assesses the means implemented by the company in order to reduce its pre-consumer scrap.

INTANGIBLE INVESTMENT

- **AL 3.1 R&D SPENDING IN LOW-CARBON TECHNOLOGIES**

DESCRIPTION & REQUIREMENTS

AL 3.1 R&D SPENDING IN LOW-CARBON 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:

- % of R&D costs/investments in low-carbon technologies of the company over the last 3 years over the total R&D costs/investments of the company over the last 3 years.

HOW THE ASSESSMENT 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' over the last 3 years to the company's 'total annual capital expenditure in R&D' over the same span of time.

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:

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

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 low-carbon technologies?	Below 20%	Between 21% and 35%	Between 36 % and 50%	Between 51% and 65%	Above 65%	**50%**

DEFINING 'LOW-CARBON TECHNOLOGIES':

Relevant sectoral roadmaps have been used to define a list of low-carbon technologies for the sector. It includes technologies to decarbonise the production assets and improvements of sold product carbon performance. The technologies have been classified as mature and non-mature.

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.

Technologies are considered "non-mature" if TRL ≤ 8.

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 following lists give high-level categories of mature and non-mature technologies (more details on the annex section "Low-carbon technologies landscape). The categories are intentionally broad to allow the analyst to assess the company's presented technologies; given the technologies

achieve electricity decarbonization, direct emissions reduction or recycling & resource efficiency. These high-level categories come from relevant sectoral roadmaps: IAI [13], IEA [4] [18], European Aluminium [9], World Economic Forum [6]. They represent the main emissions reduction levers for the aluminium industry.

The list of mature technologies is:

- Electricity decarbonization
    - Low-carbon electricity self-generation
    - Energy efficiency
    - Other
- Direct emissions reduction
    - Substitute to thermal energy (green hydrogen / electrification / biomass)
    - Refinery and cast house electrification/fuel switching
    - Other
- Recycling & resource efficiency
    - Ecodesign to facilitate the post-consumer scrap collection or extend the lifetime of aluminium products
    - Technologies to improve the quality of the scrap
    - End-of-life scrap collection technologies
    - Integration of heat exchangers to vary energy consumption and production levels
    - Other

The list of non-mature technologies is:

- Electricity decarbonization
    - CCS/CCUS
    - Multipolar cells
    - Technologies to improve the electricity consumption and help make flexible the grid (e.g. EnPot, electricity demand management technologies etc.)
    - Energy storage to better handle the increase of VRE (Variable Renewable Energy) in the electricity supply
    - Other

- Direct emissions reduction
  - Inert anodes
  - CCS/CCUS
  - Other
- Recycling & resource efficiency
  - Minimization of pre-consumer scrap generated during the processes
  - Minimization of all metal losses during casting and recycling
  - Other

Rationale

Rationale of the indicator

AL 3.1 R&D SPENDING IN LOW-CARBON TECHNOLOGIES

RELEVANCE OF THE INDICATOR:

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

- To enable the transition, the aluminium sector relies heavily on R&D to activate mitigation levers: electricity decarbonisation, direct emissions reduction, resource efficiency. 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.

RELEVANCE OF THE INDICATOR'S 3-YEAR TIME HORIZON

Expenditures over the 3 last years are used for the indicator to consider that expenditure for major R&D projects may not be linear over years.

- **AL 3.2 COMPANY LOW-CARBON PATENTING ACTIVITY**

Description & Requirements

AL 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 of the company (patenting activity means a number of patents).

DATA REQUIREMENTS

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

- % of patenting activity in low-carbon technologies of the company over the last 5 years over total patenting activity of the company over the last 5 years

HOW THE ASSESSMENT WILL BE DONE

PAST LOW-CARBON PATENTS ACTIVITY RATIO

The assessment is based on the ratio of the company's patenting activity dedicated to low-carbon technologies over the last 5 years to the company's total patenting activity over the same span of time.

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 low-carbon technologies patenting activity.

The matrix is provided below:

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

What is the share of patents in low-carbon technologies compared to the total patent activity over the last 5 years?	The share of low-carbon technologies patents is below 20% of total patents	The share of low-carbon technologies patents is between 21% and 40% of total patents	The share of low-carbon technologies patents is between 41% and 60% of total patents	The share of low-carbon technologies patents is between 61% and 80% of total patents	The share of low-carbon technologies patents is above 80% of total patents	***100%***

DEFINING LOW-CARBON TECHNOLOGIES PATENTS:

See previous indicator.

The following lists give high-level categories of low-carbon technologies. The categories are intentionally broad to allow the inclusion of a diversity of technologies; given the technologies achieve electricity decarbonization, direct emissions reduction or recycling & resource efficiency.

The list of low-carbon technologies is:

- Electricity decarbonization
  - CCS/CCUS
  - Multipolar cells
  - Low-carbon electricity self-generation
  - Energy efficiency
  - Technologies to improve the electricity consumption and help make flexible the grid (e.g. EnPot, electricity demand management technologies etc.)
  - Energy storage to better handle the increase of VRE (Variable Renewable Energy) in the electricity supply
  - Other
- Direct emissions reduction
  - Inert anode
  - Substitute to thermal energy (green hydrogen / electrification / biomass)
  - Refinery and cast house electrification/fuel switching
  - CCS/CCUS

    - Other
- Recycling & resource efficiency
    - Minimization of pre-consumer scrap generated during the processes
    - Minimization of all metal losses during casting and recycling
    - Ecodesign to facilitate the post-consumer scrap collection or extend the lifetime of aluminium products
    - End-of-life scrap collection technologies
    - Technologies to improve the quality of the scrap
    - Integration of heat exchangers to vary energy consumption and production levels
    - Other

RATIONALE

RATIONALE OF THE INDICATOR

AL 3.2 COMPANY LOW-CARBON PATENTING ACTIVITY

RELEVANCE OF THE INDICATOR:

The indicator on low-carbon technologies 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 TIME HORIZON

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

SOLD PRODUCT PERFORMANCE

○ AL 4.1 CRADLE-TO-GATE ALUMINIUM CARBON FOOTPRINT

DESCRIPTION & REQUIREMENTS

AL 4.1 CRADLE-TO-GATE ALUMINIUM CARBON FOOTPRINT

SHORT DESCRIPTION OF INDICATOR

An analysis to measure if the company aluminium product cradle-to-gate CO_2e emissions from Y-5 to Y (until the last steps of the value chain covered by the company) of the aluminium products sold are aligned with what is expected from the company from Y to Y+5, that is a sectoral aluminium decarbonization pathway that will be company specific based on the last step of the value chain where the company operates.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Scope 1+2 CO_2e emissions of the steps of the value chain where the company operates in reporting year and Y-5
- Scope 3 upstream emissions at reporting year and Y-5, with ancillary material & transport CO_2e emissions included. The company is to select which are the relevant Scope 3 upstream steps to be taken into account (e.g. if the company only does recycling, then the Scope 3 upstream of the aluminium purchased is equal to 0 tCO_2e by convention, so the company should not take the CO2e emissions of these upstream steps into account). Moreover, there might be some sales and purchases gaps between several steps of the value chain (e.g. you might sell a part of the bauxite ores you mine and carry on processing the rest, or you might buy some alumina from suppliers). Basic calculation (meaning not removing or adding any CO_2e emissions) is valid as long as you do not purchase / sell too many products alongside the value chain. If not, please use the calculation your company does with its own methodology and assess if the calculation is right and matches with the two bullet points above. One way to proceed would be: to have consistent figures, please be consistent with the volume indicated at the denominator (e.g. ask for suppliers Scope 1+2 data and add it in your Scope 3 upstream if you purchased alumina, remove some of your Scope 1+2 CO_2e emissions if you sold bauxite ores to others etc.).
- Volume data (e.g. metric tonnes of bauxite ores, metric tonnes of alumina extracted etc.): the denominator of the carbon intensity to be used will be the last step of the value chain where the company operates, at Y-5 and at reporting year
- The company is to indicate which steps of the aluminium value chain it considers in the data it provides (both CO_2e and activity volume data). This will be used to compute the company's low carbon pathway

The benchmark indicators involved are the following:

Target type	Parameter	Intensity metric	Methodological sources
Scope 1+2+3 (only upstream for Scope 3)	$EI_{B\text{-}S123}$	tCO_2e/metric tonnes of aluminium products (last step of the value chain where the company operates)	IAI (see 6.1 for further details on the low carbon pathway source and computation)

HOW THE ASSESSMENT WILL BE DONE

The analysis is based on the comparison between the company's recent (reporting year minus 5 years) emissions intensity trend gradient (CR'_{S123}) and the company's decarbonization pathway trend gradient (CB'_{S123}) in the short-term (reporting year plus 5 years). The emissions intensity of the company at the reporting year (CEI_Y) and the sectoral benchmark value of emissions intensity in 2050 (SB_{2050}) are also considered to calculate the company's score.

CR'_{S123} is the gradient of the linear trend-line of the company's recent scope 1+2+3 emissions intensity ($kgCO_2$/ton) over time (CR_{S123}).

CB'_{S123} is the gradient of the linear trend-line of the company benchmark pathway for emissions intensity ($kgCO_2$/ton) (CB_{S123}). See section 6.1 for details on the computation of the company specific decarbonization pathway.

The difference between CR'_{S123} and CB'_{S123} will be measured by their ratio (r_{S123}). This is the scope 1+2+3 emissions Transition ratio, which is calculated by the following equation, with the symbol 'used to denote gradients:

$$R_{S123} = \frac{CR'_{S123}}{CB'_{S123}}$$

Four different cases are to be taken into consideration:

- Case #1: CR'_{SC123} is positive → Score = 0 (whatever the r_{SC123} and CEI_Y values)
- Case #2: CR'_{SC123} is negative and $0 < r_{SC123} < 1$ and CEI_Y is higher than SB_{2050} → Score = r_{SC123} (expressed as a percentage)

- Case #3: CR'_{SC123} is negative and $r_{SC123} \geq 1$ and CEI_Y is higher than SB_{2050} → Score = 100 %
- Case #4: CR'_{SC123} is negative and CEI_Y is lower than SB_{2050} → Score = 100 % (whatever the r_{SC123} value)

See illustrations of different cases in indicator AL 2.1 Past performance for aluminium assets, per step of the value chain, Dimension 1.

RATIONALE

RATIONALE OF THE INDICATOR

AL 4.1 CRADLE-TO-GATE ALUMINIUM CARBON FOOTPRINT

RELEVANCE OF THE INDICATOR:

This indicator is meant to ensure that companies collaborate along the value chain to provide a low-carbon aluminium at the gate of the sector.

The analysis of the past action ratio on Cradle-to-gate aluminium carbon footprint is included in the ACT assessment for the following reasons:

- The trend shows the speed at which the company has been reducing the carbon footprint of their aluminium. Comparing this to the decarbonization pathway gives an indication of the scale of the change that needs to be made within the company to bring it onto a low-carbon pathway.
- While ACT aims to be 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:

While 'gap' type scoring is preferred where possible for any indicator, this indicator only looks at past emissions and would therefore require a different baseline in order to generate a gap analysis. Thus, instead of a gap analysis, a 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. An advantage of this trend analysis is that trends can be compared directly and a score can be directly correlated to the resulting ratio.*]*

- **AL 4.2 PURCHASED PRODUCT INTERVENTION**

DESCRIPTION & REQUIREMENTS	AL 4.2 PURCHASED PRODUCT INTERVENTION
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. This indicator only concerns companies purchasing alumina and/or primary from suppliers, as they account for the hotspots in terms of CO_2e emissions for the aluminium sector. This indicator looks both at is being done in the present and what will be done in the future without specifying a precise time horizon, but this is mort short-term oriented.
DATA REQUIREMENTS	The question comprising the information request that are relevant to this indicator is: ♦ Intervention at the supplier side and actions undertaken to make them engage in decarbonizing their sold products
HOW THE ASSESSMENT WILL BE DONE	To be ready for the transition to a low-carbon economy, aluminium companies – in particular those who purchase resources that could significantly increase their carbon footprint, such as alumina and primary - 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 company will then identify interventions that determine the most ambitious impacts achievable and highlights the GHG hotspots in accordance with best practices. Hotspots are alumina and primary purchases in the aluminium sector. 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.

Subdimension	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%
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%[1] (based on IAI data on alumina and primary) of GHG reduction (absolute) of the purchased product before 2035		Breakthrough innovation to achieve more than 30%[2] (based on IAI data on alumina and primary) of the GHG reduction (absolute) of the purchased product before 2035	20%

Is the company able to determine with high level of assurance future CO_2e 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 CO_2e data on purchased product certified by third party	Robust CO_2e data on purchased product certified by third party Future CO_2e emissions intensity of suppliers is forecasted but the intensity is not low-carbon aligned	Robust CO_2e data on purchased product certified by third party Future CO_2e emissions intensity of suppliers is forecasted and the intensity is low-carbon aligned	35%
Action to reduce the carbon emissions and increase efficiency 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 5%[3] (based on IAI data on transport) the carbon emissions and increase the use of low carbon vehicles of 20%	Actions have been taken to reduce of 10%[4] (based on IAI data on transport) the carbon emissions and increase the use of low carbon vehicles of 50%	Use of low-carbon transportation and local suppliers only	5%

1. Decrease of alumina CO_2e emissions (intensity) by 11% and 30% for primary in 2035 compared to the base year 2018 => average for Next practice (IAI data)
2. Decrease of alumina CO_2e emissions (intensity) by 11% and 30% for primary in 2035 compared to the base year 2018 => upper bound for Low-carbon aligned (IAI data)
3. Half of 4. for Advanced
4. Decrease of transport CO_2e emissions (intensity) by 10% in 2035 compared to the base year 2018 => upper bound for Next practice (IAI data)

RATIONALE

RATIONALE OF THE INDICATOR

AL 4.2 PURCHASED PRODUCT INTERVENTION

RELEVANCE OF THE INDICATOR:

Alumina and primary production can be responsible for a significant share of the carbon footprint of the aluminium value chain.

A key issue with the interventions approach is that if interventions have no measurable impact on GHG emissions, they are effectively “greenwash”. 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.

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.

- **AL 4.3 RECYCLED SCRAP TRACEABILITY**

DESCRIPTION & REQUIREMENTS	**AL 4.3 RECYCLED SCRAP TRACEABILITY**
SHORT DESCRIPTION OF INDICATOR	The company demonstrates that its recycling activities do not contribute to industrial inefficiencies at their pre-consumer and post-consumer scrap suppliers, through traceability. Only companies present at the recycling or internal scrap remelting steps will be assessed for this indicator.
DATA REQUIREMENTS	The questions comprising the information request that are relevant to this indicator are: ♦ What level of scrap traceability is implemented by the company? ♦ Can the company demonstrate that it does not contribute to industrial inefficiencies?
HOW THE ASSESSMENT WILL BE DONE	The analyst evaluates the description and evidence of the scrap traceability measures 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 scrap traceability strategy include: • Management at a high level within the organisation • A certified environmental management system assessing pre-consumer scrap practices • Monitoring, reporting and verification processes included to track progress • Continuous improvement/learning feedback mechanisms

- Linking the scrap traceability strategy to the development of circular economy business models
- Linking the scrap traceability strategy to the core business strategy
- Linking the scrap traceability strategy to core business operations (procurement, product design)

The maturity matrix used for the assessment is the following:

Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned
Recycled scrap traceability	No scrap traceability management system implemented by the company	The company can report the amounts of post-consumer scrap, pre-consumer scrap from identified origin (e.g. clients and/or own transformation sites) and pre-consumer scrap purchased from scrap-dealers	The company can report that at least 50% of the scrap recycled is either post-consumer scrap or pre-consumer scrap generated in a facility with demonstrated good pre-consumer scrap reduction practices	The company can report that at least 75% of the scrap recycled is either post-consumer scrap or pre-consumer scrap generated in a facility with demonstrated good pre-consumer scrap reduction practices	The company can report that at all the scrap recycled is either post-consumer scrap or pre-consumer scrap generated in a facility with demonstrated good pre-consumer scrap reduction practices

DEFINING "GOOD PRE-CONSUMER SCRAP REDUCTION PRACTISES"

Companies that have a certified environmental management system (e.g. ISO 14001, EMAS…) are assumed to have "good pre-consumer scrap practises" for example (not the only case possible).

RATIONALE

AL 4.3 RECYCLED SCRAP TRACEABILITY

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

The share of recycled aluminium is expected to increase in the future. It is crucial that this increase does not occur at the expense of industrial efficiencies in aluminium transformation. This can be prevented by improving transparency and traceability of the pre-consumer scrap that is recycled.

MANAGEMENT

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

DESCRIPTION & REQUIREMENTS	AL 5.1 OVERSIGHT OF CLIMATE CHANGE ISSUES
SHORT DESCRIPTION OF INDICATOR	The company discloses that responsibility for climate change within the company lies at the highest level of decision-making within the company structure.
DATA REQUIREMENTS	The relevant data for this indicator are: ♦ Environmental policy and details regarding governance ♦ The reporter shall provide details on where is the highest level of direct responsibility for climate change within the organization External sources of data may also be used for the analysis of this indicator.
HOW THE ASSESSMENT WILL BE DONE	The benchmark case is that climate change is managed within the highest decision-making structure within the company. The company situation will be compared to the benchmark case, if it is similar then points will be awarded. The position at which climate change is managed within the company structure will be determined from the company data submission and accompanying evidence. The maturity matrix used for the assessment is the following:

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

Rationale

AL 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. Evidence of how climate change is addressed within the top decision-making structures is a proxy for how seriously the company takes climate change, and how well integrated it is at a strategic level. High-level ownership also increases the likelihood of effective action to address low-carbon transition.

Changes in strategic direction are necessarily future-oriented, which fits with this principle of the ACT initiative.

Managing oversight of climate change is considered as a good practice.

- **AL 5.2 CLIMATE CHANGE OVERSIGHT CAPABILITY**

DESCRIPTION & REQUIREMENTS

AL 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.

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

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

HOW THE ASSESSMENT WILL BE DONE

The presence of expertise on 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	Sub dimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score
Associated score		***0%***	***25%***	***50%***	***75%***	***100%***	
Does this employee / committee have a proven expertise	***The presence of expertise on relevant topics to climate***	The employee/committee does not meet the	The employee/committee meets several of the	The employee/committee meets all	The employee/committee meets all	The employee/committee meets all	***100%***

regarding climate change topics	***change and low-carbon transition within the individual or committee with overall CC responsibility***	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.	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 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 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 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	

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

AL 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.

• AL 5.3 LOW-CARBON TRANSITION PLAN

DESCRIPTION & REQUIREMENTS

AL 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
  - 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.)

HOW THE ASSESSMENT 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. From now or the near future <5 years, until at least 2035 and preferably beyond (2050)
- 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
- The company has a publicly-acknowledged well-below 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.

Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Subscore
Associated score	***0%***	***25%***	***50%***	***75%***	***100%***	
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	***21%***
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	***10%***
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	***17%***
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)	***10%***

RATIONALE **AL 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.

• AL 5. 4 CLIMATE CHANGE MANAGEMENT INCENTIVES

DESCRIPTION & REQUIREMENTS

AL 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 relevant data for this indicator are:

- Management incentives
- The reporter shall report whether the company provides incentives for the management of climate change issues, including the attainment of targets
- The reporter shall provide details on the incentives provided for the management of climate change issues
- The reporter shall provide details on the activities that are usually rewarded by incentives in the company

HOW THE ASSESSMENT WILL BE DONE

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

Who is entitled to benefit?	Benefit	Any other answer		Executive	Senior executive	Board chairman - Board/Executive board - Director on board - Corporate executive team - Chief Executive Officer (CEO) - Chief Operating Officer (COO) - Chief Financial Officer (CFO) - All employees	***33%***
What is the type of incentives (non-monetary/ monetary)?	Type of incentives	Non-monetary	Recognition (non-monetary)	Other non-monetary reward		Monetary reward	***33%***
What are the targets related to CC incentives? *	Incentivized performance indicator	No targets incentivized	Behaviour change 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	***33%***

* 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 tonnes of carbon 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.

RATIONALE

AL 5.4 CLIMATE CHANGE MANAGEMENT INCENTIVES

RATIONALE OF THE INDICATOR

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

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

• AL 5.5 CLIMATE CHANGE SCENARIO TESTING

DESCRIPTION & REQUIREMENTS

AL 5.5 CLIMATE CHANGE SCENARIO TESTING

SHORT DESCRIPTION OF INDICATOR

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

DATA REQUIREMENTS

The relevant data for this indicator are:

- The reporter shall provide the details and supporting documents on the organization's climate change scenario testing

HOW THE ASSESSMENT WILL BE DONE

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

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

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

What is the scope of the scenario testing?	***Boundary***	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?	***Timescale***	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?	***Results***	Expressed in qualitative terms	Expressed in quantitative terms	Expressed in financial terms	Expressed in financial terms and results are translated into value-at-risk	Expressed as value-at-risk	***10%***
What are the types of changing conditions considered?	***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%***

RATIONALE

AL 5.5 CLIMATE CHANGE SCENARIO TESTING

RATIONALE OF THE INDICATOR

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 techniques such as use of an internal price on carbon, scenario analysis and stress testing to be implemented to enable companies to calculate the value-at-risk that such changes could pose to the business. As this practice is emergent at this time there is currently no comprehensive survey or guidance on specific techniques or tools recommended for the sector. The ACT methodology thus provides a broad definition of types of testing and analysis which can be relevant to this information requirement, to identify both current and best practices and consider them in the analysis.

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

SUPPLIER ENGAGEMENT

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

DESCRIPTION & REQUIREMENTS	AL 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS
SHORT DESCRIPTION OF INDICATOR	This indicator assesses the strategic policy and the process which are formalized and implemented into business decision making-process to influence, enable or otherwise shift suppliers' choices and behaviours in order to reduce its GHG emissions.
DATA REQUIREMENTS	The relevant data for this indicator are: ♦ Methods of supplier engagement, strategy to prioritizing supplier engagements and measures of success, especially for companies purchasing alumina and/or primary from suppliers ♦ Number of suppliers engaged and proportion of total spend ♦ Data on suppliers' GHG emissions and climate change strategies
HOW THE ASSESSMENT 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. This maturity matrix is indicative but does not show all possible options that can result in a particular score. Companies' responses will be scrutinized by the analyst and then placed on the level in the matrix where the analyst deems it most appropriate.

Question	Sub dimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub scores
Associated score		***0%***	***25%***	***50%***	***75%***	***100%***	
To what extent GHG emissions reduction issues are integrated in engagement with suppliers?	**Consideration of reduction targets**	No consideration	CSR clause included in engagements with suppliers. Means commitment included in contracts	CSR clause with GHG emissions reduction included in engagements with suppliers. Results-driven commitment in contracts	CSR clause with quantified GHG emissions reduction included in engagements with suppliers. Results commitment in contracts. Regular reporting	CSR clause with GHG emissions reduction included as priority in engagements with suppliers. Results-driven commitment in contracts. Regular reporting.	***20%***
What action levers are used by the company to encourage suppliers to develop low-carbon offer?	**Use of action levers**	No action levers used	Passive approach (suppliers may offer low-carbon product/service but no specific requirements from the company)	Use of one action lever	Use of several action levers (	Use of several action levers 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%***

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:

- Awareness campaign,
- Purchasing rules
- Joint R&D
- Supporting/leading industry environmental groups
- Supplier Code of Conduct
- Sanctions
- Audits
- Sharing patents
- Sustainability manager involved in appointment/can veto new supplier appointments

RATIONALE

AL 6.1 STRATEGY TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

Supplier engagement is included in this ACT methodology for the following reasons:

- It might have a significant impact in terms of GHG emissions, especially for companies purchasing alumina and/or primary from suppliers but not only as it covers all types of purchase
- Achieving decarbonization of the whole supply chain is also key to reach the ambitious goals in most of the companies of the value chain
- Engaging suppliers through contract clauses and sales incentives is necessary to take them on board

SCORING THE INDICATOR:

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

- ## AL 6.2 ACTIVITIES TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS

DESCRIPTION & REQUIREMENTS **AL 6.2 ACTIVITIES TO INFLUENCE SUPPLIERS TO REDUCE THEIR GHG EMISSIONS**

SHORT DESCRIPTION OF INDICATOR

The company participates in activities that help, influence or otherwise enable suppliers to reduce their GHG emissions. The indicator aims to be a holistic measure of these activities to assess how active the company is in reducing the emissions of their products/services in the value chain across all products/services.

DATA REQUIREMENTS

The relevant data for 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

HOW THE ASSESSMENT 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.

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

Question	Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon' aligned	Subscore

Associated score		0%	25%	50%	75%	100%	
How the company encourage suppliers to reduce their GHG emissions?	**Suppliers GHG emissions**	No activity	Company requires suppliers to sign a code of conduct (or similar) and/or to provide data regarding their environmental performance (for audited suppliers). Means-driven commitment	Company assists suppliers to reduce their GHG emissions	Company 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	***50%***
Does the company develop a low-carbon demand?	**Low-carbon offer of suppliers**	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	***50%***

Rationale

AL 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 this ACT methodology for the following reasons:

- It might have a significant impact in terms of GHG emissions, especially for companies purchasing alumina and/or primary from suppliers but not only as it covers all types of purchase
- Achieving decarbonization of the whole supply chain is also key to reach the ambitious goals in most of the companies of the value chain

- Engaging suppliers through contract clauses and sales incentives is necessary to take them on board.

SCORING THE INDICATOR:

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

CLIENT ENGAGEMENT

AL 7.1 STRATEGY TO INFLUENCE CLIENT BEHAVIOUR TO REDUCE THEIR GHG EMISSIONS

DESCRIPTION & REQUIREMENTS	**AL 7.1 STRATEGY TO INFLUENCE CLIENTS TO REDUCE THEIR GHG EMISSION**
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 client choices and behaviour in order to reduce GHG emissions.
DATA REQUIREMENTS	The relevant data for this indicator are: ♦ Strategy to influence clients GHG emissions ♦ % of products/services ♦ Data on clients' choices and preferences towards reducing GHG emissions

HOW THE ASSESSMENT WILL BE DONE

The assessment will assign a maturity score based on the company's formalized strategy to influence clients, expressed in a maturity matrix.

Question	Subdimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score
Associated score		***0%***	***25%***	***50%***	***75%***	***100%***	
To what extent GHG emissions reduction issues are integrated in engagement with clients?	***Consideration of reduction targets***	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?	***Influence on clients***	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?	***Scope***	No strategy		Only large clients (represent 20% of revenues in total)	Majority of clients (represent more than 60% of total revenues)	Almost all clients (represent more than 90% of total revenues)	***20%***

Rationale

Rationale of the indicator

AL 7.1 Strategy to influence client behaviour to reduce their GHG emissions

RELEVANCE OF THE INDICATOR:

Strategies to influence clients are included in this ACT methodology for the following reasons:

- Companies usually have the ability to influence the strategy and performance of clients regarding climate thanks to their products or services.
- The downstream can represent a large source of emissions for some companies throughout the value chain and clients should be engaged through a proper ambitious strategy. This might be especially the case for companies that will sell aluminium products before the smelting part (e.g. bauxite, alumina) that is the most carbon intensive one of the aluminium value chain.

SCORING THE INDICATOR:

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

• AL 7.2 ACTIVITIES TO INFLUENCE CLIENT BEHAVIOUR TO REDUCE THEIR GHG EMISSIONS

Description & Requirements

AL 7.2 Activities to influence clients to reduce their GHG emission

SHORT DESCRIPTION OF INDICATOR

The company participates in activities, to influence, enable, or otherwise shift client choices and behaviour in order to reduce GHG emissions.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Activities to influence clients GHG emissions
- % of products/services
- Data on clients' choices and preferences towards reducing GHG emissions

HOW THE ASSESSMENT WILL BE DONE

The assessment will assign a maturity score based on the company's activities to influence clients, expressed in a maturity matrix.

Question	Sub Dimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub scores
Associated score		***0%***	***25%***	***50%***	***75%***	***100%***	
How does the company encourage clients to reduce their GHG emissions?	***Clients GHG emissions***	No engagement	Company promotes products/services 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	***50%***

Does the company promote low-carbon solutions to its clients?	***Low-carbon products/ services***	No offer	The company does offer low-carbon/energy efficient products/services 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/services	The company promotes its low-carbon offer through marketing and communication channels. The company offers buying incentives regarding low-carbon products/services. The brand identity of the company is based only on its range of low-carbon solutions.	**50%**

Rationale

AL 7.2 Activities to influence clients to reduce their GHG emissions

Rationale of the indicator

RELEVANCE OF THE INDICATOR:

Activities to influence clients are included in this ACT methodology for the following reasons:

- Companies usually have the ability to influence the strategy and performance of clients regarding climate thanks to their products or services.
- The downstream can represent a large source of emissions for some companies throughout the value chain and clients should be engaged through low-carbon solutions. This might be especially the case for companies that will sell aluminium products before the smelting part (e.g. bauxite, alumina) that is the most carbon intensive one of the aluminium value chain.

SCORING THE INDICATOR:

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

POLICY ENGAGEMENT

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

DESCRIPTION & REQUIREMENTS **AL 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS**

SHORT DESCRIPTION OF INDICATOR

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

DATA REQUIREMENTS

The relevant data for this indicator are:

- Public climate change policy positions
- Description of this policy (scope & boundaries, responsibilities, process to monitor and review)

Trade associations that are likely to take a position on climate change legislation

HOW THE ASSESSMENT WILL BE DONE

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

Maximum points are awarded if all these elements are demonstrated.

Question	Sub dimension	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub scores
Associated score		*0%*	*25%*	*50%*	*75%*	*100%*	

What is the scope covered by the engagement policy? Is the policy publicly available?	**Transparency and scope**	Does not cover the entire company or all group memberships. Is not publicly available.	Does not cover the entire company or all group memberships. Is publicly available.	Covers the entire company and its activities, and all group memberships and associations, but not publicly available		Covers the entire company and its activities, and all group memberships and associations. Public policy is publicly available	***40%***
Does the company have a review process of trade associations?	**Oversight**	No process to review trade associations positions	A process to monitor and review trade association positions exists but is not necessarily implemented	A process to monitor and review trade association positions exists and is well implemented	A process to monitor and review trade association positions exists and is well implemented at a high level of the organization	A process to monitor and review trade associations positions exists. Responsibility for oversight of the policy lies at top level of the organization	***40%***
Does the 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%***

RATIONALE

RATIONALE OF THE INDICATOR

AL 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS

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

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

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

DESCRIPTION & REQUIREMENTS

AL 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 relevant data for this indicator are:

Company policy on engagement with trade associations

HOW THE ASSESSMENT WILL BE DONE

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

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

RATIONALE

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

RATIONALE OF THE INDICATOR

Trade associations are a key instrument by which companies can indirectly influence policy on climate. Thus, participating in trade associations which actively lobby against climate-positive legislation is a negative indicator and likely to obstruct low-carbon transition.

- **AL 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES**

DESCRIPTION & REQUIREMENTS

AL 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES

SHORT DESCRIPTION OF INDICATOR

The company is not opposed to any significant climate relevant policy and/or supports climate friendly policies.

DATA REQUIREMENTS

The relevant data for this indicator are:

- The company should attach supporting documentation, if this exists, giving evidence on the position of the company on significant climate policies (public statements, etc.).
- The company shall disclose details of the issues on which it has been directly engaging with policy makers and its proposed legislative solution.

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 ASSESSMENT WILL BE DONE

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

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Sub score
Associated score	*0%*	*25%*	*50%*	*75%*	*100%*	
What is the position of the company on significant climate policies?	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)	***100%***

RATIONALE

AL 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES

RATIONALE OF THE INDICATOR

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

- **AL 8.4 COLLABORATION WITH LOCAL PUBLIC AUTHORITIES**

DESCRIPTION & REQUIREMENTS

AL 8.4 COLLABORATION WITH LOCAL PUBLIC AUTHORITIES

SHORT DESCRIPTION OF INDICATOR

The company is collaborating with local public authorities whether on aluminium scrap collection and sorting and/or on contribution to the low-carbon transition of the grid of the territory.

DATA REQUIREMENTS

The relevant data for this indicator are:

- Participation in meetings / collaborations with public authorities
- Contracts with public authorities

HOW THE ASSESSMENT WILL BE DONE

The analyst evaluates the description and evidence on the company's collaboration and pilot tests with local authorities on scrap collection and sorting or/and on contribution to the low-carbon transition of the grid 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 are allocated for elements indicating a higher level of maturity.

Examples of actions to contributes to enhance aluminium scrap collection and sorting:

- Work with local authority to better collect post-consumer aluminium scrap
- Work with local authority to better sort post-consumer aluminium scrap

Examples of actions to contributes to the low-carbon transition of the grid:

- Enhance the development of new low-carbon electricity assets, as defined in the EU Taxonomy [17]
- Participate in demand-side management programs to reduce, flatten or shift power demand when needed by the grid (increase the maximum of % of electricity supply variation that can be handled, and/or extend the time during which this electricity supply variation might happen without damaging the aluminium facility)

Question	Basic	Standard	Advanced	Next practice	Low-carbon aligned	Subscore
Associated score	***0%***	***25%***	***50%***	***75%***	***100%***	
Does the company partner and support local authorities in aluminium scrap collection and sorting?	**No evidence** that the company is collaborating with local authorities **Third-party claims** are found showing that the company is not willing to collaborate		The company is proactive through established **dialogue** with local public authorities to enhance scrap collection and sorting	The company dialogues with **local** public authorities to enhance scrap collection and sorting, and participates in pilot programs to test or develop such actions on the territory	The company implements **on large-scale actions** previously designed in collaboration with local authorities and tested through pilot programs on the territory. The company also shows willingness to replicate such initiatives in other areas.	***See matrix below***
Does the company partner and support local authorities to enhance the low-carbon transition of the grid (decarbonization, flexibility)?	**No evidence** that the company is collaborating with local authorities **Third-party claims** are found showing that the company is not willing to collaborate		The company is proactive through established **dialogue** with local public authorities to enhance the low-carbon transition of the grid (decarbonization, flexibility)	The company dialogues with **local** public authorities, as well as energy system players and governments, to enhance the low-carbon transition of the grid (decarbonization, flexibility), and participates in pilot programs to test or develop such	The company implements **on large-scale actions** previously designed in collaboration with local authorities, as well as energy system players and governments, and tested through pilot programs on the territory. The company also shows willingness	***See matrix below***

				actions on the territory	to replicate such initiatives in other areas.	

Weighting of the maturity matrices for indicator 8.4	Present at electrolysis	Present at either casting, recycling, semis production or internal scrap remelting but not at electrolysis	Present at neither eletrolysis, casting, recycling, semis production or internal scrap remelting nor at electrolysis
Does the company partner and support local authorities in aluminium scrap collection and sorting?	*50%*	*100%*	*0%*
Does the company partner and support local authorities to enhance the low-carbon transition of the grid (decarbonization, flexibility)?	*50%*	*0%*	*0%*

RATIONALE **AL 8.4 COLLABORATION WITH LOCAL PUBLIC AUTHORITIES**

RATIONALE OF THE INDICATOR

Collaboration with local authorities can be a key instrument by which companies can indirectly influence policy on scrap or on low-carbon transition of the grid on their territory. Thus, participating actively in local dialogues shows leadership in such climate actions and can significantly help enhancing local policies on such topics.

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 activating 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

A variety of sources have been consulted to develop a comprehensive review of the challenges facing the Aluminium sector in relation to the low-carbon transition. The ACT initiative chose to use the recent work from IAI to define 3 potential business models for the aluminium sector [13].

Climate scenarios can identify shifts in the use of aluminium (transport, solar panels…) 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 maturity matrix used to assed all the indicators of the module is the following:

Question	Basic	Advanced	Low-carbon aligned	Subscore
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 years horizon or more	Deployment scheduled with a 2 years horizon or less	25%

- **AL 9.1 LOW CARBON BUSINESS MODELS THAT AIM AT INCREASING LOW CARBON POWER PRODUCTION AND/OR MORE FLEXIBLE GRID**

DESCRIPTION & REQUIREMENTS

AL 9.1 LOW CARBON BUSINESS MODELS THAT AIM AT INCREASING LOW-CARBON POWER PRODUCTION AND/OR MORE FLEXIBLE GRID

SHORT DESCRIPTION OF INDICATOR

The company is actively developing a business model that aim at increasing low-carbon power production and/or more flexible grid.

DATA REQUIREMENT

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

- Details on business model(s)

HOW THE ASSESSMENT WILL BE DONE

Best practice elements to be identified in the 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

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 following lists give high-level categories of business activities. The categories are intentionally broad to allow the inclusion and the assessment of a diversity of business activities. Examples of business activities:

- Low-carbon electricity self-generation (according to the EU Taxonomy, low carbon electricity generation corresponds to renewable energies. Discussions on whether gas and nuclear energy are considered low-carbon are still undergoing [17])
- Adapt the processes of the company to be able to undergo the growing volatility of electricity supply and make the electricity grid more flexible (e.g. through EnPot technologies, integration of heat exchangers to vary energy consumption and production levels etc.). Technologies that

increase the maximum of % of electricity supply variation that can be handled, and/or extend the time during which this electricity supply variation might happen without damaging the aluminium facility are good examples

- Other services provided to the electricity grid
- Other

RATIONALE	**AL 9.1 LOW CARBON BUSINESS MODELS THAT AIM AT INCREASING LOW CARBON POWER PRODUCTION AND/OR MORE FLEXIBLE GRID**
RATIONALE OF THE INDICATOR	See module rationale above

• AL 9.2 LOW CARBON BUSINESS MODELS THAT AIM AT SWITCHING TO LOW CARBON-PROCESSES

DESCRIPTION & REQUIREMENTS	**AL 9.2 LOW CARBON BUSINESS MODELS THAT AIM AT SWITCHING TO LOW CARBON-PROCESSES**
DATA REQUIREMENT	The questions comprising the information request that are relevant to this indicator are: ♦ Details on business model(s)
SHORT DESCRIPTION OF INDICATOR	The company is actively developing business models that aim at switching to low-carbon-processes.
HOW THE ASSESSMENT WILL BE DONE	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

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.

Examples of business activities:

- Inert anode
- CCS/CCUS
- Substitute to thermal energy (green hydrogen / electrification / biomass)
- Energy storage to better handle the increase of VRE (Variable Renewable Energy) in the electricity supply
- Other

RATIONALE

AL 9.2 LOW CARBON BUSINESS MODELS THAT AIM AT SWITCHING TO LOW CARBON-PROCESSES

RATIONALE OF THE INDICATOR

See module rationale above

• AL 9.3 LOW CARBON BUSINESS MODELS THAT AIM AT TAKING PART IN ALUMINIUM CIRCULAR ECONOMY

DESCRIPTION & REQUIREMENTS

AL 9.3 LOW CARBON BUSINESS MODELS THAT AIM AT TAKING PART IN ALUMINIUM CIRCULAR ECONOMY

DATA REQUIREMENT

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

♦ Details on business model(s)

SHORT DESCRIPTION

The company is actively developing business models that aim at taking part in aluminium circular economy.

OF INDICATOR

HOW THE ASSESSMENT WILL BE DONE

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

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.

Examples of business activities:

- Minimization of pre-consumer scrap generated during the processes
- Minimization metal losses during casting and recycling
- Ecodesign to facilitate the post-consumer scrap collection
- End-of-life scrap collection technologies
- Technologies to improve the quality of the scrap
- Improve scrap sorting/segregation
- Circular waste good practices to support other industry decarbonization efforts (e.g. aluminium dross replacing clinker in the cement industry)
- Other

RATIONALE

AL 9.3 LOW CARBON BUSINESS MODELS THAT AIM AT TAKING PART IN ALUMINIUM CIRCULAR ECONOMY

RATIONALE OF THE INDICATOR	See module rationale above

6. Assessment

6.1. SECTOR BENCHMARK

A literature review has been performed in order to identify low carbon pathways for the aluminium sector. A low carbon pathway is a projection of a sectoral carbon metric over time matching with an ambitious scenario (1.5°; WB2C or "well-below two degrees", 2°). The carbon metrics that will be used in ACT Aluminium are Scope 1+2 and Scope 1+2+3 emissions intensities in tCO_2e/tonnes of aluminium products, "aluminium products" depending on the step of the value chain operated by the company (see section 4.1 for more details on boundaries). A company's low carbon pathway will then be computed from the sectoral low carbon pathway to be specific to the company assessed. To compute the low carbon pathway for Scope 1+2+3, the numerator will correspond to all the steps upstream to the company's value chain plus the steps of the value chain at which the company operates. The denominator will be the last step of the value chain where the company operates.

DESCRIPTION OF THE BENCHMARK

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 B2DS (Below Two Degree Scenario) scenarios.

Every company shall be benchmarked according to an acceptable and credible benchmark that aligns with spatial boundary of the methodology. All aluminium companies shall be benchmarked to the steps of the value chain where they operate, and also through cradle-to-gate assessment (until the last step of the value chain where the company operates).

IAI low carbon pathways

As part of their work on low carbon pathways, the IAI provides CO_2e emissions of each step of the value chain, as well as the corresponding aluminium production volume, from 2014 to 2050. This enables to compute a low carbon intensity trajectory for each step of the value chain, on which company's specific low carbon pathways can be built. As a consequence, these low carbon pathways are more granular and more precise than what would have been possible to compute from data provided by the IEA. To build these low carbon pathways, the SDA methodology will be partially used:

- The company's low carbon pathway will have the same starting point as the company's carbon intensity

- The company's low carbon pathway must converge to the sectoral low carbon intensity in 2050 thanks to the market share parameter and the convergence index

Two index parameters will be computed to indicate the rate of decrease the company should follow:

- CO_2e emissions decrease of the sectoral emissions intensity
- Market share: if the market share of the company increases over time, its carbon intensity should decrease even more

As a consequence, the higher the carbon intensity of the company at the reporting year, the faster the SDA calculation requires companies to decrease their carbon intensity. This enables to reward the past efforts the company has made to reduce its carbon intensity.

The CO_2e emissions posts to be taken into account will depend on the module. For example, module 2 will not take into account ancillary materials and transport CO_2e emissions as this will be part of the Scope 3 of the aluminium companies; however, these CO_2e emissions will be taken into account in module 4 that assess the global carbon footprint of the aluminium products sold by the company.

For the quantitative part of indicator 2.4 (dimension 3), the SDA calculation will be used to assess the carbon intensity of the self-generated electricity of the company. The source of the sectoral low carbon pathway is IEA ETP 2017 B2DS scenario, and the calculation of the company's low carbon pathway will be exactly the Sectoral Decarbonization Approach methodology from Science-Based Targets. This data source has been used to be consistent with the other low carbon pathways.

Later in the chapter, the reference pathway definition and classification are presented.

Distinctions between the modules

For module 1 Targets, several steps of the value chain will be taken into account when accounting the CO_2e. The company is asked to indicate where it operates, and then the corresponding CO_2e emissions will be taken into account by the company's low carbon pathway. In other words, the CO_2e emissions of each step of the value chain will be summed. The activity volume data will correspond to the last step of the value chain where the company operates. Ancillary materials and transport are not taken into account for Scope 1+2 low carbon pathways, but they will be for Scope 1+2+3.

For module 2 Material investments, one company's low carbon pathway will be built per step of the value chain. Therefore, the numerator (CO_2e) and denominator (metric tonnes of aluminium products, depending on which step of the value chain is considered) concern only one step of the aluminium value chain.

For module 4 Sold product performance, the company shall indicate which upstream steps of the value chain are relevant to be taken into account, and then the company's low carbon pathway will include the corresponding CO_2e emissions. Indeed, a company doing only recycling should not consider the CO_2e emissions from electrolysis for example (carbon accountability convention used in ACT), as we consider that both pre- and post-consumer scrap are considered carbon free (0 tCO_2e for Scope 3 upstream). The denominator will be the last step of the value chain where the company operates. Ancillary materials and transport are taken into account in the low carbon pathway as Scope 3 is included in this indicator.

Note that IAI reports together the direct and indirect CO_2e emissions when accounting for thermal energy CO_2e emissions. ACT always includes both even when computing the Scope 1+2 company's low carbon pathways, as the split between direct and indirect CO_2e emissions is not available from IAI data. However, as regards thermal energy CO_2e emissions, the bulk of the CO_2e emissions come from the direct emissions that are the actual Scope 1 of the company, so this does not change the order of magnitude.

MECHANISMS TO COMPUTE THE COMPANY BENCHMARK

The convergence mechanism has been chosen. 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, based on IAI data and hypotheses.

The next figure illustrates the mechanism (benchmark and low carbon pathway mean the same):

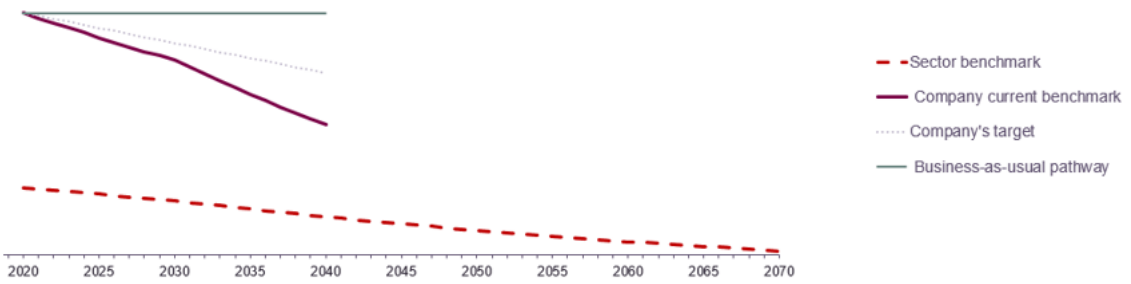


FIGURE 23: CONVERGENCE MECHANISM ILLUSTRATION

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.

The next figure highlights the carbon intensity to generate electricity. This will be the sectoral low carbon pathway used for the quantitative part of indicator 2.4 Contribution to low carbon electricity generation (IEA ETP 2017 B2DS scenario).

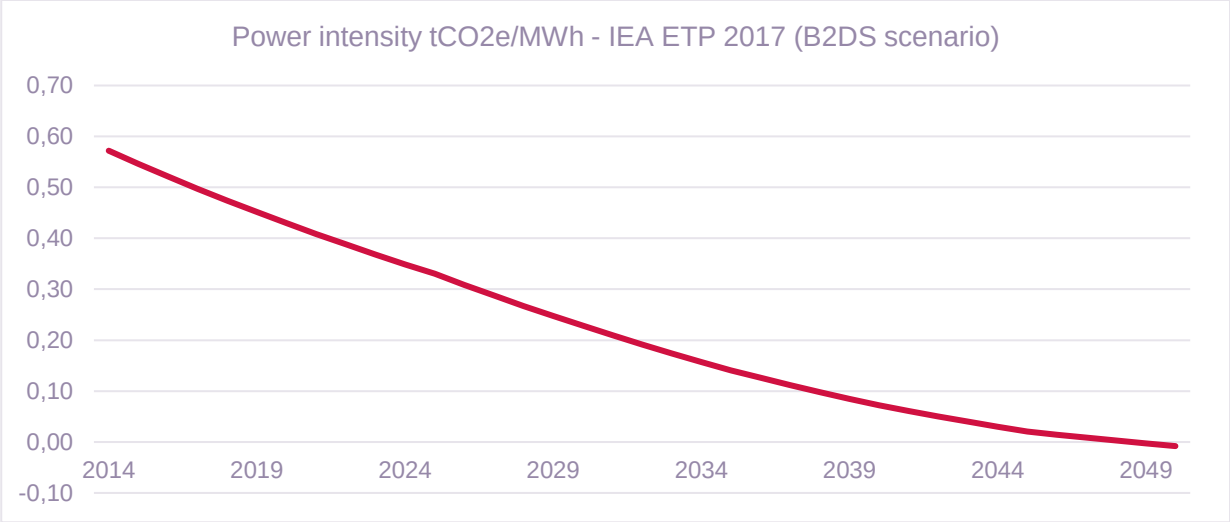


FIGURE 24: POWER INTENSITY TCO2E/MWH - IEA ETP 2017 (B2DS SCENARIO)

REFERENCE PATHWAY CLASSIFICATION

A reference pathway defines the carbon intensity (tCO_2e/metric tonnes of aluminium products) pathway for a given company type.

For the Aluminium sector we consider the following types of pathways:

- Bauxite mining
- Alumina refining
- Anode production
- Electrolysis
- Casting
- Recycling
- Semis production
- Internal scrap remelting

Moreover, some pathways mix several steps of the value chain, as explained previously.

AVAILABLE REFERENCE PATHWAYS

The low carbon pathways selected will use IAI data and IAI hypotheses to get the carbon intensity from 2014 to 2050.

Figures highlighting the activity volume and emissions intensities for each step of the value chain, based on IAI data and hypotheses, will be presented in the final version of the methodology when IAI data is available publicly. ACT is entitled to use IAI figures to build the low carbon pathways.

6.2. WEIGHTINGS

The scope of the aluminium sector encompasses a broad variety of companies, which have different types of levers to build their low-carbon strategy. Therefore, the weightings of modules, and indicators is specific to

each company, and calculated dynamically, depending on where the company operates along the aluminium value chain. In practice, companies shall report their Scope 1+2 CO_2e emissions for the eight steps of the aluminium value chain, which are then used for calculating company-specific weights.

The Figure below provides the range of weightings per module. These ranges depend on where the company is involved in the aluminium value chain. More explanations are provided below, as well as fictive examples to illustrate this.

Module	Range of weightings
Targets	**15%**
Material investment	**12% - 35%**
Intangible investment	**10%**
Sold product performance	**7% - 30%**
Management	**10%**
Suppliers	**2% - 6%**
Clients	**2% - 6%**
Policy engagement	**5%**

Business model	**10%**

FIGURE 25: RANGE OF WEIGHTINGS PER MODULE

In addition to the weightings of the modules, the weightings of many indicators will also depend on where the company operates – based on its CO_2e emissions – alongside the aluminium value chain. A weighted average based the percentages of Scope 1+2 CO_2e emissions of the company corresponding for each step and default weightings for each step of the value chain will be computed to get the weighting for the company specifically. By doing so, ACT enables to adapt to the specificities of each aluminium company and to focus on the indicators that are the most relevant in terms of CO_2e emissions reduction potential. The figure below indicates the default weighting for each indicator and for each step of the value chain. The percentages correspond to the weighting of each indicator to the weighting of the module, hence the fact that summing all percentages of one module makes 100%.

Within the same module, the weightings of some indicators will vary to adapt to the specificity of the company. A summary of the default weightings per indicators is presented in Figure 26. The sum of the weightings of each indicator within the same module is 100%.

	Indicator weightings							
Indicator	Bauxite mining	Alumina refining	Anode production	Electrolysis	Casting	Recycling	Semis production	Internal scrap remelting
1.1 Alignment of Scope 1+2 and Scope 1+2+3 emissions reduction targets	67%	67%	67%	67%	67%	67%	67%	67%
1.2 Time horizon of targets	20%	20%	20%	20%	20%	20%	20%	20%
1.3 Achievement of past and current targets	13%	13%	13%	13%	13%	13%	13%	13%
2.1 Past performance for aluminium assets, per step of the value chain	40%	20%	40%	15%	10%	20%	30%	20%
2.2 Locked-in emissions	0%	40%	0%	30%	0%	0%	0%	0%
2.3 Future performance of aluminium assets, per step of the value chain	60%	40%	60%	25%	10%	30%	40%	30%
2.4 Contribution to low carbon electricity generation	0%	0%	0%	20%	0%	0%	0%	0%
2.5 Reducing process-scrap generation	0%	0%	0%	10%	80%	50%	40%	50%
3.1 R&D spending in low-carbon technologies	60%	60%	60%	60%	60%	60%	60%	60%
3.2 Company low-carbon patenting activity	40%	40%	40%	40%	40%	40%	40%	40%
4.1 Cradle-to-gate aluminium carbon footprint	100%	100%	100%	70%	70%	20%	70%	20%
4.2 Purchased product intervention	0%	0%	0%	30%	30%	0%	30%	0%
4.3 Recycled scrap traceability	0%	0%	0%	0%	0%	80%	0%	80%
5.1 Oversight of climate change issues	20%	20%	20%	20%	20%	20%	20%	20%
5.2 Climate change oversight capability	10%	10%	10%	10%	10%	10%	10%	10%
5.3 Low-carbon transition plan	30%	30%	30%	30%	30%	30%	30%	30%
5.4 Climate change management incentives	10%	10%	10%	10%	10%	10%	10%	10%
5.5 Climate change scenario testing	30%	30%	30%	30%	30%	30%	30%	30%
6.1 Strategy to influence suppliers to reduce their GHG emissions	50%	50%	50%	50%	50%	50%	50%	50%
6.2 Activities to influence suppliers to reduce their GHG emissions	50%	50%	50%	50%	50%	50%	50%	50%
7.1 Strategy to influence customer behaviour to reduce their GHG emissions	50%	50%	50%	50%	50%	50%	50%	50%
7.2 Activities to influence customer behaviour to reduce their GHG emissions	50%	50%	50%	50%	50%	50%	50%	50%
8.1 Company policy on engagement with trade associations	40%	40%	40%	30%	35%	35%	35%	35%
8.2 Trade associations supported do not have climate-negative activities or positions	20%	20%	20%	10%	15%	15%	15%	15%
8.3 Position on significant climate policies	40%	40%	40%	30%	35%	35%	35%	35%
8.4 Collaboration with local public authorities	0%	0%	0%	30%	15%	15%	15%	15%
9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid	0%	0%	0%	60%	0%	0%	0%	0%
9.2 Low carbon business models that aim at switching to low carbon-processes	100%	100%	100%	20%	70%	70%	70%	70%
9.3 Low carbon business models that aim at taking part in aluminium circular economy	0%	0%	0%	20%	30%	30%	30%	30%

FIGURE 26: DEFAULT WEIGHTINGS PER INDICATOR AND PER STEP OF THE VALUE CHAIN

- **RATIONALE FOR WEIGHTINGS**

The selection of weights for both the modules and the individual indicators was guided by a set of principles (see the ACT framework document [1] for more information). These principles helped define the weighting scheme of the modules and indicators.

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

The weightings below indicate the range for each module. Indeed, depending on where the company operates alongside the aluminium value chain, these weightings will vary. To compute the weighting for these modules, two different calculations are done:

- For modules 2 and 4, a weighted average based on the percentages of Scope 1+2 CO_2e emissions of the company corresponding to each step of the value chain, and the default weightings for each step of the value chain and for each indicator of modules 2 and 4, will be computed to get the specific weighting of the company
- For module 6 and 7, the company is asked to indicate the aluminium product that generates the highest amount of revenue, and depending on if this product is present at the upstream or downstream of the value chain, the weightings of the suppliers and clients modules will be updated (e.g. if the highest revenue comes from semis production, then the suppliers module will have higher weightings as the company can have more levers there)

Targets 15%

The targets Module has a relatively large weight of 15%. Most of it is placed on the 'alignment of Scope 1+2 / scope 1+2+3 emissions reduction targets' with 10%. The 'time horizon of targets' has 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 12-35%

Step of the value chain	Default module weighting
Bauxite mining	35%
Alumina refining	35%
Anode production	30%
Electrolysis	30%
Casting	25%

Recycling	30%
Semis production	12%
Internal scrap remelting	30%

Aluminium producers require high and long-term investment with best available technologies. Roadmaps specific to the aluminium sector show that resources and energy efficiency and low-carbon electricity 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.

Intangible Investment 10%

For companies operating in value chains with high stakes regarding low-carbon transition, such as the aluminium sector, R&D spending in low-carbon technologies are crucial. This module has thus a weight of 10%. There is no difference depending on where the company operates alongside the aluminium value chain not to add too much complexity.

Sold product performance 7-30%

Step of the value chain	Default module weighting
Bauxite mining	7%
Alumina refining	7%
Anode production	12%
Electrolysis	12%

Casting	17%
Recycling	12%
Semis production	30%
Internal scrap remelting	12%

This module is key for downstream companies.

“Cradle-to-gate aluminium carbon footprint” has a large part of the module weighting for any company except recycling companies (the scrap is considered as carbon-free by convention); “Purchased product intervention” and “Recycled scrap traceability” are not triggered for all companies.

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 indicators “*climate change oversight capability* (2%), “*oversight of climate change issues” (1%)* and *“Climate change management incentives” (1%)* are low weighted. These indicators provide more information on how this company is managed, if decisions are coming from the top management and if the person in charge knows the topics. 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.

Supplier engagement 2-6%

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

The supplier engagement Module is focused on the company's efforts to purchase low-carbon products and to encourage suppliers reduce their emissions. Nevertheless, this indicator alone is a narrow aspect of the transition and therefore its total weight is low to medium (2-6%) depending on where the product that accounts for the highest revenue for the company is in the value chain.

Step of the value chain	**Module weighting**
Bauxite mining	2%
Alumina refining	2%
Anode production	2%
Electrolysis	4%
Casting	4%
Recycling	6%
Semis production	6%
Internal scrap remelting	6%

Client engagement 2-6%

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

The client engagement Module is focused on the company's efforts to promote low-carbon products, more efficient use of aluminium and recycling of products to their customers. Nevertheless, this indicator alone is a narrow aspect of the transition and therefore its total weight is low to medium (2-6%) depending on where the product that accounts for the highest revenue for the company is in the value chain.

Step of the value chain	**Module weighting**
Bauxite mining	6%
Alumina refining	6%
Anode production	6%
Electrolysis	4%
Casting	4%
Recycling	2%
Semis production	2%
Internal scrap remelting	2%

Policy engagement 5%

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

for this Module is therefore medium at 5%. As the *''Trade associations supported do not have climate-negative actions or positions'* is less robust than other indicators, it is less weighted.

Business model 10%

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

- **EXAMPLES OF WEIGHTINGS**

The following fictive examples will help better understand how the weighting tool works by highlighting actual output.

Example 1:

- **Bauxite mining accounts for 2% of Scope 1+2 CO_2e emissions**
- **Alumina refining accounts for 98% of Scope 1+2 CO_2e emissions**

Module	Indicator	Indicator weightings
Targets	1.1 Alignment of Scope 1+2 and Scope 1+2+3 emissions reduction targets	10,0%
	1.2 Time horizon of targets	3,0%
	1.3 Achievement of past and current targets	2,0%
Material investment	2.1 Past performance for aluminium assets, per step of the value chain	7,1%
	2.2 Locked-in emissions	13,7%
	2.3 Future performance of aluminium assets, per step of the value chain	14,1%
	2.4 Contribution to low carbon electricity generation	0,0%
	2.5 Reducing process-scrap generation	0,0%
Intangible investment	3.1 R&D spending in low-carbon technologies	6,0%
	3.2 Company low-carbon patenting activity	4,0%
Sold product performance	4.1 Cradle-to-gate aluminium carbon footprint	7,0%
	4.2 Purchased product intervention	0,0%
	4.3 Recycled scrap traceability	0,0%
Management	5.1 Oversight of climate change issues	2,0%
	5.2 Climate change oversight capability	1,0%
	5.3 Low-carbon transition plan	3,0%
	5.4 Climate change management incentives	1,0%
	5.5 Climate change scenario testing	3,0%
Suppliers	6.1 Strategy to influence suppliers to reduce their GHG emissions	1,0%
	6.2 Activities to influence suppliers to reduce their GHG emissions	1,0%
Clients	7.1 Strategy to influence customer behaviour to reduce their GHG emissions	3,0%
	7.2 Activities to influence customer behaviour to reduce their GHG emissions	3,0%
Policy engagement	8.1 Company policy on engagement with trade associations	2,0%
	8.2 Trade associations supported do not have climate-negative activities or positions	1,0%
	8.3 Position on significant climate policies	2,0%
	8.4 Collaboration with local public authorities	0,0%
Business model	9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid	0,0%
	9.2 Low carbon business models that aim at switching to low carbon-processes	10,0%
	9.3 Low carbon business models that aim at taking part in aluminium circular economy	0,0%

FIGURE 27: WEIGHTINGS FOR FICTIVE COMPANY EXAMPLE 1

Example 2:

- **Anode production accounts for 4% of Scope 1+2 CO_2e emissions**
- **Electrolysis accounts for 95% of Scope 1+2 CO_2e emissions**
- **Casting accounts for 1% of Scope 1+2 CO_2e emissions**

Module	Indicator	Indicator weightings
Targets	1.1 Alignment of Scope 1+2 and Scope 1+2+3 emissions reduction targets	10,0%
	1.2 Time horizon of targets	3,0%
	1.3 Achievement of past and current targets	2,0%
Material investment	2.1 Past performance for aluminium assets, per step of the value chain	4,8%
	2.2 Locked-in emissions	8,5%
	2.3 Future performance of aluminium assets, per step of the value chain	7,9%
	2.4 Contribution to low carbon electricity generation	5,7%
	2.5 Reducing process-scrap generation	3,1%
Intangible investment	3.1 R&D spending in low-carbon technologies	6,0%
	3.2 Company low-carbon patenting activity	4,0%
Sold product performance	4.1 Cradle-to-gate aluminium carbon footprint	8,6%
	4.2 Purchased product intervention	3,5%
	4.3 Recycled scrap traceability	0,0%
Management	5.1 Oversight of climate change issues	2,0%
	5.2 Climate change oversight capability	1,0%
	5.3 Low-carbon transition plan	3,0%
	5.4 Climate change management incentives	1,0%
	5.5 Climate change scenario testing	3,0%
Suppliers	6.1 Strategy to influence suppliers to reduce their GHG emissions	1,0%
	6.2 Activities to influence suppliers to reduce their GHG emissions	1,0%
Clients	7.1 Strategy to influence customer behaviour to reduce their GHG emissions	3,0%
	7.2 Activities to influence customer behaviour to reduce their GHG emissions	3,0%
Policy engagement	8.1 Company policy on engagement with trade associations	1,5%
	8.2 Trade associations supported do not have climate-negative activities or positions	0,5%
	8.3 Position on significant climate policies	1,5%
	8.4 Collaboration with local public authorities	1,4%
Business model	9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid	5,7%
	9.2 Low carbon business models that aim at switching to low carbon-processes	2,4%
	9.3 Low carbon business models that aim at taking part in aluminium circular economy	1,9%

FIGURE 28: WEIGHTINGS FOR FICTIVE COMPANY EXAMPLE 2

Example 3:

- **Recycling accounts for 100% of Scope 1+2 CO_2e emissions**

Module	Indicator	Indicator weightings
Targets	1.1 Alignment of Scope 1+2 and Scope 1+2+3 emissions reduction targets	10,0%
	1.2 Time horizon of targets	3,0%
	1.3 Achievement of past and current targets	2,0%
Material investment	2.1 Past performance for aluminium assets, per step of the value chain	6,0%
	2.2 Locked-in emissions	0,0%
	2.3 Future performance of aluminium assets, per step of the value chain	9,0%
	2.4 Contribution to low carbon electricity generation	0,0%
	2.5 Reducing process-scrap generation	15,0%
Intangible investment	3.1 R&D spending in low-carbon technologies	6,0%
	3.2 Company low-carbon patenting activity	4,0%
Sold product performance	4.1 Cradle-to-gate aluminium carbon footprint	2,4%
	4.2 Purchased product intervention	0,0%
	4.3 Recycled scrap traceability	9,6%
Management	5.1 Oversight of climate change issues	2,0%
	5.2 Climate change oversight capability	1,0%
	5.3 Low-carbon transition plan	3,0%
	5.4 Climate change management incentives	1,0%
	5.5 Climate change scenario testing	3,0%
Suppliers	6.1 Strategy to influence suppliers to reduce their GHG emissions	1,0%
	6.2 Activities to influence suppliers to reduce their GHG emissions	1,0%
Clients	7.1 Strategy to influence customer behaviour to reduce their GHG emissions	3,0%
	7.2 Activities to influence customer behaviour to reduce their GHG emissions	3,0%
Policy engagement	8.1 Company policy on engagement with trade associations	1,8%
	8.2 Trade associations supported do not have climate-negative activities or positions	0,8%
	8.3 Position on significant climate policies	1,8%
	8.4 Collaboration with local public authorities	0,8%
Business model	9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid	0,0%
	9.2 Low carbon business models that aim at switching to low carbon-processes	7,0%
	9.3 Low carbon business models that aim at taking part in aluminium circular economy	3,0%

FIGURE 29: WEIGHTINGS FOR FICTIVE COMPANY EXAMPLE 3

Example 4:

- **Semis production accounts for 100% of Scope 1+2 CO_2e emissions**

Module	Indicator	Indicator weightings
Targets	1.1 Alignment of Scope 1+2 and Scope 1+2+3 emissions reduction targets	10,0%
	1.2 Time horizon of targets	3,0%
	1.3 Achievement of past and current targets	2,0%
Material investment	2.1 Past performance for aluminium assets, per step of the value chain	3,6%
	2.2 Locked-in emissions	0,0%
	2.3 Future performance of aluminium assets, per step of the value chain	4,8%
	2.4 Contribution to low carbon electricity generation	0,0%
	2.5 Reducing process-scrap generation	4,8%
Intangible investment	3.1 R&D spending in low-carbon technologies	6,0%
	3.2 Company low-carbon patenting activity	4,0%
Sold product performance	4.1 Cradle-to-gate aluminium carbon footprint	21,0%
	4.2 Purchased product intervention	9,0%
	4.3 Recycled scrap traceability	0,0%
Management	5.1 Oversight of climate change issues	2,0%
	5.2 Climate change oversight capability	1,0%
	5.3 Low-carbon transition plan	3,0%
	5.4 Climate change management incentives	1,0%
	5.5 Climate change scenario testing	3,0%
Suppliers	6.1 Strategy to influence suppliers to reduce their GHG emissions	1,0%
	6.2 Activities to influence suppliers to reduce their GHG emissions	1,0%
Clients	7.1 Strategy to influence customer behaviour to reduce their GHG emissions	3,0%
	7.2 Activities to influence customer behaviour to reduce their GHG emissions	3,0%
Policy engagement	8.1 Company policy on engagement with trade associations	1,8%
	8.2 Trade associations supported do not have climate-negative activities or positions	0,8%
	8.3 Position on significant climate policies	1,8%
	8.4 Collaboration with local public authorities	0,8%
Business model	9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid	0,0%
	9.2 Low carbon business models that aim at switching to low carbon-processes	7,0%
	9.3 Low carbon business models that aim at taking part in aluminium circular economy	3,0%

FIGURE 30: WEIGHTINGS FOR FICTIVE COMPANY EXAMPLE 4

6.3. DATA REQUEST

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

TABLE 5: DATA REQUEST PER INDICATOR

Module	Indicators	Data request
1 - Targets	1.1 1.2 1.3	- Target ID - Specify if this is an intensity target or an absolute target - Data related to base year (base year, base year emissions Scope 1+2 and/or Scope 1+2+3 ($ktCO_2e$), activity in base year for the last step of the value chain operated) - Data related to reporting year (reporting year emissions Scope 1+2 and/or Scope 1+2+3 ($ktCO_2e$), activity in reporting year for the last step of the value chain operated, target coverage %, % of target completed since base year) - Data related to target year (target year, target year emissions Scope 1+2 and/or Scope 1+2+3 ($ktCO_2e$), activity in target year for the last step of the value chain operated, % of target complete since base year, If emission covered by target is not 100%, give reasons for exclusion)
2- Material investment	2.1 2.2 2.3	- Asset name - Geography - Step of the value chain - Total capacity per year (tonnes of aluminium products) - Ownership stake (%) - Production rate to get nominal production (%)

		- Scope 1+2 emissions factor (tCO2e/tonne of aluminium product/per year) - Year of commissioning - Expected lifetime (years) For 2.1 => need all assets from Y-5 to Y For 2.2 => need all assets (alumina and electrolysis only) from Y to Y+15 For 2.3 => need all assets from Y to Y+5
	2.4	Dimension 1 => Action to use low-carbon electricity
		Dimension 2 => Policy regarding the development of low-carbon electricity
		Dimension 3 - Emissions intensity in Y (tCO_2e/MWh of self-generated electricity) - Emissions intensity in Y+15 (tCO_2e/MWh of self-generated electricity) - MWh of self-generated electricity in Y - MWh of self-generated electricity in Y+15 - Target coverage (% of total emissions) Instead of self-generated data, we might use electricity purchase because of the 4 cases we can encounter. See the details on this indicator for further details
	2.5	Qualitative data to assess the reduction of process-scrap generation
3 - Intangible investment	3.1	R&D costs/investments (total and in low-carbon technologies) of the company over the last 3 years
	3.2	Patenting activity (total and in low-carbon technologies) of the company over the last 5 years
4 - Sold Product Performance	4.1	For each step of the value chain - Scope of the emissions (Scope 1+2 vs Scope 3 upstream) - Scope 1+2 or Scope 3 upstream tCO_2e in Y-5 - Scope 1+2 or Scope 3 upstream tCO_2e in Y - Metric tonnes of Aluminium products in Y-5 (last step operated by the company) - Metric tonnes of Aluminium products in Y (last step operated by the company)
	4.2	Qualitative data to assess the purchased product intervention for alumina and/or primary
	4.3	Qualitative data to assess the recycled scrap traceability
5- Management	5.1	Environmental policy and details regarding governance
	5.2	
	5.3	
	5.4	Management incentives
	5.5	Scenario testing
6 - Supplier engagement	6.1	Methods of supplier engagement, strategy to prioritizing supplier engagements and measures of success
		Number of suppliers engaged and proportion of total spending
		Data on suppliers' GHG emissions and climate change strategies
	6.2	List of initiatives implemented to influence suppliers to reduce their GHG emissions, green purchase policy or track record, supplier code of conduct
7 - Client engagement	7.1	Strategy to influence clients GHG emissions
		% of products/services
		Data on clients' choices and preferences towards reducing GHG emissions
		Strategy to influence clients GHG emissions

	7.2	% of products/services
		Data on clients' choices and preferences towards reducing GHG emissions
8- Policy engagement	8.1	Public climate change policy positions
		Description of this policy (scope & boundaries, responsibilities, process to monitor and review)
		Trade associations that are likely to take a position on climate change legislation
	8.2	Company policy on engagement with trade associations
	8.3	Position of the company on significant climate policies (public statements, etc.).
	8.4	Public climate change policy positions
		Description of this collaboration (scope & boundaries, responsibilities, process to monitor and review)
9 - Business Model	9.1	Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid data Description of each new business model launched by the company, based on the following criteria: - Profitability of business model - Size of business model - Growth potential of business model Deployment schedule of business model
	9.2	Low carbon business models that aim at switching to low carbon-processes data (same)
	9.3	Low carbon business models that aim at taking part in aluminium circular economy data (same)

7. Integration of Physical risks and Adaptation in ACT

7.1. INTRODUCTION AND CONTEXT

There is a lack of standardized framework for analysing physical risks and assessing the adaptation strategy of private actors. Standards exist but they provide some generic guidelines and recommendations (e.g.: ISO 14090 and ISO 14091). **This ACT physical risks and adaptation framework aims at assessing the physical risks analysis and the adaptation strategy of companies, thanks to precise indicators through several modules. It is a first version to integrate these dimensions in ACT historical assessment method.** A specific method will be developed with a separate score, modules specific to climate risks and adaptation, and a possible joint assessment with the mitigation part of ACT.

This maturity matrix is mainly based on the work of the WRI and the IPCC. The climate physical risks dimension also relies on the reports from Carbone 4 and I4CE. The indicators and the structure of the adaptation part mainly focuses on reports from ADEME. Modules and indicators include recommendations from the EU Taxonomy, EBRD, TCFD and Norme ISO 14 090. **All references can be found in the bibliography, in the long version of this document.**

The structure of this physical risks and adaptation maturity matrix is different from the 9-module in ACT mitigation. It is to better take into account certain specific aspects of physical risks and adaptation such as the exposition and vulnerability of the different part of the value chain or the four aspects of a company's adaptation to climate change. The two dimensions do not have the same characteristics and each could have a different level of maturity for the same company.

To be noted:

- This framework is not a risk analysis methodology

- Each line (row) of the matrix corresponds to an indicator that is independent from others. Indicators are just grouped by module. The matrix is composed of two dimensions, the physical climate risks and adaption. Each of these dimensions contains several modules.
- **Scores and weightings are detailed in this document.**
- The lists of impacts and vulnerabilities for the different activities of a company along its value chain are not exhaustive. Any other impact or vulnerability that is relevant for the company can be considered and analysed.
- A **glossary** of climate physical risks and adaptation terms is available at the end of this document.

7.2. MATURITY MATRIX

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

Physical climate risks correspond to the potential for negative consequences from physical climate events or trends. Risks from climate change impacts arise from the interaction between hazard (triggered by an event or trend related to climate change), vulnerability (susceptibility to harm) and exposure (people, assets or ecosystems at risk) (from IPCC, 2014) (see chart page 17 of this document).

Hazards refer to the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. In this note, the term hazard usually refers to climate-related physical events or trends or their physical impacts. Thus, it includes processes that range from brief events, such as severe storms, to slow trends, such as multi-decade droughts or multi-century sea level rise (from IPCC, 2014).

Exposition is the degree to which a company's value chain (e.g., assets, operations, supply chain, customers) has the potential to be impacted by physical climate hazards due to its geographic location. These metrics should link part of a company's value chain (e.g., physical assets) with specific physical climate hazards (e.g., tropical cyclones) (from IPCC, 2014).

Vulnerability is the propensity of different parts of a company's value chain to suffer negative impacts when exposed to and then impacted by physical climate hazards. These metrics should assess specific characteristics of a company's value chain (e.g., water intensity) that may make that part of the value chain more or less likely to suffer negative impacts from physical climate hazards (WRI, 2021).

The second dimension of the matrix is **adaptation**. It is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.

Adaptation options exist in all sectors, but their context for implementation and potential to reduce climate-related risks differs across sectors and regions. Some adaptation responses involve significant co-benefits, synergies and trade-offs (from IPCC, 2014).

Here is presented the complete physical risks and adaptation maturity matrix.

Resilience can be defined as the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation [19].

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 analysed through their likelihood, magnitude and duration.	Considers the hazards that affect the most the company, if possible in a quantitative way, along the complete value chain Consistent with the expected lifetime of the activity and the specific location of facilities Hazards shall be analysed through their likelihood, magnitude and duration.	Considers the hazards that affect the most the company in a quantitative way along the complete value chain Consistent with the expected lifetime of the activity and the specific location of facilities Hazards shall be analysed through their likelihood, magnitude and duration.

1.3 Exposition and vulnerability/sensitivity	The company has not conducted any in-depth climate physical risk analysis or assessment regarding, among others, its exposition and vulnerability/sensitivity	Exploration of the notions of exposition and vulnerability / sensitivity	Evaluation of the exposition and sensitivity/vulnerability of some facilities on a part of the value chain, at least qualitative, for the most important hazards identified	Evaluation of the exposition and sensitivity/vulnerability of all facilities on the complete value chain, in a quantitative way, for the most important hazards identified The relationship between current and future weather variability and the performance is identified along the complete value chain performance	Quantitative evaluation of the exposition and sensitivity/vulnerability of all facilities for the most important hazards identified The relationship between current and future weather variability and the performance is identified and analysed along the complete value chain performance

Supply chain / raw materials impacts and vulnerabilities:

Disruptions
Impact on production depending on the availability of water, electric energy, raw materials or on climate variation sensitive materials
Geographic concentration of suppliers/cluster tendency
Shortage of inputs or raw materials
Increased cost of supplies due to scarcity
Change in input/resource prices

2	These impacts and vulnerabilities on the supply chain/raw materials of the company are not considered, it remains passive in the face of climate risks for this dimension of the value chain.	The most relevant impacts and vulnerabilities were considered for some hazards The most relevant impacts and physical risks are identified depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analysed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the most important hazards identified, depending on the location of facilities

Production / Process / Operations / Machineries / Infrastructures impacts and vulnerabilities:

Weather sensitivity of production and operation process
Need to cool or heat processes and workplaces / variations in energy costs
Disruptions or reduced productivity of operations/production capacity due to impacts on fixed capital, labor force (stress on human health and productivity), natural resources
Permanent loss
Relocation costs
Workforce intensity of production
Physical damage to assets : production facilities, infrastructures, stock & equipment
Increased insurance premiums and capital costs

3	These impacts and vulnerabilities on the production/process/operations/machineries/infrastructures of the company are not considered, it remains passive in the face of climate risks for this dimension of the value chain.	These impacts and vulnerabilities were considered for some hazards The most relevant impacts and risks are identified depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analysed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the most important hazards identified, depending on the location of facilities

Logistics / Transports (upstream & downstream) impacts and vulnerabilities: Need for cold chain Damage to transportation infrastructure when use of road, water and rail transportation or permanent loss and relocation cots Dependency to port facilities, fluvial transportations and operations Cost of delays due to degraded transport conditions Loss of revenue due to failed delivery or service disruption					
4	These impacts and vulnerabilities on the logistics/transports of the company are not considered, it remains passive in the face of climate risks for this dimension of the value chain.	These impacts and vulnerabilities were considered for some hazards The most relevant impacts and risks are identified depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analysed for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified, depending on the location of facilities, for the company considered	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the most important hazards identified, depending on the location of facilities
Demand & Sales					
5	The climate-related opportunities were not considered, neither the impacts and vulnerabilities on the demand and sales.	The most relevant impacts and vulnerabilities were considered for some hazards (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities	The most relevant impacts and vulnerabilities were considered and analyzed for some hazards (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities Breakdown of sales by country and by segment for monitoring and analysis	The most relevant impacts and vulnerabilities were considered, analysed and quantified for the main hazards identified (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities Identification of climate-related opportunities based on adapting to market shifts driven by a changing climate Breakdown of sales by country and by segment for monitoring and analysis	The most relevant impacts and vulnerabilities were considered, analysed, quantified and monitored (regularly updated) for the main hazards identified (eg: weather sensitivity of price volatility, disruptions, change in demand), depending on the location of facilities Identification of climate-related opportunities based on adapting to market shifts driven by a changing climate and development Breakdown of sales by country and by segment for monitoring and analysis

ADAPTATION DIMENSION

	Basic	Standard	Advanced	Next practice	Resilient
Organizational capacity Governance, exchange and decision-making bodies. Among other aspects, the business model of the company has to be profitable, viable and should integrate climate physical risks and climate adaptation strategy.					
6.1 The climate head	No one is in charge or supervising climate change issues	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is the manager/officer	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is Senior manager/officer	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is Senior manager/officer closely related to decision-making structure within the company	The following actions/modules are mostly managed or supervised by the individual/committee with highest responsibility for climate change that is the Board or individual/sub-set of the board or other committee appointed by the board
6.2 Climate governance	The company has not engaged any adaptation strategy regarding its corporate projects and policies	Assessments of the gaps in management governance of physical climate risks and the needs to integrate climate change adaptation approach in corporate projects and policies	The gaps in management governance of physical climate risks and the needs to integrate climate change adaptation approach in corporate projects and policies were identified and work is in progress (eg: major plans of action, risk management policies, annual budgets, reviewing and guiding strategy)	The management governance of physical climate risks and the climate change adaptation approach in corporate projects and policies are formalized (eg: major plans of action, risk management policies, annual budgets, reviewing and guiding strategy)	The management governance of physical climate risks and the climate change adaptation approach in corporate projects and policies are formalized and in place (eg: major plans of action, risk management policies, annual budgets, reviewing and guiding strategy)

6.3 Decision support tools & external expertise	The company has not engaged in setting up any indicator, impact threshold, assessment, monitoring system or external collaborations/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 (eg: maximum flood flow without damage to the activity), as well as monitoring and assessment systems for physical climate risks and adaptation Collaborations/partnerships for further expertise in progress	The company has set up indicators for decision making and impact thresholds (eg: maximum flood flow without damage to the activity), as well as monitoring and assessment systems for physical climate risks and adaptation, that are regularly reviewed Collaborations/partnerships for further expertise developed
6.4 Adaptation strategy	The company has not engaged any adaptation strategy regarding its organizational capacity or didn't considered how it is aligned with other strategies		It has an adaptation strategy that partly takes into account other environmental issues (impact on climate mitigation, biodiversity, health and pollution) The adaption actions are context and location-specific	It has an adaptation strategy in place that takes into account other environmental issues (impact on climate change mitigation, biodiversity, health and pollution) The adaption actions are context and location-specific Engagement with relevant actors (suppliers, local or national governments, local stakeholders, distributors, keys customers, suppliers with local and national governments) to identify, assess and manage climate-related physical risks, as well as local adaptation Consider diversification of activities related to climate physical risks when relevant	It has an adaptation strategy in place that takes into account other environmental issues (impact on climate change mitigation, biodiversity, health and pollution) The adaption actions are context and location-specific Engagement with relevant actors (suppliers, local or national governments, local stakeholders, distributors, keys customers, suppliers with local and national governments) to identify, assess and manage climate-related physical risks, as well as local adaptation Consider diversification of activities related to climate physical risks when relevant

Financial ressources Financing available to implement actions					
7	The company has not engaged any adaptation strategy regarding its financial ressources or took any measure.	Identification of financial positions that could suffer from climate change impacts		Definition and quantification of financial costs from climate change impacts (eg: value-at-risk, annual average loss projected impacts of climate change from disruptions, projected change in production, revenues, markets, opex, capex due to climate change) Integration of climate physical risks to financial planning tools and definition of critical financial thresholds Subscription to insurance in order to prevent physical climate risks to which the company is exposed, as analysed in the first module in terms of hazards, scenarios, data and value chain. Identification of climate-related opportunities	Definition and quantification of financial costs from climate change impacts regularly updated (eg: value-at-risk, annual average loss projected impacts of climate change from disruptions, projected change in production, revenues, markets, opex, capex due to climate change) Integration of climate physical risks to financial planning tools and definition of critical financial thresholds regularly revised Subscription to insurance in order to prevent physical climate risks to which the company is exposed, as analysed in the first module in terms of hazards, scenarios, data and value chain. Identification of climate-related opportunities and development

Technological ressources Technologies, techniques and new solutions					
8.1 Technical tools and solutions	The company has not engaged any adaptation strategy regarding its technological ressources or took any measure	Start/begining of considerations regarding potentials needs in tools and technical solutions	Needs in tools and technical solutions are identified and start of development	Identification and development of technical knowledge (for example through experimental projects) Tools and technical services in finalization phase The company has to explore how the choices of new technologies and solutions (eg: better farming practices such as crop management, crop species, land use) take into account both current weather variability and future climate change, including uncertainty	Technical knowledge developed (for example through experimental projects) Tools and technical services developed The company has to develop and mention how the choices of new technologies and solutions (eg: better farming practices such as crop management, crop species, land use) take into account both current weather variability and future climate change, including uncertainty
8.2 R&D	The share of adaption R&D is below 5% of total R&D investments	The share of adaption R&D is between 5% and 10% of total R&D investments	The share of adaption R&D is between 10% and 15% of total R&D investments	The share of adaption R&D is between 15% and 20% of total R&D investments	The share of adaptation R&D is above 20% of total R&D investments

Human ressources The specific skills and working time that the company mobilises

9.1 Teams trainings	The company has not engaged any adaptation strategy regarding the training of its employees and its key decision makers	Assessments of the gaps and needs of training for physical climate risks and adaptation of teams and key decision makers	Awareness-raising of employees to physical climate risks and adaptation, especially for the individual/committee with highest responsability for climate change (i.e. module 6.1)	Training of employees to physical climate risks and adaptation is in progress and almost completed, especially for the individual/committee with highest responsability for climate change (i.e. module 6.1) It concerns between 60% and 80% of teams members	Training and integration in-depth of issues and dimensions related to physical climate risks and adaptation for all employees with content and objectives regularly updated, especially for the individual/committee with highest responsability for climate change (i.e. module 6.1) It concerns above 80% of teams members
9.2 Watch and sharing information device	The company has not engaged in the development of a watch and sharing information device		Watch, acquisition and sharing device of information and knowledge about climate physical risks and adaptation		Watch, acquisition and sharing device of information and knowledge about climate physical risks and adaptation with regularly updated content

7.3. WEIGHTINGS

The weightings on 100% are distributed equally among Physical risks and Adaptation dimensions, as they are considered as equally important for a company to face climate change impacts. Analysis and Organizational capacity modules are both fixed to 25%. They have the higher weightings among their respective dimension since they contain the indicators that determine the most respectively the climate physical risks exposition and vulnerability analysis (indicators 1.1, 1.2 and 1.3), and the Adaptation strategy (indicator 6.4). The remaining weightings are distributed approximately equally among the other modules. The ones that have a slightly higher weightings (for example production / operations / infrastructures impacts and vulnerabilities, indicator 3.0) are the ones on which companies might have more space for decision and action.

If a company is not concerned by one or several modules between Supply chain, Production, Logistics or Demand (indicators 2, 3, 4 and 5), the analyst can decide to attribute a weighting of 0 for it. Weightings are then computed proportionally, on a new base that is less than 100%, while respecting previous computation rules.

For example, if the indicator 2.0 is excluded from the analysis, the total will be on 94% and proportionally, the physical risks dimension on 47% and the analysis module on 23.5%.

The final score of the complete matrix will be computed on 20 thanks to a weighted average. Two other scores will be computed, the physical risks score on 100% and the adaptation score on 100%.

MODULE		AG	INDICATOR	WEIGHTINGS	
				Indicator	Module
CLIMATE PHYSICAL RISKS 50%	**ANALYSIS**	1.1	Data and scenarios	8%	**25%**
		1.2	Hazards	9%	
		1.3	Exposition and vulnerability/sensitivity	8%	
	SUPPLY CHAIN / RAW MATERIALS	2.0	Impacts and vulnerabilities	6%	**6%**

	PRODUCTION / PROCESS / OPERATIONS / MACHINERIES / INFRASTRUCTURES	3.0	Impacts and vulnerabilities	7%	**7%**
	LOGISTICS / TRANSPORTS	4.0	Impacts and vulnerabilities	6%	**6%**
	DEMAND AND SALES	5.0	Opportunities, impacts and vulnerabilities	6%	**6%**
ADAPTATION 50%	ORGANIZATIONAL CAPACITY	6.1	The climate head	4%	**25%**
		6.2	Climate governance	5%	
		6.3	Decision support tools & external expertise	5%	
		6.4	Adaptation strategy	11%	
	FINANCIAL RESSOURCES	7.0	Financing available to implement actions	9%	**9%**
	TECHNOLOGICAL RESSOURCES	8.1	Technical tools and solutions	5%	**7%**
		8.2	R&D	2%	
	HUMAN RESSOURCES	9.1	Teams trainings	5%	**9%**
		9.2	Watch and sharing information device	4%	

7.4. GLOSSARY

ACTIONS THAT DO NOT (SIGNIFICANTLY) HARM MITIGATION, BIODIVERISTY,

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):

HEALTH AND POLLUTION	- Sustainable use and protection of water and marine resources - Transition to a circular economy, waste prevention and recycling - Pollution prevention and control - Protection of healthy ecosystems This assessment ensures that progress against some objectives are not made at the expense of others and recognises the reinforcing relationships between different environmental objectives. [20]
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. [19]
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. **[19]**
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. [19]
CLIMATE-RELATED OPPORTUNITY	It is the potential positive impacts related to climate change on an organisation. It will vary depending on the region, market and industry in which an organisation operates. In the ACT framework, climate-related opportunity focuses on opportunities to adapt to market shifts driven by physical climate impacts and cater to any resulting new market needs, that is to say, the fundamental shifts in climate over the longer term may affect value chains and drive new consumer needs. For example, technology to keep buildings cool, along with water- and energy-efficient technologies, or crops that are better suited to chronic changes in precipitation and temperature. (EBRD)

EMISSION SCENARIO	A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g., greenhouse gases (GHGs), aerosols) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socio-economic development, technological change, energy and land use) and their key relationships. Concentration scenarios, derived from emission scenarios, are used as input to a climate model to compute climate projections. [19]
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. [19]
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). [19]
FINANCIAL RESSOURCES	It is the funds available to implement its adaptive capacity. (ADEME, 2019)
HAZARDS	The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. In this report, the term hazard usually refers to climate-related physical events or trends or their physical impacts. Thus, it includes processes that range from brief events, such as severe storms, to slow trends, such as multi-decade droughts or multi-century sea level rise. [19] A climate hazard should be appreciated in function of its likelihood, magnitude and duration.
HUMAN RESSOURCES	It is the internal skills and working time that the company uses to improve its adaptive capacity. (ADEME, 2019)
ORGANIZATIONAL CAPACITY	It is the governance bodies, exchanges, decision-making processes and the management mode that contribute to its adaptive capacity. (ADEME, 2019)
PHYSICAL CLIMATE RISKS	The potential for negative consequences from physical climate events or trends.

Acute physical risks refer to those that are event-driven, including increased severity of extreme weather events, such as tropical cyclones or floods.

Chronic physical risks are longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level change or chronic heat waves.

Risks from climate change impacts arise from the interaction between hazard (triggered by an event or trend related to climate change), vulnerability (susceptibility to harm) and exposure (people, assets or ecosystems at risk). [19]

The classification of physical hazards is the following :

CHRONIC PHYSICAL HAZARDS	Includes	Definition
Sustained temperature rise	Urban heat island	A gradual increase in overall temperature.
Change in precipitation patterns		Increase or decrease in precipitation annually and seasonally.
Water Stress	Degraded water quality	High ratio of total water withdrawals to available renewable surface and groundwater supplies.
Sea level change	Costal erosion	Change to the height of sea level, both globally and locally (relative sea level change) at seasonal, annual, or longer time scales due to (1) a change in ocean volume as a result of a change in the mass of water in the ocean (e.g., due to melt of glaciers and ice sheets), (2) changes in ocean volume as a result of changes in ocean water density (e.g., expansion under warmer conditions), (3) changes in the shape of the ocean basins and changes in Earth's gravitational and rotational fields, and (4) local subsidence or uplift of the land.

Ocean acidification	Ocean acidification refers to a reduction in the pH of the ocean over an extended period, typically decades or longer, which is caused primarily by uptake of carbon dioxide (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	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.
		Pluvial Flood	
		Groundwater Flood	
		Coastal Flood	
	Landslides	Mass mouvements	A mass of material that has moved downhill because of gravity, often assisted by water when the material is saturated.
		Shrinkage-swelling of clay soils (SSCS)	Clay soils can have their consistency change according to their water content. In a humid context, a clayey soil appears supple and malleable, while the same soil dried out will be hard and brittle. Variations of volume more or less consequent according to the structure of the soil and the minerals in presence, accompany these modifications of consistency.
	Extreme winds	Storm	Wind speed that is rare (unusually low or high) in a particular place and at a particular time of year. An extreme event would normally be as rare as or rarer than the 10th or 90th percentile of a probability density function estimated from observations.
	Tornadoes		A violently rotating column of air touching the ground; usually attached to the base of a thunderstorm.

Tropical cyclones	The general term for a strong, cyclonic-scale disturbance that originates over tropical oceans. Distinguished from weaker systems (often named tropical disturbances or depressions) by exceeding a threshold wind speed. A tropical storm is a tropical cyclone with 1-minute average surface winds between 18 and 32 m s–1. Beyond 32 m s–1, a tropical cyclone is called a hurricane, typhoon, or cyclone, depending on geographic location.
Dust Storm	The result of terminal winds raising large quantities of dust into the air and reducing visibility at eye level (1.8 meters) to less than 1,000 meters.

Note: The definitions of these hazards from the WRI and the IPCC are examples, any other relevant definition and corresponding indicator will be appropriate.

Sources : WRI based on a review of reports from the IPCC (2014a, 2021, 2018, 2019a, 2019b), Géorisques, and adapted from I4CE

REPRESENTATIVE CONCENTRATION PATHWAYS (RCP)

Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases (GHGs) and aerosols and chemically active gases, as well as land use/land cover (Moss et al., 2008). The word representative signifies that each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics. The term pathway emphasizes that not only the long-term concentration levels are of interest, but also the trajectory taken over time to reach that outcome (Moss et al., 2010).

RCPs usually refer to the portion of the concentration pathway extending up to 2100, for which Integrated Assessment Models produced corresponding emission scenarios. Extended Concentration Pathways (ECPs) describe extensions of the RCPs from 2100 to 2500 that were calculated using simple rules generated by stakeholder consultations and do not represent fully consistent scenarios.

Four RCPs produced from Integrated Assessment Models were selected from the published literature and are used in the present IPCC Assessment as a basis for the climate predictions and projections presented in WGI AR5 Chapters 11 to 14 (IPCC, 2013b):

RCP2.6

One pathway where radiative forcing peaks at approximately 3 W/m2 before 2100 and then declines (the corresponding ECP assuming constant emissions after 2100). RCP2.6 is representative of a scenario that aims to keep global warming likely below 2°C above pre-industrial temperatures. The increase of global mean surface temperature by the end of the 21st century (2081–2100) relative to 1986–2005 is *likely* to be 0.3°C to 1.7°C under RCP2.6.

RCP4.5 and RCP6.0

	Two intermediate stabilization pathways and scenarios in which radiative forcing is stabilized at approximately 4.5 W/m2 and 6.0 W/m2 after 2100 (the corresponding ECPs assuming constant concentrations after 2150). The increase of global mean surface temperature by the end of the 21st century (2081–2100) relative to 1986–2005 is *likely* to be 1.1°C to 2.6°C under RCP4.5, 1.4°C to 3.1°C under RCP6.0. **RCP8.5** It is the scenario with very high GHG emissions. One high pathway for which radiative forcing reaches >8.5 W/m2 by 2100 and continues to rise for some amount of time (the corresponding ECP assuming constant emissions after 2100 and constant concentrations after 2250). Scenarios without additional efforts to constrain emissions ('baseline scenarios') lead to pathways ranging between RCP6.0 and RCP8.5. The increase of global mean surface temperature by the end of the 21st century (2081–2100) relative to 1986–2005 is *likely* to be 2.6°C to 4.8°C under RCP8.5. Relative to 1850–1900, global surface temperature change for the end of the 21st century (2081–2100) is projected to *likely* exceed 1.5°C for RCP4.5, RCP6.0 and RCP8.5 (*high confidence*). Warming is *likely* to exceed 2°C for RCP6.0 and RCP8.5 (*high confidence*), *more likely than not* to exceed 2°C for RCP4.5 (*medium confidence*), but *unlikely* to exceed 2°C for RCP2.6 (*medium confidence*). [19]
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. **[19]**
TECHNICAL RESSOURCES	The technologies, techniques and new solutions that contribute to improving its adaptive capacity. (ADEME, 2019)
THRESHOLD	Identifying the stages beyond which the operation of a system is significantly or irreversibly compromised, and understanding how climate change interacts with these functional thresholds, threshold analysis enables to identify different levels of risk. The identification of these different risks thresholds in space and time then allows to prioritize and sequence incremental adaptation solutions. (ADEME, 2020)
TRANSFORMATION	A change in the fundamental attributes of natural and human systems. **[19]**
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. [21]

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. [21]

7.5. BIBLIOGRAPHY

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8. Rating

The ACT rating shall comprise:

→ A performance score
→ A narrative score
→ A trend score
→ A Climate Physical Risks and Adaptation Score (experimental)

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

a. **Performance score** as a number from 1 (lowest) to 20 (highest)
b. **Narrative score** as a letter from E (lowest) to A (highest)
c. **Trend score** as either "+" for improving, "-" for worsening, or "=" for stable. In some situations, trend scoring may reveal itself to be unfeasible depending on data availability. In this case, it should be replaced with a "?".
d. Climate Physical Risks and Adaptation score as a number from 1 (lowest) to 20 (highest

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

TABLE 6: HIGHEST SCORE FOR EACH ACT SCORE TYPE

The highest available ACT rating is 20 A + 20	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 receives high scores in its assessment against maturity matrixes assesssment

Each company assessed using an ACT methodology received not only an ACT rating but a commentary on their performance across the four 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

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

The organisation of the company – steps of the value chain where the company operates – shall be considered in the narrative assessment and narrative scoring for the Aluminium sector. The indicators and modules concerned are:

- Module 1
    - 1.1 needs to be taken into account to assess as has a high weighting (10%) and it assesses the future carbon intensity of the company
    - 1.3 Achievement of past and current targets, 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 takes another look at the following dimensions:
        - Achievement level: To what degree has the company achieved its previously set emissions reduction targets.
        - Progress level: To what degree is the company on track to meet its currently active emissions reduction targets.
        - Ambition level: What level of ambition do the previously achieved emissions reduction targets represent.
- Module 2
    - Indicators 2.1 / 2.2 and 2.3 assess the carbon performance of the company in the past and in the future, and should be taken into account
    - Indicators 2.4 Contribution to low carbon electricity generation and 2.5 Reducing process-scrap generation
- The information reported in Module 4 shall be considered with peculiar attention for the narrative analysis and narrative scoring for the Aluminium sector because they assess most parts of CO_2e

emissions due to Aluminium production (the upstream steps of the value chain, and ancillary materials & transport CO_2e emissions). This is the same for indicators 4.2 and 4.3

- For indicator 8.2, membership in associations that support climate positive policies should also be considered in the narrative score analysis. The website https://influencemap.org/ could be used to get this information. Same for 8.4 assessing the collaboration with local public authorities
- Module 9 Business model is also key to rate the narrative scoring tool

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.

TABLE 6: RELEVANT PERFORMANCE INDICATORS FOR NARRATIVE SCORING

Module	Indicator
Targets	1.1 Alignment of Scope 1+2 and Scope 1+2+3 targets
	1.3 Achievement of past and current targets
Material investment	2.1 Past performance for aluminium assets, per step of the value chain
	2.2 Locked-in emissions of all aluminium production assets
	2.3 Future performance of aluminium assets, per step of the value chain
	2.4 Contribution to low carbon electricity generation
	2.5 Reducing process-scrap generation
Sold product performance	4.1 Cradle-to-gate aluminium carbon footprint
	4.2 Purchased product intervention
	4.3 Recycled scrap traceability
Policy engagement	8.2 Trade associations supported do not have climate-negative activities or positions
	8.4 Collaboration with local public authorities
Business model	9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid
	9.2 Low carbon business models that aim at switching to low carbon-processes
	9.3 Low carbon business models that aim at taking part in aluminium circular economy

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 7: RELEVANT PERFORMANCE INDICATORS FOR TRENDS IDENTIFICATION

Module	Indicator
Targets	1.1 Alignment of Scope 1+2 and Scope 1+2+3 targets
	1.2 Time horizon of targets for aluminium production
Material investment	2.2 Locked-in emissions
	2.3 Future performance of aluminium assets, per step of the value chain
	2.4 Contribution to low carbon electricity generation
	AL 2.5 Reducing process-scrap generation
Sold product performance	4.2 Purchased product intervention
Management	5.3 Low-carbon transition plan
	5.5 Climate change scenario testing
Supplier	6.1 Strategy to influence suppliers to reduce their GHG emissions
Client	7.1 Strategy to influence customer behaviour to reduce their GHG emissions
Business model	9.1 Low carbon business models that aim at increasing low carbon power production and/or a more flexible grid
	9.2 Low carbon business models that aim at switching to low carbon-processes
	9.3 Low carbon business models that aim at taking part in aluminium circular economy

9. Aligned state

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

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

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

that is key for the mining and metals sector.

FIGURE 31: ALIGNED STATE FOR ALUMINIUM COMPANIES

10. 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.
ACTIVITY DATA	Activity data are defined as data on the magnitude of human activity resulting in emissions or removals taking place during a given period of time (**UNFCCC definitions**).
ADEME	Agence de la Transition Ecologique; The French Agency for Ecological Transition (**ADEME webpage**).
ALIGNMENT	The ACT project seeks to gather information that will be consolidated into a rating that is intended to provide a general metric of the 2-degree alignment of a given company. The wider goal is to provide companies specific feedback on their general alignment with 2-degrees in the short and long term.
ANALYST	Person in charge of the ACT assessment.
ASSESS	Under the ACT project, to evaluate and determine the low-carbon alignment of a given company. The ACT assessment and rating will be based on consideration of a range of indicators. Indicators may be reported directly from companies. Indicators may also be calculated, modelled or otherwise derived from different data sources supplied by the company. The ACT project will

	measure 3 gaps (Commitment, Horizon and Action gaps – defined in this glossary) in the GHG emissions performance of companies. This model closely follows the assessment framework presented above. It starts with the future, with the goals companies want to achieve, followed by their plans, current actions and past actions.
Asset	An item of property owned by a company, regarded as having value and available to meet debts, commitments, or legacies. Tangible assets include 1) fixed assets, such as machinery and buildings, and 2) current assets, such as inventory. Intangible assets are nonphysical such as patents, trademarks, copyrights, goodwill and brand value.
AL	Abbreviation of the 'Aluminium' sector
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.
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).
Capital expenditure	Money spent by a business or organization on acquiring or maintaining fixed assets, such as land, buildings, and equipment.
Carbon Capture and Storage (CCS)	The process of trapping carbon dioxide produced by burning fossil fuels or other chemical or biological process and storing it in such a way that it is unable to affect the atmosphere.
Carbon offsets	Carbon offsets are avoidance of GHG emissions or GHG suppressions made by a company, sector or economy to compensate for emissions made elsewhere in the economy, where the marginal cost of decarbonization proves to be lower.
CDP	Formerly the "Carbon Disclosure Project", CDP is an international, not-for-profit organization providing the only global system for companies and cities to measure, disclose, manage and share vital environmental information. CDP works with market forces, including 827 institutional investors with assets of over US$100 trillion, to motivate companies to disclose their impacts on the environment and natural resources and take action to reduce them. More than 5,500 companies worldwide disclosed environmental information through CDP in 2015. CDP now holds the largest collection globally of primary climate change, water and forest risk commodities information and puts these insights at the heart of strategic business, investment and policy decisions (**CDP website**).
Climate change	A change in climate, attributed directly or indirectly to human activity, that alters the composition of the global atmosphere and that is, in addition to natural climate variability, observed over comparable time periods (UNFCCC).
Commitment gap	In relation to emissions performance, the difference between what a company needs to do and what it says it will do.
Company	A commercial business.

Company 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)).
Emissions	The GHG Protocol defines direct GHG emissions as emissions from sources that are owned or controlled by the reporting entity, and indirect GHG emissions

	as emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity (**GHG Protocol**).
ENERGY	Power derived from the utilization of physical or chemical resources, especially to provide light and heat or to work machines.
FOSSIL FUEL	A natural fuel such as coal, oil or gas, formed in the geological past from the remains of living organisms.
FUTURE	A period of time following the current moment; time regarded as still to come.
GREENHOUSE GAS (GHG)	Greenhouse gas (e.g. carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and three groups of fluorinated gases (sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs)) which are the major anthropogenic GHGs and are regulated under the Kyoto Protocol. Nitrogen trifluoride (NF_3) is now considered a potent contributor to climate change and is therefore mandated to be included in national inventories under the United Nations Framework Convention on Climate Change (UNFCCC).
GUIDANCE	Documentation defining standards or expectations that are part of a rule or requirement (e.g. **CDP reporting guidance for companies**).
HORIZON GAP	In relation to emissions performance, the difference between the average lifetime of a company's production assets (particularly carbon intensive) and the time-horizon of its commitments. Companies with large asset-lives and small-time horizons do not look far enough into the future to properly consider a transition plan.
IAI	International Aluminium Institute
INCENTIVE	A thing, for example money, that motivates or encourages someone to do something (e.g. a monetary incentive for company board members to set emissions reduction targets).
INDICATOR	An indicator is a quantitative or qualitative piece of information that, in the context of the ACT project, can provide insight on a company's current and future ability to reduce its carbon intensity. In the ACT project, 3 fundamental types of indicators can be considered: ♦ **Key performance indicators (KPIs);**

	♦ **Key narrative indicators (KNIs); and** **Key asset indicators (KAIs).**
Intensity (emissions)	♦ The average emissions rate of a given pollutant from a given source relative to the intensity of a specific activity; for example, grams of carbon dioxide released per MWh of energy produced by a power plant.
Intervention	Methods available to companies to influence and manage emissions in their value chain, both upstream and downstream, which are out of their direct control (e.g. a retail company may use consumer education as an intervention to influence consumer product choices in a way that reduces emissions from the use of sold products).
Lifetime	The duration of a thing's existence or usefulness (e.g. a physical asset such as a power plant).
Long-term	Occurring over or relating to a long period of time; under ACT this is taken to mean until the year 2050. The ACT project seeks to enable the evaluation of the long-term performance of a given company while simultaneously providing insights into short- and medium-term outcomes in alignment with the long-term.
Low-carbon benchmark pathway	Benchmark pathway (See 'Benchmark')
Low-carbon scenario (or pathway)	A low-carbon scenario (or pathway) is a 2°C scenario, a well-below 2°C scenario or a scenario with higher decarbonization ambition.
Low-carbon solution	A low-carbon solution (e.g. energy, technology, process, product, service, etc.) is a solution whose development will contribute to the low-carbon transition.
Low-carbon transition	The low-carbon transition is the transition of the economy according to a low-carbon scenario.
Manufacture	Making objects on a large-scale using machinery.
Maturity matrix	A maturity matrix is essentially a "checklist", the purpose of which is to evaluate how well advanced a particular process, program or technology is according to specific definitions.

Maturity progression	An analysis tool used in the ACT project that allows both the maturity and development over time to be considered with regards to how effective or advanced a particular intervention is.
Mitigation (emissions)	The action of reducing the severity of something (e.g. climate change mitigation through absolute GHG emissions reductions)
Model	A program designed to simulate what might or what did happen in a situation (e.g. climate models are systems of differential equations based on the basic laws of physics, fluid motion, and chemistry that are applied through a 3-dimensional grid simulation of the planet Earth).
Module	A module is a family of indicators, there are quantitative and qualitative modules to ensure a robust assessment of the low carbon strategy of the company.
Pathway (emissions)	A way of achieving a specified result; a course of action (e.g. an emissions reduction pathway).
Performance	Measurement of outcomes and results.
Plan	A detailed proposal for doing or achieving something.
Point	A mark or unit of scoring awarded for success or performance.
Power	Energy that is produced by mechanical, electrical, or other means and used to operate a device (e.g. electrical energy supplied to an area, building, etc.).
Power generation	The process of generating electric power from other sources of primary energy.
Primary energy	Primary energy is an energy form found in nature that has not been subjected to any conversion or transformation process. It is energy contained in raw fuels, and other forms of energy received as input to a system. Primary energy can be non-renewable or renewable.
Progress ratio	An indicator of target progress, calculated by normalizing the target time percentage completeness by the target emissions or renewable energy percentage completeness.

Relevant / Relevance	In relation to information, the most relevant information (core business and stakeholders) to assess low-carbon transition.
Renewable energy	Energy from a source that is not depleted when used, such as wind or solar power.
Reporting year	Year under consideration.
Research and Development (R&D)	A general term for activities in connection with innovation; in industry; for example, this could be considered work directed towards the innovation, introduction, and improvement of products and processes.
Scenario	The **Fifth Assessment Report** (AR5) of the Intergovernmental Panel on Climate Change (IPCC) presents the results of an extensive climate modelling effort to make predictions of changes in the global climate based on a range of development/emissions scenarios. Regulation on climate change-related issues may present opportunities for your organization if it is better suited than its competitors to meet those regulations, or more able to help others to do so. Possible scenarios would include a company whose products already meet anticipated standards designed to curb emissions, those whose products will enable its clients to meet mandatory requirements or those companies that provide services assisting others in meeting regulatory requirements.
Scenario analysis	A process of analysing possible future events by considering alternative possible outcomes.
Science-Based Target	To meet the challenges that climate change presents, the world's leading climate scientists and governments agree that it is essential to limit the increase in the global average temperature at below 2°C. Companies making this commitment will be working toward this goal by agreeing to set an emissions reduction target that is aligned with climate science and meets the requirements of the **Science-Based Targets Initiative**.
Sectoral Decarbonization Approach (SDA)	The Sectoral Decarbonization Approach (SDA) is a scientifi cally-informed method for companies to set GHG reduction targets necessary to stay within a 2°C temperature rise above preindustrial levels. The method is based on the 2°C scenario, one of the International Energy Agency's detailed CO2 sector scenarios modeled in their 2014 Energy Technology Perspectives report. The Energy Technology Perspectives report's

	budget is consistent with the representative concentration pathway 2.6 (RCP2.6) scenario from the IPCC's Fifth Assessment Report, which gives the highest likelihood of staying within the global target temperature of less than 2°C in the year 2100. The probability is estimated by the IPCC at a minimum of 66 percent. The IEA 2°C scenario estimates an overall carbon budget of 1,055 GtCO2 up to 2050. The SDA is differentiated from other existing methods by virtue of its subsector-level approach and global least cost mitigation perspective. SDA results and assumptions are based on mitigation potential and cost data from the IEA's TIMES model 2ºC scenario, which identifies the least-cost technology mix available to meet final demand for industry, transport, and buildings services. The SDA is intended to help companies in homogenous, energy intensive sectors align their emissions reduction targets with a global 2ºC pathway. The SDA is best suited for companies in the following subsectors with well-defi ned activity and physical intensity data: electricity generation; iron and steel; chemicals; aluminium; cement; pulp and paper; road, rail, and air transport; and commercial buildings.
Scope 1 emissions **Direct GHG emissions and removals**	All direct GHG emissions (**GHG Protocol Corporate Standard**). Category 1 from ISO 14064-1:2018*: Direct GHG emissions and removals occur from GHG sources or sinks inside organizational boundaries and that are owned or controlled by the* [reporting] *organization. Those sources can be stationary (e.g. heaters,electricity generators, industrial process) or mobile (e.g. vehicles).*
Scope 2 emissions **Indirect GHG emissions from imported energy**	Indirect GHG emissions from consumption of purchased electricity, heat or steam (**GHG Protocol Corporate Standard**). Category 2 from ISO 14064-1:2018: *GHG emissions due to the fuel combustion associated with the production of final energy and utilities, such as electricity, heat, steam, cooling and compressed air* [imported by the reported company]. *It excludes all upstream emissions (from cradle to power plant gate) associated with fuel, emissions due to the construction of the power plant, and emissions allocated to transport and distribution losses.*
Scope 3 emissions **Indirect GHG emissions**	Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc. (**GHG Protocol Corporate Standard**). Scope 3 also encompass the emissions related to the use of sold-products.

	ISO 14064-1:2018: *GHG emission that is a consequence of an organization's operations and activities, but that arises from GHG sources that are not owned or controlled by the* [reporting] *organization*. *These emissions occur generally in the upstream and/or downstream chain.* *Category 3 : indirect GHG emissions from transportation* *Category 4: Indirect GHG emissions from products used by an organization* *Category 5: Indirect GHG emissions associated with the use of products from the organization* *Category 6: Indirect GHG emissions from other sources*
SECTOR	A classification of companies with similar business activities, e.g. automotive manufacturers, power producers, retailers, etc.
SECTORAL DECARBONIZATION APPROACH (SDA)	To help businesses set targets compatible with 2-degree climate change scenarios, 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).
TARGET	A quantifiable goal (e.g. to reduce GHG emissions). ♦ **The following are examples of absolute targets:** → **metric tonnes CO_2e or % reduction from base year**

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

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Appendix

1. TWG MEMBERS

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

TABLE 8: LIST OF TWG MEMBERS

ORGANISATION	NAME
ADEME	Elliot MARI
Aluminium Dunkerque	Amandine Chaillous
Aluminium Dunkerque	Adrien Berthier
Aluminium Dunkerque	Emilie Bridier-jacob
Aluminium France Extrusion	Gilles Le Bouquin
Aluminium Stewardship Institute	Chris Bayliss
Aughinish Alumina	Stephan Beaulieu
AUREA - Affimet	François China
BMO Global Asset Management	Derek Ib
CANDRIAM	Alix Chosson
Companhia Brasileira de Alumínio (CBA)	Marina Westrupp Alacon Rayis
Constellium France	Mickaël Faliu
Emirates Global Aluminium (EGA)	Steven Bater
Emirates Global Aluminium (EGA)	Mohammad Hassan Al Jaw
Hydro Extruded Solutions	Jean-Marc Moulin
IEA	Tiffany Vass
International Aluminium Institute	Pernelle Nunez
International Aluminium Institute	Marlen Bertram
Rocky Mountain Institute	Marc Johnson
SNFA	Simon Algis
Vedanta Resources	Rohit Mukund Nanoty
WBA	Charlotte Hugman
WBA	Kaibin Tang

2. COMPANIES INVOLVED IN THE ROADTEST

TABLE 9: LIST OF COMPANIES INVOLVED IN THE ROADTEST

COMPANIES

3. LOW-CARBON TECHNOLOGY LANDSCAPE

GHG emissions in the aluminium sector are mainly occurring at two main steps:

- Aluminium smelting during the electrolysis
  - Indirect emissions coming from the electricity consumption (main source of CO_2e emissions of the whole aluminium value chain)
  - Direct emissions
- Alumina extraction
  - Thermal energy (main source of CO_2e emissions of the alumina extraction step of the value chain)
  - Calcination of calcium carbonate

Moreover, aluminium recycling is a main CO_2e emissions reduction lever, especially as it requires around 5% of the energy consumption compared to the primary route [6].

Therefore, the main approaches for reducing GHG emissions in the aluminium sector are therefore:

- Electricity decarbonization
- Direct CO_2e emissions reduction
- Recycling & resource efficiency

Improving the energy efficiency of the processes could also be a CO_2e emissions reduction lever, but its potential is more limited compared to the three CO_2e emissions reduction levers indicated above.

ELECTRICITY DECARBONIZATION

There are two ways to address the decarbonization of the power supply:

- Transition to renewable energy
  - Through self-generated electricity
  - By delocalizing to countries which electricity carbon intensity is low)
- CCUS
- Energy efficiency

The next figure from IAI highlights these levers [13].

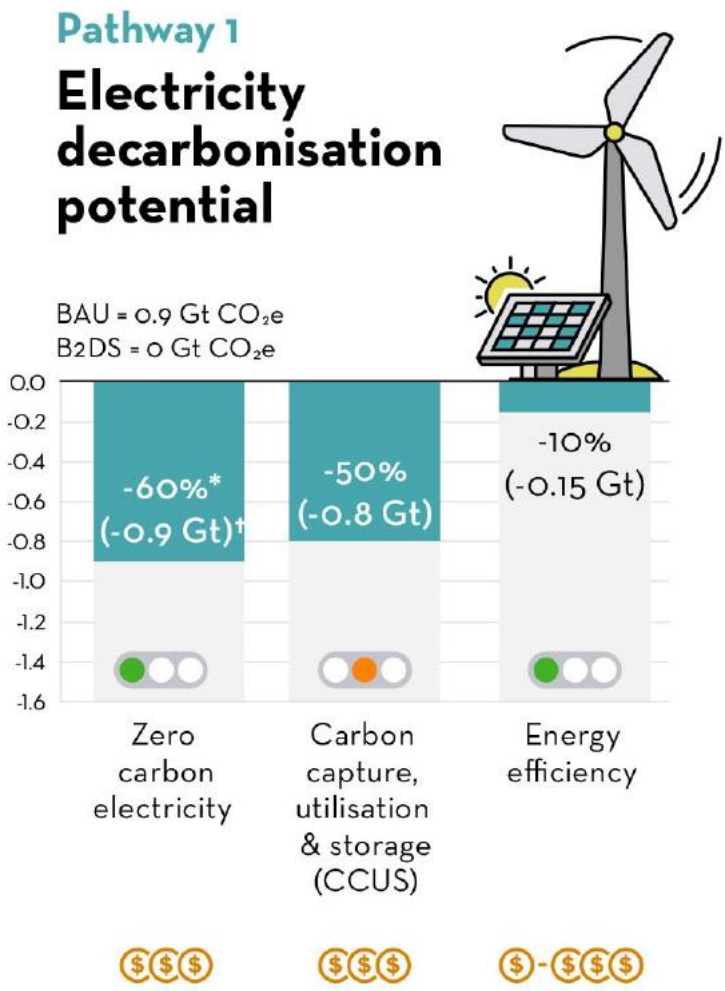

FIGURE 32: ELECTRICITY DECARBONIZATION LEVERS

The electrolysis process requires a great amount of electricity, and about 60% of the power consumed by the aluminium industry is self-generated and not purchased from the grid [4]. In the following figure, the power mix of the industry is highlighted. The coal power plants proportion is important in China (coal supplies 90% of the electricity production) while China is producing more and more aluminium [4].

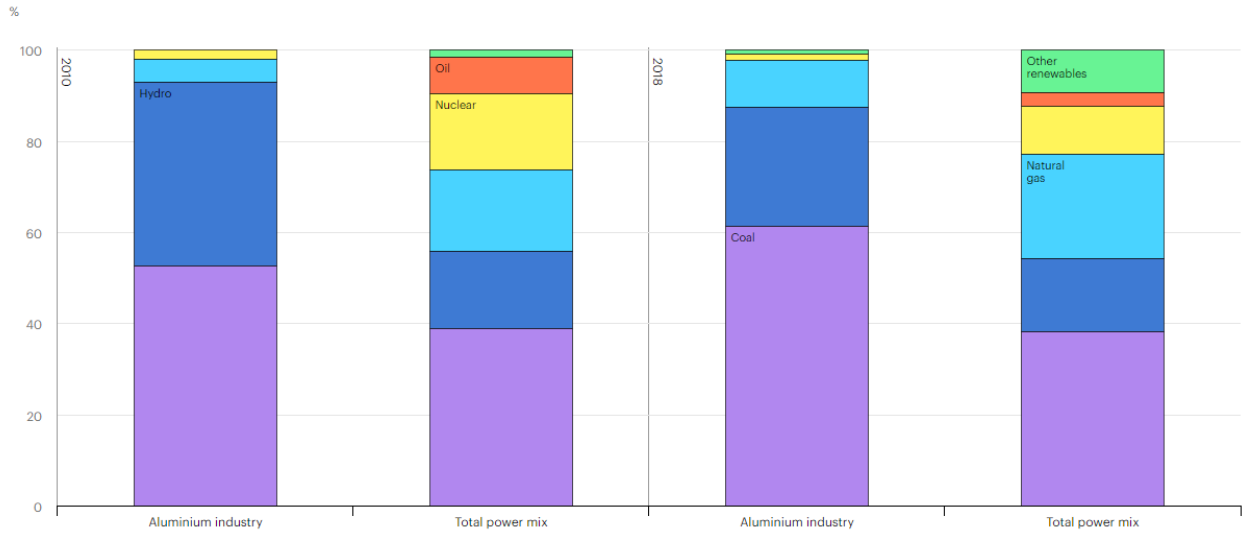

FIGURE 33: GLOBAL ALUMINIUM INDUSTRY POWER MIX COMPARED WITH THE GLOBAL TOTAL POWER MIX, 2010 AND 2018

CCUS can therefore plays a big role in terms of CO_2e emissions reduction.

Moreover, for the 40% of power remaining that is not self-generated, the decarbonization of the power grid is an important emissions reductions lever. To that end, a lever could be to delocalize its smelting facilities where the national electricity carbon intensity is lower.

Moreover, the aluminium can play a role in providing flexibility to the power grid as aluminium smelters consume a great amount of electricity. This might be a key topic especially in a context of an increasing share of intermittent electricity production means (photovoltaic and wind turbines). A project in Essen, Germany, is based on virtual battery, which is a concept relying on installing adjustable heat exchangers to maintain the energy balance in each electrolytic cell irrespective of shifting power inputs [4]. The aluminium industry is not the only one that can provide flexibility to the power grid, and all industrial processes consuming electricity can play this role as well.

DIRECT CO_2E EMISSIONS REDUCTION

The two main sources of direct emissions are:

- Fuel combustion to generate heat and/or steam to extract alumina in digestion process. At the alumina extraction step of the value chain, thermal energy is used to heat bauxite slurry in autoclaves/digesters to extract the alumina, or aluminium oxide, from the bauxite ore. Fuel combustion is also used to calcine at temperature above 1 050°C aluminium hydroxide into alumina oxide.
- Direct emissions from the electrolysis of alumina that use a carbon anode when smelting. In 2018, anode consumption accounted for around 10% of sectoral emissions and fuel combustion accounted for 15–20% of sectoral emissions [6]. Although direct emissions are a proportionally smaller decarbonization opportunity area than power consumption, they are easier to address collectively as aluminium refining and smelting techniques are shared across the industry (e.g. Bayer process, Hall-Héroult process).

Several options exist to reduce the CO_2e emissions of these two sources.

Concerning the thermal energy at the alumina extraction step, switching to technologies providing heat and steam without resorting to fossil fuels is the main option. Alternatives might be solar water heaters, biomass, geothermal, green hydrogen or concentrated solar power [6]. Some experiments are being held such as in Australia where the use of 30% of biomass has been successfully tested. Another project, also in Australia, is trying to obtain 50% of energy from concentrating solar power instead of from thermal energy [4]. Electrification could also be an interesting CO_2e emissions reduction lever.

And concerning the direct emissions from anodes, inert anodes are a promising technological solution. Rio Tinto and Alcoa have created the joint-venture Elysis that aims at replacing the carbon-based anode by inert anode releasing only oxygen during the electrolysis [6]. It is important to notice that PFC emissions might have an important impact in the whole carbon footprint of aluminium production. UC Rusal is also developing inert anode technologies.

The figure below from IAI highlights these levers [13].

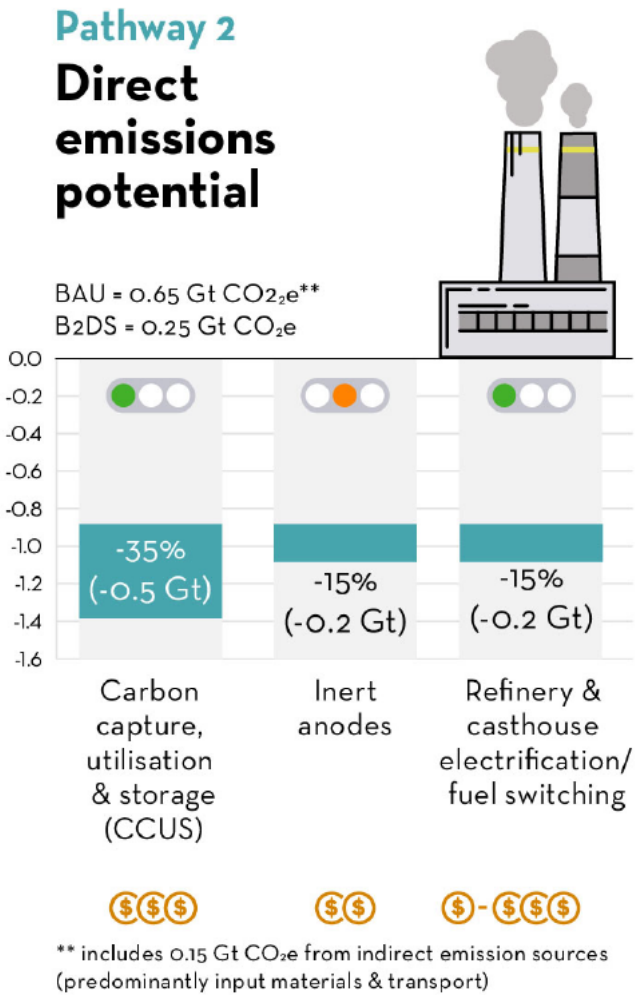

FIGURE 34: DIRECT CO_2E EMISSIONS REDUCTION LEVERS

RECYCLING & RESOURCE EFFICIENCY

Processing scrap to produce aluminium is a major CO_2e emissions reduction lever compared to producing aluminium from the primary production route. However, the scrap availability is limited. Hence, the main levers for recycling are the following:

- Minimization of pre-consumer scrap generated during the processes
- Minimization of all metal losses during casting and recycling
- Ecodesign to facilitate the post-consumer scrap collection
- End-of-life scrap collection technologies
- Technologies to improve the quality of the scrap

The next figure from IAI highlights these levers [13].

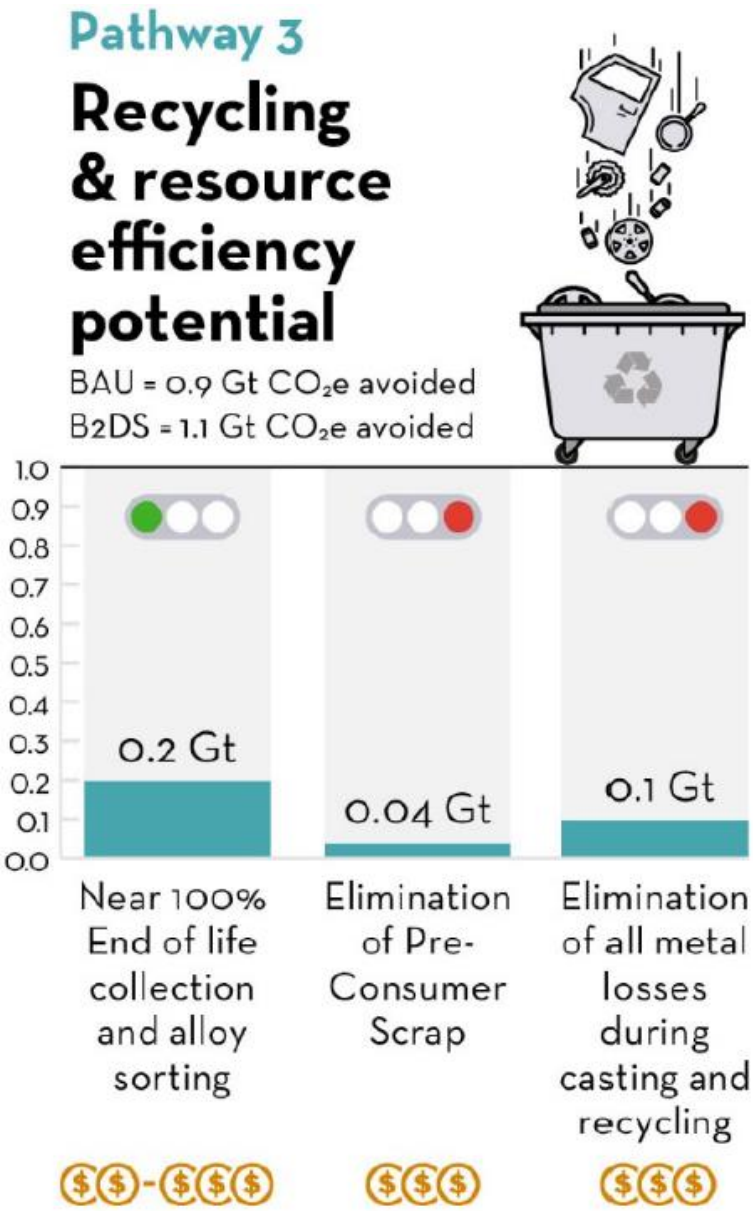

FIGURE 35: RECYCLING AND RESOURCE EFFICIENCY LEVERS

Moreover, improving the material efficiency is one of the main leads to reduce the GHG emissions in the sector. This would mainly result in the decrease of global demand for aluminium all else being equal (but global demand is expected to grow at the same time), through 4 main levers, as presented in the next figure. This lever would require commitment of all the actors along the value chain, aluminium producers have only a limited action and should develop an alternative business model which does not rely on selling bigger and bigger amounts of products [18].

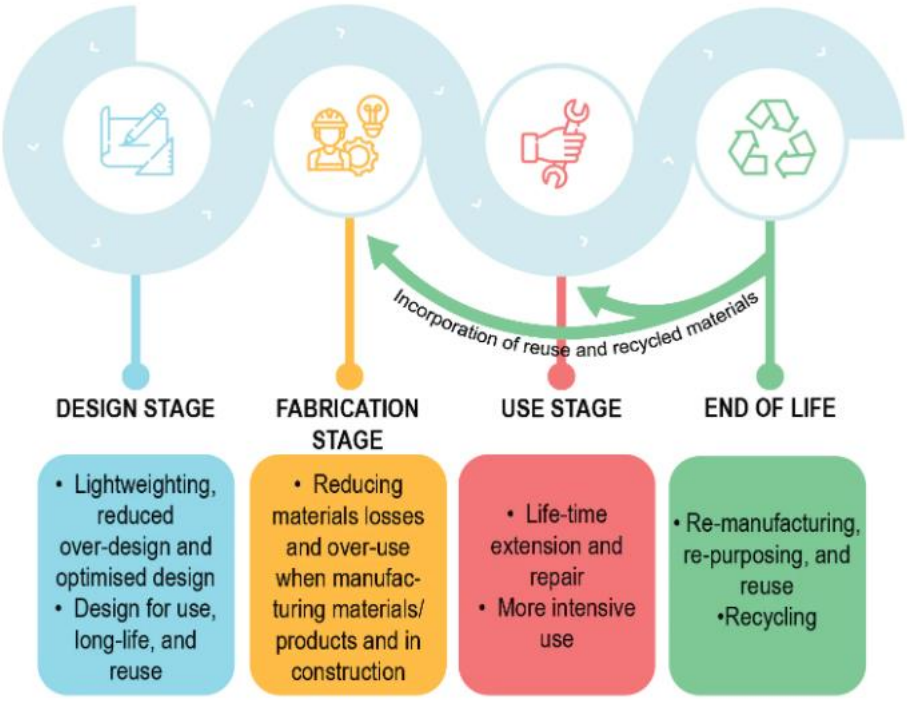

FIGURE 36: MATERIAL EFFICIENCY STRATEGIES ACROSS THE VALUE CHAIN

Recycling and scrap recovery are a very effective lever to reduce the carbon footprint of the aluminium production. Indeed, the aluminium production from scrap requires just 5% of the total energy needed compared to the primary production route [6], hence an important reduction in terms of CO_2e reduction. Aluminium has the particularity to be almost infinitively recyclable. The collection of scrap is already high (around 80% of scrap aluminium was collected in 2018), but there is a limited amount of scrap available, notably because aluminium products have a long lifetime (e.g. construction). This long lifetime of aluminium products implies the need for primary aluminium to meet the growing demand. Several challenges still remain to maximize the collection of aluminium scrap, such as improving separation techniques to decrease the mixing of alloys, developing circular business models with the whole aluminium ecosystem etc.

At last, the notion of “good scrap donor” which can be recycled into various alloy families or “good scrap acceptor" which can absorb various alloy families is interesting.

ENERGY EFFICIENCY

At each step of the aluminium value chain, energy is consumed, which leads to CO_2e emissions. As a consequence, a non-negligible CO_2e emissions reduction levers consists therefore in reducing the amount of energy consumed. However, incremental savings in energy efficiency will not have a big impact if electricity comes from fossil fuels. A great number of research papers and R&D projects carried out in order to develop new technologies or improve the current ones to reduce the energy consumption, and therefore reduce the carbon footprint when producing aluminium. These energy efficiency measures can take place at each step of the value chain.

Concerning the electrolysis step, several energy efficiency levers are available with different TRL. The electrolysis process is indeed the most energy-intensive process within the aluminium industry. The figure

below shows the results of a research paper on different energy efficiency technologies to reduce the amount of electricity consumed during the electrolysis [14].

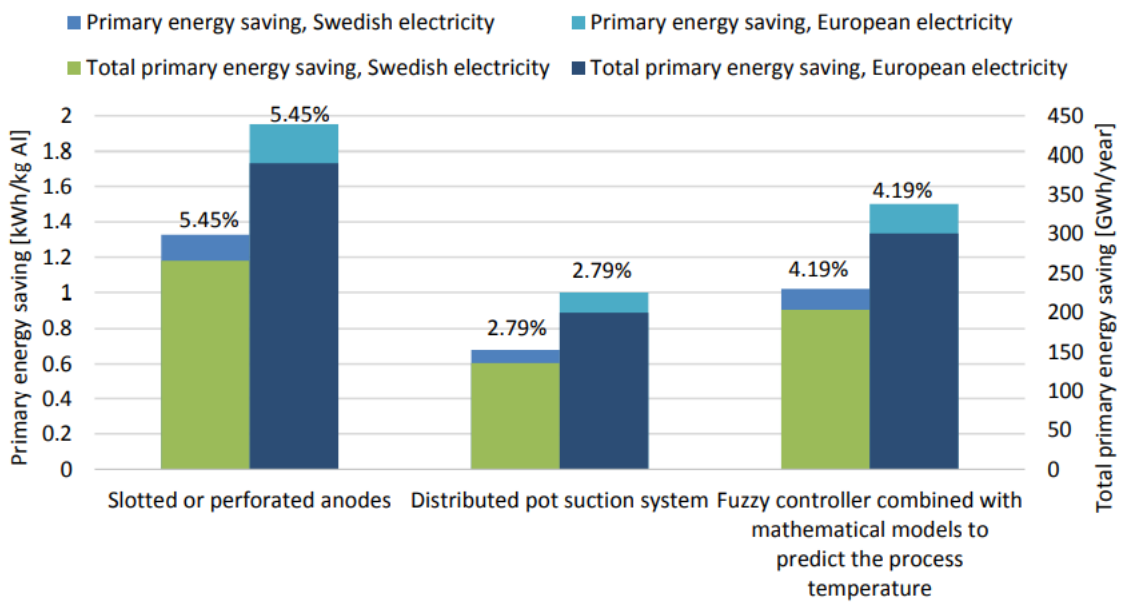

FIGURE 37: POTENTIAL SAVINGS IN PRIMARY ENERGY DEMAND

Another research paper is working on a method to automatically determine the state of an aluminium melting furnace thanks to a 3D camera system. At present, the amount of molten aluminium is determined manually: at regular intervals, a worker opens the oven door and checks the state of the aluminium and a lot of heat is lost. The aim of the research project is to determine the state of the aluminium without opening the oven's door, which would significantly reduce the energy loss and contributes to increasing the energy efficiency of the cast aluminium industry [22].

4. 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%

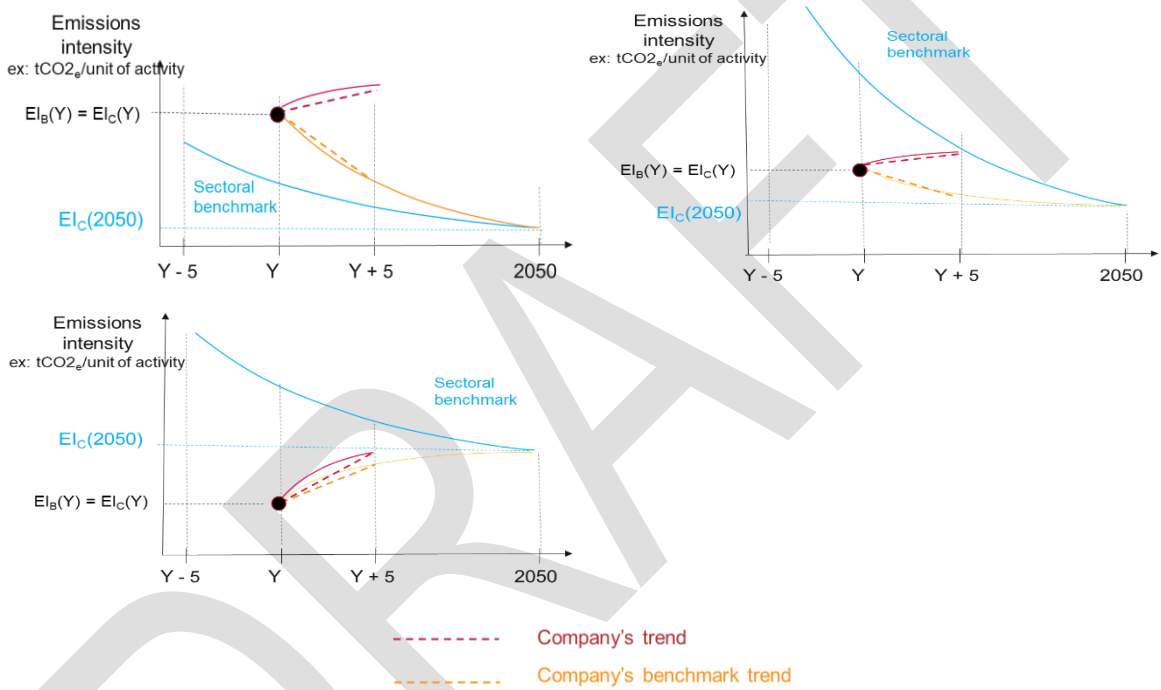

FIGURE 38: TREND RATIO - CASE 1

CASE 2

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

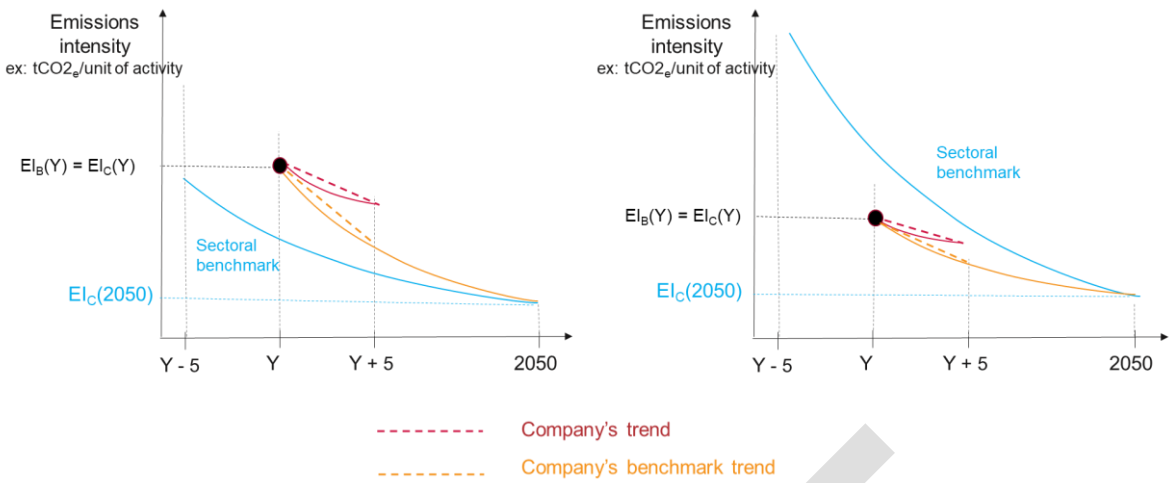

FIGURE 39: TREND RATIO - CASE 2

CASE 3

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

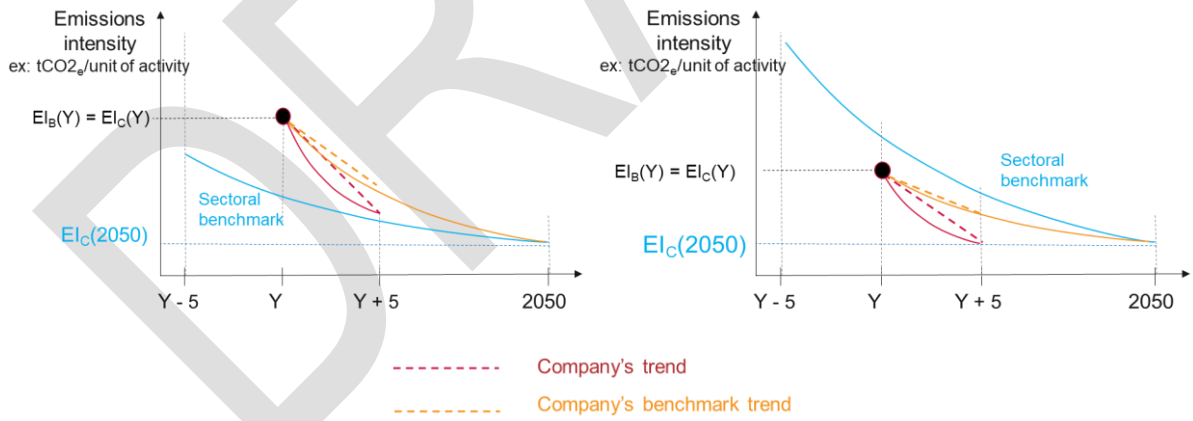

FIGURE 40: TREND RATIO - CASE 3

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%

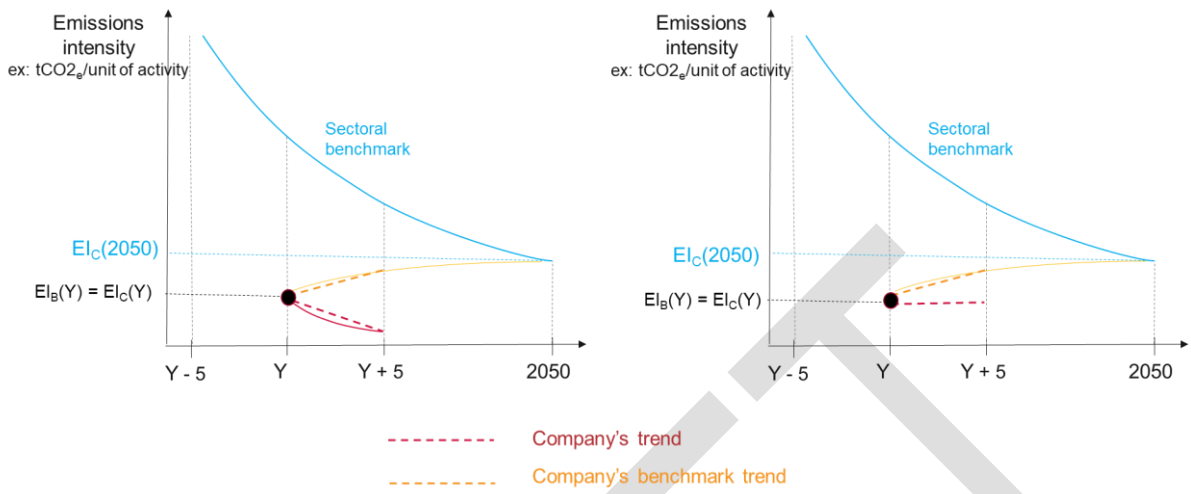

FIGURE 41: TREND RATIO - CASE 4