ACT

ACT | ASSESSING LOW CARBON TRANSITION ®

Assessing low-Carbon Transition

Aluminium sector methodology

Short version
(version 1.1 – September 2021)

Contents

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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).

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.

The figure below highlights the main source of greenhouse gases (GHG) emissions during the whole value chain until the casting part of the primary route, expressed in CO_2 equivalent (CO_2e). The aluminium smelting step through the electrolysis is indeed the most material step of the value chain in terms of CO_2e emissions [2].

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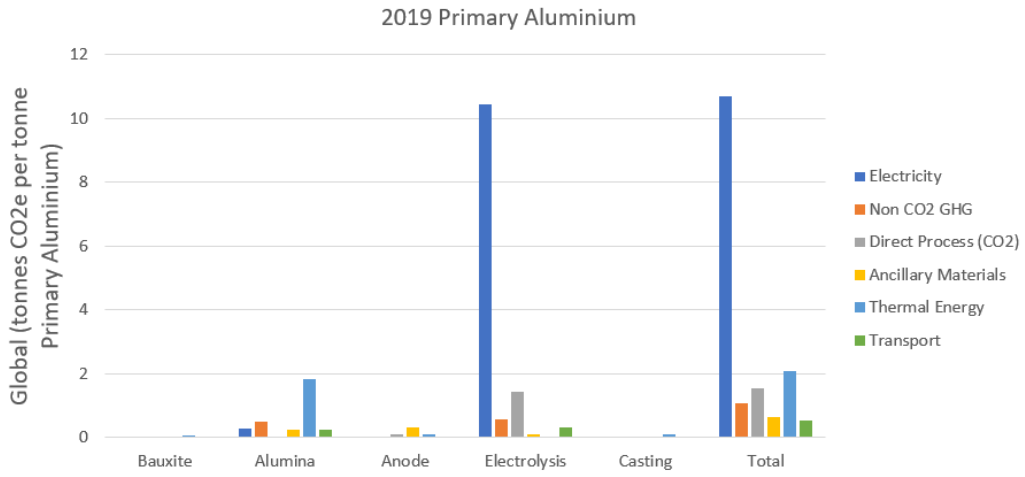

FIGURE 1: GLOBAL METRIC TONNES CO_2E PER METRIC TONNE OF PRIMARY ALUMINIUM (GRAPH OBTAINED FROM IAI DATA)

The figure below provides the percentage of CO_2e emissions for each step of the value chain until the casting part in 2019. This is another illustration of the figure above.

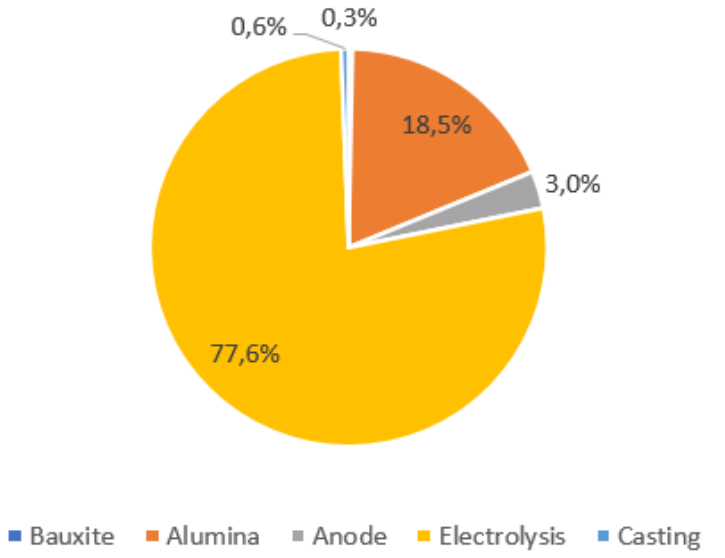

FIGURE 2: PERCENTAGE OF CO_2E EMISSIONS FOR EACH STEP OF THE VALUE CHAIN (GRAPH OBTAINED FROM IAI DATA)

At last, the figure below provides the weights of each CO_2e emissions type compared to each other.

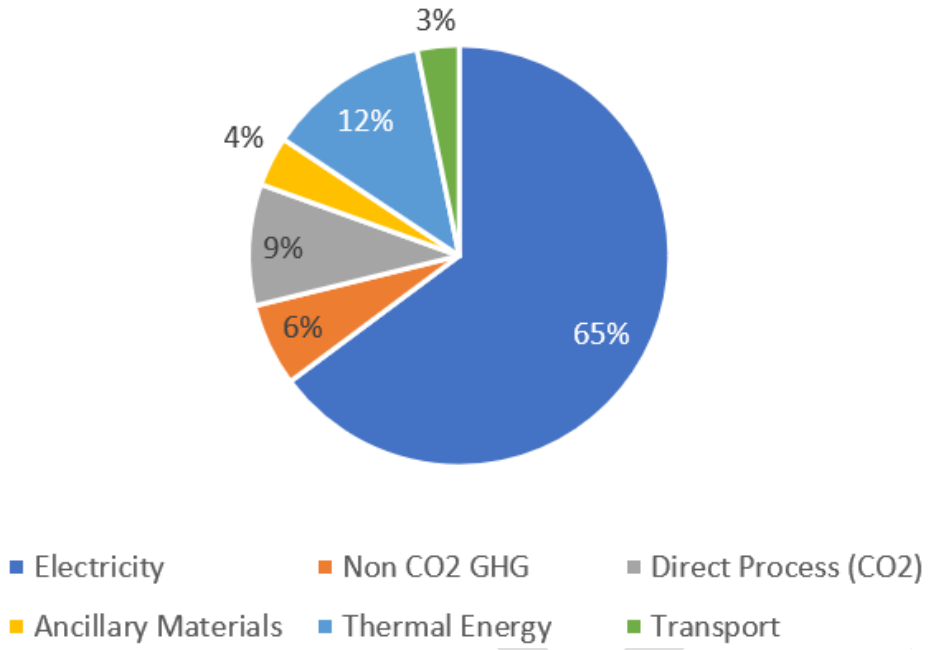

FIGURE 3: PERCENTAGE OF CO_2E EMISSIONS PER TYPE OF CO_2E EMISSIONS (GRAPH OBTAINED FROM IAI DATA)

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 [3]. 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 secondary aluminium production route emits much less CO_2e, especially as it requires only 5% of the total energy of the total primary production route, BREF 2014 [6].

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 [1].

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

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and refining routes [7]. 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.

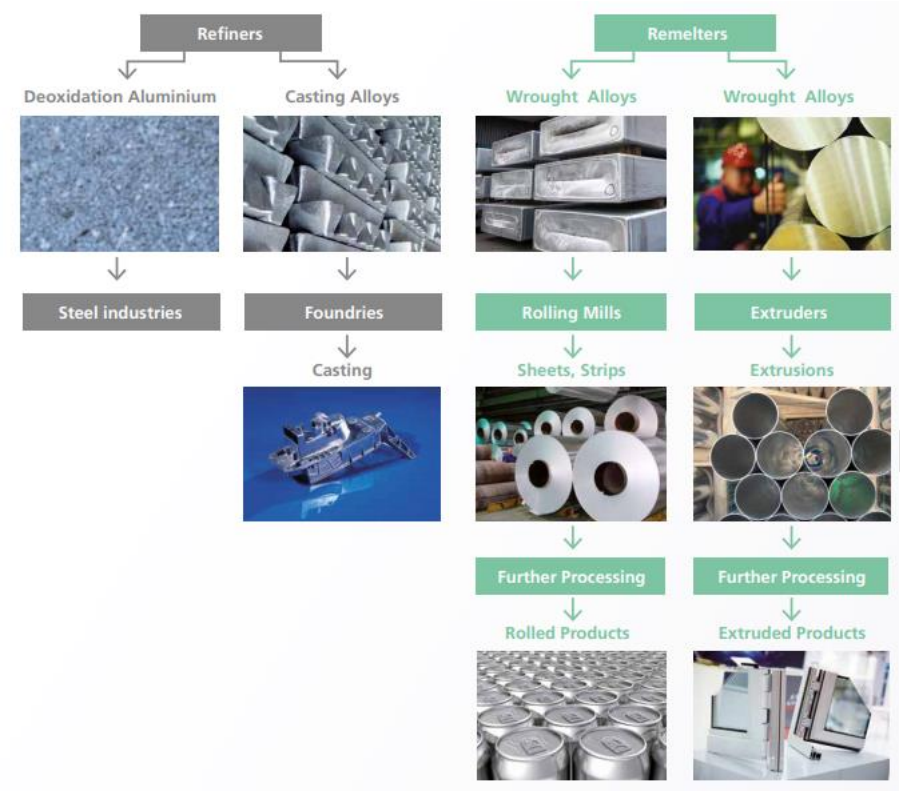

FIGURE 4: FOCUS ON THE REMELTING AND REFINING ROUTES AND PROCESSES

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 [8]. 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 [9].

CARBON FOOTPRINT PER STEP OF THE VALUE CHAIN AND CO_2E EMISSIONS TYPE

The International Aluminium Institute provides a comprehensive table – next figure - 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 each line is a CO_2e emissions post to cover the global carbon footprint of the aluminium sector accounting for more than 1 GT of CO_2e emissions per year [18].

	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

The carbon footprint of aluminium products is mainly due to the electrolysis step of the value chain, which is part of the primary aluminium production route. The following figure provides an overview of the different CO_2e emissions at each step of the value chain for the primary route [6].

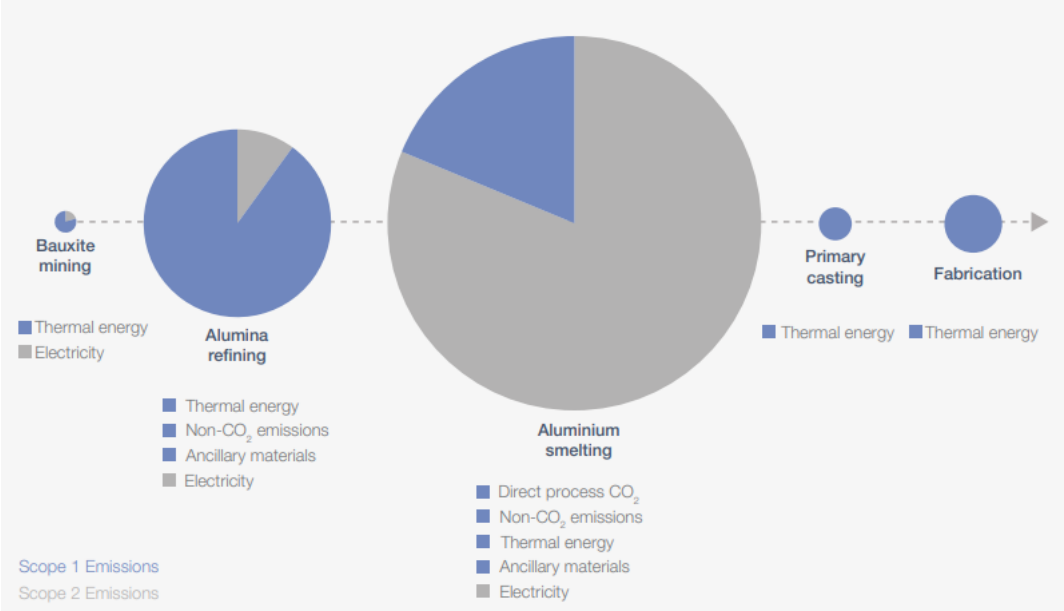

FIGURE 6: MAIN CO_2E EMISSIONS OF THE ALUMINIUM PRIMARY PRODUCTION ROUTE

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.

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3. Scope and Boundaries

3.1. SCOPE OF THE SECTOR

SCOPE OF THE ACTORS

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.

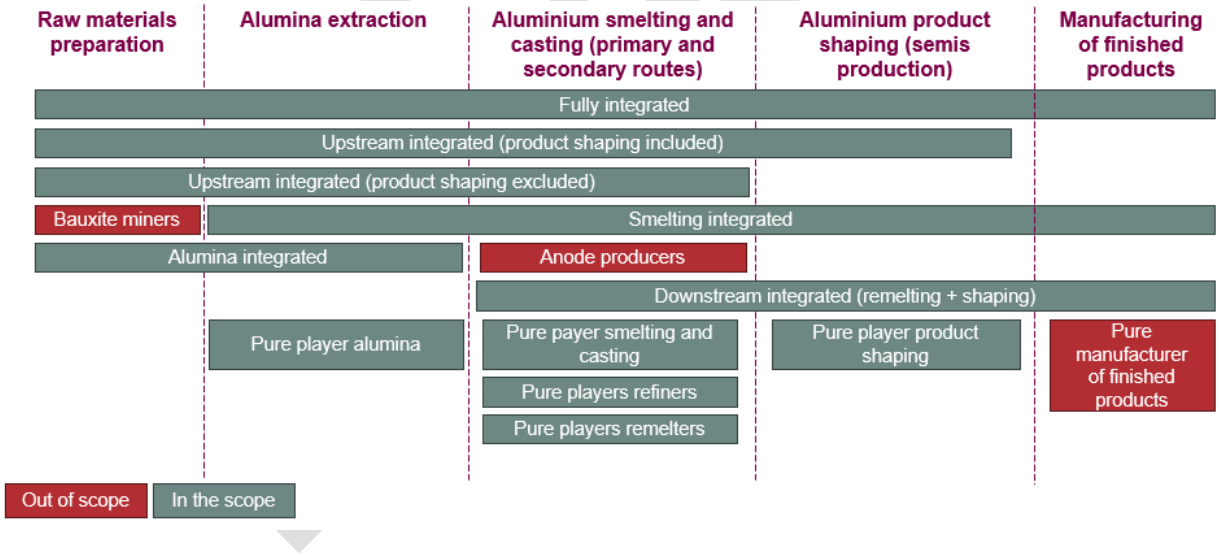

FIGURE 7: COMPANIES THAT CAN BE ASSESSED BY THE ACT IRON & STEEL METHODOLOGY

3.2. BOUNDARIES

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

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

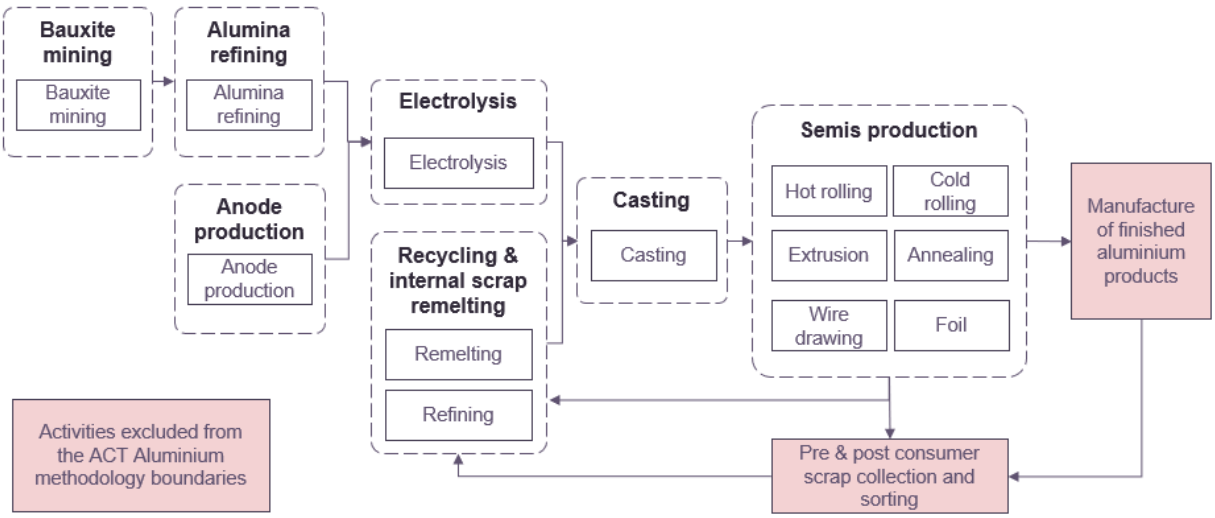

FIGURE 8: ALUMINIUM SECTOR REPORTING BOUNDARIES

3.3. BENCHMARKS USED FOR INDICATORS

The mechanism allocation is taken partially from the sectoral decarbonization approach to science-based targets, based on IAI data and hypotheses. It relies mainly on IEA ETP 2017 B2DS scenario.

The Aluminium company production emissions benchmark is the company's allocated decarbonization pathway, it is calculated from the sectoral decarbonisation pathway.

To compute this low carbon pathway inspired by the SDA methodology, the sector benchmark is used an input to compute the company's benchmark that will adapt to the company's carbon intensity of the reporting year. The rate of convergence is determined by a market share parameter that will require the company to reduce faster its carbon intensity if its market share increases (based on the total amount of Aluminium of IEA ETP 2017 B2DS projected), and a convergence index based on the emissions intensity reduction pathway of the sector benchmark (the rate of decrease of the emissions intensity from base year to 2050 according to IAI data and hypotheses).

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

IAI low carbon pathways consist of the CO_2e emissions of each step of the value chain, as well as the corresponding aluminium 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.

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.

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 (needed for indicators 1.1 and 4.1 mixing several steps of the aluminium value chain).

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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 launched publicly.

4. Performance Indicators

4.1. DATA SOURCES

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

4.2. COMPANY DATA REQUEST

The data request will be presented to companies in a comprehensive data collection format. The following data will be requested (not exhaustive, see section 6.3 of the long-version of the methodology for further details):

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 (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

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4.3. PERFORMANCE INDICATORS

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 2: 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 3: 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

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.

RATIONALE OF THE INDICATOR

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, scope1+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.

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- **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.
RATIONALE OF THE INDICATOR	**RELEVANCE OF THE INDICATOR:** The time horizon of targets is included in this ACT methodology for the following reasons: ♦ The target endpoint is an indicator of how forward-looking the company's transition strategy is. ♦ Aside from communicating long-term commitments, short-term action needs to be incentivized. This is why short time intervals between targets are needed. A 5-year interval is seen as a suitable interval to ensure company is taking enough action, holding itself accountable by measuring progress every 5 years.

- **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.
RATIONALE OF THE INDICATOR	**RELEVANCE OF THE INDICATOR:** The historic target ambition and company performance is included in this ACT methodology for the following reasons:

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- 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 (past targets) adds credibility to any company claim to commit to a science-based reduction pathway.
- Dimension 2 of this indicator (current targets) adds value to the assessment of comparison to the company's performance with respect to their targets in the reporting year.

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)

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

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

- Dimension 1 (trend in past emissions intensity) shows the speed at which the company has been reducing its emissions intensity over the recent past. Comparing this to the decarbonization pathway gives an indication of the scale of the change that needs to be made within the company to bring it onto a low-carbon pathway.
- Dimension 2 (Alignment of past performance with sectoral carbon budget) helps the company having an overview of its emissions exceedance in the recent past. This dimension also intends to remind that the carbon budget is set for the global economy and that each sector and each company has a defined carbon budget that cannot be exceeded to reach the overall long-term objective of limiting global warming. The sector benchmark is defined for the next years, assuming it was respected for the past years where it was already defined. The emissions overshooting the benchmark in the past correspond to accumulated CO_2 that will remain in the atmosphere for decades. Hence, a company having already

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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.

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.

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- 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)

RATIONALE OF THE INDICATOR

RELEVANCE OF THE INDICATOR:

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

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

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- 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.

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 according to if the company self-generates electricity or not

RATIONALE OF THE INDICATOR

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.

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- **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.
RATIONALE 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.
RATIONALE OF THE INDICATOR	**RELEVANCE OF THE INDICATOR:** R&D in low-carbon technologies is included in the ACT assessment for the following reasons:

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- 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 either a number of patents).

RATIONALE OF THE INDICATOR

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.

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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.

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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.

RATIONALE OF THE INDICATOR

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**

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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.
RATIONALE OF THE INDICATOR	**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 scrap suppliers, through traceability. Only companies present at the recycling and internal scrap remelting steps will be assessed for this indicator.

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

- **AL 5.2 CLIMATE CHANGE OVERSIGHT CAPABILITY**

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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.
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.
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**

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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.
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.
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.

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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.

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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.
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

- **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.

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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.

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.

RATIONALE OF THE INDICATOR

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.

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- **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.

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.

POLICY ENGAGEMENT

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

DESCRIPTION & REQUIREMENTS

AL 8.1 COMPANY POLICY ON ENGAGEMENT WITH TRADE ASSOCIATIONS

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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.
RATIONALE OF THE INDICATOR	Trade associations are a key instrument by which companies can indirectly influence policy on climate. Thus, when trade associations take positions, which are negative for climate, companies need to take action to ensure that this negative influence is countered or minimized. This indicator is consistent with 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.
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. However, membership in associations that support climate positive policies should also be considered in the analysis.

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

DESCRIPTION & REQUIREMENTS	**AL 8.3 POSITION ON SIGNIFICANT CLIMATE POLICIES**

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SHORT DESCRIPTION OF INDICATOR	The company is not opposed to any significant climate relevant policy and/or supports climate friendly 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.
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

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.

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This module aims to identify both relevant current business activities and those still at a burgeoning stage. It is recognised that transition to a low-carbon economy, with the associated change in business models, will take place over a number of years. The analysis will thus seek to identify and reward projects at an early stage as well as more mature business activities, although the latter (i.e. substantially sized, profitable, and/or expanding) business activities will be better rewarded.

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

• 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 models that aim at increasing low-carbon power production and/or more flexible grid.
RATIONALE OF THE INDICATOR	In addition to developing sustainable practices, a company may transition its business model to other areas to remain profitable in a low-carbon economy. The company's future business model should enable it to decouple financial results from GHG emissions, in order to meet the constraints of low-carbon transition while continuing to generate value.

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This indicator aims to identify both relevant current business activities, and those still at a burgeoning stage. It is recognized that transition to a low-carbon economy, with associated change in business models, will take place over a number of years. The assessment will thus seek to identify and reward projects at an early stage as well as more mature business activities, although the latter (i.e. substantially sized, profitable, and/or expanding) business activities will be better rewarded.

• 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

SHORT DESCRIPTION OF INDICATOR

The company is actively developing business models that aim at switching to low-carbon-processes.

RATIONALE OF THE INDICATOR

In addition to developing sustainable practices, a company may transition its business model to other areas to remain profitable in a low-carbon economy. The company's future business model should enable it to decouple financial results from GHG emissions, in order to meet the constraints of low-carbon transition while continuing to generate value.

This indicator aims to identify both relevant current business activities, and those still at a burgeoning stage. It is recognized that transition to a low-carbon economy, with associated change in business models, will take place over a number of years. The assessment will thus seek to identify and reward projects at an early stage as well as more mature business activities, although the latter (i.e. substantially sized, profitable, and/or expanding) business activities will be better rewarded.

• 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

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SHORT DESCRIPTION OF INDICATOR

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

RATIONALE OF THE INDICATOR

In addition to developing sustainable practices, a company may transition its business model to other areas to remain profitable in a low-carbon economy. The company's future business model should enable it to decouple financial results from GHG emissions, in order to meet the constraints of low-carbon transition while continuing to generate value.

This indicator aims to identify both relevant current business activities, and those still at a burgeoning stage. It is recognized that transition to a low-carbon economy, with associated change in business models, will take place over a number of years. The assessment will thus seek to identify and reward projects at an early stage as well as more mature business activities, although the latter (i.e. substantially sized, profitable, and/or expanding) business activities will be better rewarded.

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4.4. WEIGHTINGS

The weightings of a great number of modules, and indicators, will depend on where the company operates along the aluminium value chain by indicating the Scope 1+2 CO_2e emissions of the company for the eight steps of the aluminium value chain.

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 9: RANGE OF WEIGHTINGS PER MODULE

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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 the figure below. 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 10: DEFAULT WEIGHTINGS PER INDICATOR AND PER STEP OF THE VALUE CHAIN

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- **RATIONALE FOR WEIGHTINGS**

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

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

The weightings 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 will be computed to get the specific weighting of the company

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- 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' have a medium weight of 3%. The 'time horizon of targets' is a proxy of how forward-looking the company is, which is very long-term oriented. Finally, the 'achievement of previous targets' indicator measures the company's past credentials on target setting and achievement, which provides more contextual information on the company's ability to meet ambitious future targets. 2% score is attributed to this indicator.

Material Investment 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%

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Semis production	12%
Internal scrap remelting	30%

Aluminium producers requires 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.

Material investment is a key module for alumina producers and smelters.

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%.

Sold product performance 7-30%

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

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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) ; “pre-consumer scrap reduction” and “recycled scrap traceability” are not triggered for all companies, but are key to measure the transition to an efficient circular economy.

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.

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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 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%

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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 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%

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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.

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. 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%.

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The following fictive examples will help better understand how the weighting tool works.

Example 1

- **Bauxite mining accounts for 2% of Scope 1+2 CO2e emissions**
- **Alumina refining accounts for 98% of Scope 1+2 CO2e 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 11: WEIGHTINGS FOR FICTIVE COMPANY EXAMPLE 1

Example 2

- **Anode production accounts for 4% of Scope 1+2 CO2e emissions**
- **Electrolysis accounts for 95% of Scope 1+2 CO2e emissions**
- **Casting accounts for 1% of Scope 1+2 CO2e emissions**

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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 12: WEIGHTINGS FOR FICTIVE COMPANY EXAMPLE 2

Example 3

- **Recycling accounts for 100% of Scope 1+2 CO2e emissions**

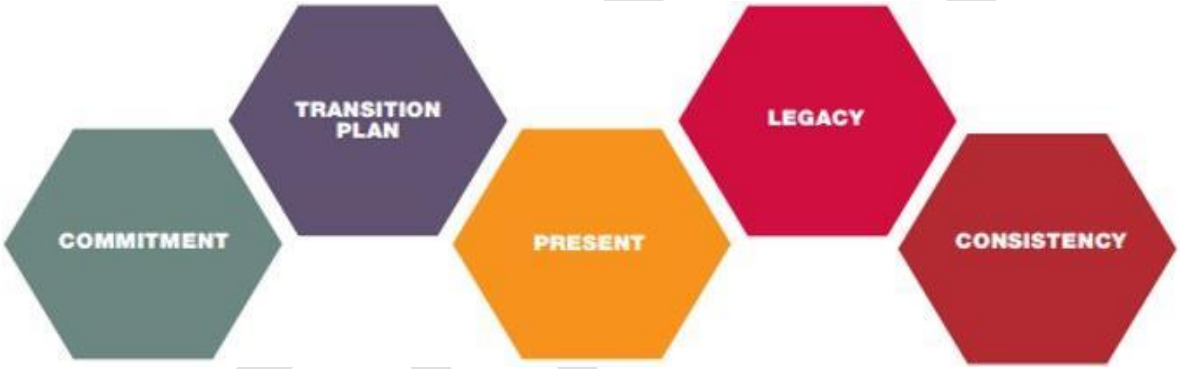
Module	Indicator	Indicator weightings
Targets	1.1 Alignment of Scope 1+2 and Scope 1+2+3 emissions reduction targets	10,0%
	1.2 Time horizon of targets	3,0%
	1.3 Achievement of past and current targets	2,0%
Material investment	2.1 Past performance for aluminium assets, per step of the value chain	6,0%
	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 13: WEIGHTINGS FOR FICTIVE COMPANY EXAMPLE

5. 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	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

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companies have more levers there.

holds its due place in the circular economy that is key for the mining and metals sector.

FIGURE 14: ALIGNED STATE FOR COMPANIES

6. Integration of Physical risks and Adaptation in ACT

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

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

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 in the long version 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 a summary of the maturity matrix with a short description of each indicator. You can find the full maturity matrix in the longer version.

Here is an example, for one indicator, of the 5-level physical risks and adaptation maturity matrix:

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	Basic	Standard	Advanced	Next practice	Resilient
Analysis					
1.1 Data & scenarios	The company has not conducted any climate physical risks data, projection or scenario analysis nor assessment.	Exploration of some climate data and projections	Considers at least past weather events and eventualy current weather variability Based if possible on available climate data and projections across a least one scenario, that should be the RCP 2.6	Considers at least past and current weather variability and if possible future climate change Based on available climate data and projections across a least two scenarios, that shall be RCP 2.6 and RCP8.5	Considers past and current weath variability, as well as future climat change, including uncertainty Based on robust analysis of availal climate data and projections across range of future scenarios, that sha be at least RCP 2.6 and RCP 8.5

Resilience can be defined as the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation (IPCC, 2014).

MODULE		AG	INDICATOR	DESCRIPTION
CLIMATE PHYSICAL RISKS	**ANALYSIS**	1.1	Data and scenarios	Analysis of past, current and future weather variability, as well as uncertainty, through data and scenarios.
		1.2	Hazards	Analysis of hazards that affect the company along the value chain through the likelihood, magnitude and duration.
		1.3	Exposition and vulnerability/sensitivity	Analysis of the exposition and vulnerability/sensitivity of facilities to hazards, and the impacts on the performance.
	SUPPLY CHAIN / RAW MATERIALS	2.0	Impacts and vulnerabilities	Analysis, quantification and monitoring of the supply chain/raw materials impacts and vulnerabilities for the company considered.
	PRODUCTION / PROCESS / OPERATIONS / MACHINERIES / INFRASTRUCTURES	3.0	Impacts and vulnerabilities	Analysis, quantification and monitoring of the production/operations/infrastructures impacts and vulnerabilities for the company considered.
	LOGISTICS / TRANSPORTS	4.0	Impacts and vulnerabilities	Analysis, quantification and monitoring of the logistics/transports impacts and vulnerabilities for the company considered.
	DEMAND AND SALES	5.0	Opportunities, impacts and vulnerabilities	Analysis of the climate-related opportunities, the demand and sales impacts and vulnerabilities for the company considered.
ADAPTATION	**ORGANIZATIONAL CAPACITY**	6.1	The climate head	Considers the individual/committee with highest responsibility for climate change.
		6.2	Climate governance	Assess that corporate projects and policies integrate physical risks and adaptation aspects.
		6.3	Decision support tools & external expertise	Assess indicators for decision-making and impact thresholds set up by the company, as well as potential external expertise.
		6.4	Adaptation strategy	Assess the adaptation strategy to assure that it do not significantly harm other strategies or that it is compatible, that it is context and location-specific and regularly revised.
	FINANCIAL RESSOURCES	7.0	Financing available to implement actions	Analyses the integration of financial planning tools, critical thresholds, climate-related opportunities and measures financial costs and insurance premiums.

	TECHNOLOGICAL RESSOURCES	8.1	Technical tools and solutions	Assess the technical services, tools and knowledge developed.
		8.2	R&D	Measures the share of adaptation R&D
	HUMAN RESSOURCES	9.1	Teams trainings	Measure the trainings and integration of physical risks and adaptation for all employees.
		9.2	Watch and sharing information device	Considers whether or not the company has implement a watch, acquisition and sharing device of information regarding climate change.

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%.

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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%	

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