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DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK GROUP

TECHNICAL GUIDANCE TO ALIGN IDB GROUP OPERATIONS WITH THE PARIS AGREEMENT

MANUFACTURING INDUSTRY, WITH EMPHASIS ON ENERGY-INTENSIVE INDUSTRIES

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ABBREVIATIONS	
CC	Climate Change
CCAP	Climate Change Action Plan
CCUS	Carbon capture, use and/or storage
CO_2e	Carbon Dioxide Equivalent
ECLAC	Economic Commission for Latin America and the Caribbean
EE	Energy efficiency
EIIs	Energy-intensive industries
ESPF	IDB Environmental and Social Policy Framework
ESSP	IDB Invest Environmental and Social Sustainability Policy
GHG	Greenhouse Gases
IDB	Inter-American Development Bank
IEA	International Energy Agency
LAC	Latin America and the Caribbean
MDB	Multilateral Development Banks
MSMEs	Micro, small and medium-sized companies
Mt	Metric tons
NAP	National Adaptation Plan
NDC	Nationally Determined Contributions
PA	Paris Agreement
PAIA	Paris Alignment Implementation Approach
PBL	Policy-Based Loans
RE	Renewable Energies
SBTI	Science-Based Targets Initiative
TRL	Technology Readiness Level (TRL)

I. INTRODUCTION

1.1 This document is a technical complement to the Paris Agreement Alignment Implementation Approach (PAIA). The PAIA has been developed by the IDB Group (IDB, IDB Invest and IDB Lab), as a methodological tool to pursue the objective of aligning to the Paris Agreement (PA) new operations and projects that have been reformulated. Both the PAIA and this technical guidance are based on the Joint Methodological Principles for the assessment of alignment with the Paris Agreement, developed by Multilateral Development Banks (MDB).[1]

1.2 The PAIA outlines IDB Group's strategy to assess the alignment of operations to the PA with the objective of informing decisions on project activities to be financed and the ongoing dialogue with countries and private sector clients. It establishes a set of principles to guide the consistent and equitable interpretation of the Joint MDB framework when performing the assessment, and it lays out a series of methodical steps to be followed along the preparation cycle of projects.

1.3 The PAIA builds on IDB's Environmental and Social Policy Framework (ESPF) and IDB Invest's Environmental and Social Sustainability Policy (ESSP). All operations covered by the ESPF and ESSP must *comply* with these policies during project preparation, execution, and closure. In contrast, PA alignment assessment is meant to *inform* project design before approval using the information and tools at the disposal of the IDB Group at the time it is made.

1.4 This document provides additional criteria to interpret the Joint MDB Framework, with specific considerations that are relevant to the IDB Group operations and tools[2].

1.5 The objective of this guidance is to help IDB Group personnel design and assess operations aligned to the mitigation and adaptation goals of the PA, providing them with the necessary elements to determine, justify, and disclose the information related to this alignment at approval. In this regard, the PAIA clarifies that aligning an operation with the PA does not equate to achieving net-zero emissions at present, nor to completely eliminating the risks associated with the physical impacts of climate change. In its opening paragraphs (¶ 2.6 - ¶ 2.7) it explains that alignment with the **mitigation goal of the PA** involves ensuring that operations do not undermine the transition to net-zero emissions outlined in the PA; and that, if present, the risk of deviating from decarbonization pathways must be identified and managed consistently with national and global commitments. In turn, alignment with the **adaptation goal of the PA** involves ensuring that operations identify and address physical climate risks, considering ways to develop climate resilience, and avoiding inconsistencies with national/local priorities for climate adaptation. Additionally, in section II.C, the PAIA outlines a set of principles that guide towards a just transition.

1.6 **This document contains specific technical guidance for aligning operations with the PA when their activities encompass the manufacturing industry,** primarily addressing the need to guide the design of those related to energy-intensive industries (EIIs) that are relevant to IDB Group's portfolio. Thus, although this document addresses

[1] It is emphasized that, in cases of discrepancy, the MDB's Joint Methodological Principles for analyzing alignment with the PA prevail over the PAIA, save for the exceptions explicitly provided by the latter. Available in IDB 2023: "Alignment of financial flows with Paris Agreement targets" https://www.iadb.org/en/who-we-are/topics/climate-change/climate-change-finance/paris-alignment

[2] In case of discrepancies between this technical guide and the MDB Joint Framework, the latter prevails except in those cases explicitly justified by this technical guide.

the manufacturing industry in general[3], it covers with specificity the alignment of projects linked to the following EIIs: **processes and value chains involved in the production of steel, aluminum, cement, pulp, and paper**.[4]

1.7 For those activities in operations that differ from the manufacturing industry sector defined above, the corresponding technical guidance[5] will be applied simultaneously and complementarily, always adhering to the materiality principle. In the event that an application conflict arises due to the concurrent use of this technical guidance with other technical guidance(s), resolution will be handled on a case-by-case basis, ensuring proportionality to risk and striving for the highest possible climate ambition.

1.8 **Scope of this document**. This guidance has the same scope as the IDB Group Paris Alignment Implementation Approach (GN-3142-1) as outlined in its paragraphs 2.10 and 2.11. It therefore covers IDB Group operations in the manufacturing sector, including investment loans, investment grants for an approved amount greater than US$3 million and guarantees (i.e., operations involving capital expenditures referred to as "direct investments" in the MDB framework), as well as policy-based loans and guarantees. The guidance is also applicable to products involving financial intermediaries and corporate finance (including equity financing), which follow specific methodological approaches agreed upon with other MDB. In this regard, the analysis of alignment with the PA in the manufacturing sector covers direct financing to manufacturing activities and companies in such sector, as well as policies and enabling actions by the public and private sectors for the development of manufacturing, for example: large-scale infrastructure, associated equipment and facilities, industrial regulations, etc.

1.9 **Relation to other IDB Group documents**. In 2020, the IDB Group Climate Change Action Plan (CCAP, GN-2848-9) was approved. The CCAP proposed to 'promote the consistency of financial flows with low-carbon and climate-resilient development,' and to this end established as an action to 'integrate alignment with the PA into the IDB and IDB Invest operations procedures.' The PA alignment exercise builds on that basis as well as upon the principles of the Energy Sector Framework Document (GN-2830-8) prepared by the IDB Group in 2018, which includes energy sustainability as one of its four pillars and covering energy efficiency (EE), renewable energy (RE) and adaptation to Climate Change (CC). This framework emphasizes the Bank's commitment to promote EE and RE to achieve sustainable and resilient development regarding CC in Latin America and the Caribbean (LAC). This was complemented in April 2022, when the Sustainable Energy Sector Guidelines (GN-2613-1) were approved, which aim to provide methodological guidance to IDB Group personnel for the design and implementation of investment

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3 Establishments (factories, mills, plants) and processes involved in the mechanical, physical, or chemical transformation of materials, substances, or components into new products (which may or may not be ready for final consumption). The NAICS categories are used for reference in this definition: https://www.census.gov/naics/?input=31&year=2022&details=31.

4 These are the most relevant subsectors for IDB Group's portfolio at present. It is recognized that there are other subsectors considered energy-intensive that are not covered in this Technical Guidance, such as all those establishments and processes associated with the chemical industry, production of glass, ceramics, lime, as well as the transformation of non-ferrous metals other than aluminum, such as copper (see: European Commission, 2023: "Scaling up innovative technologies for climate neutrality" ISBN 978-92-68-03466-8.). These subsectors require a specific assessment of alignment with the Paris Agreement mitigation goal under the general MDB methodology and if present, will be analyzed on a case-by-case basis according to the MDB methodology and the PAIA. The IDB Group is in the process of defining a strategy to collect and standardize operational information to analyze and identify opportunities for decarbonization and resilience in the EIIs subsectors not covered in this Guidance.
Note: The analysis of the food industry is considered energy-intensive and should be guided jointly by IDB Group's Technical Guidance for the Agri-Food Sector. On the other hand, while this Technical Guidance covers the manufacturing process of inputs relevant to the construction industry such as cement and steel, construction activities financed by the IDB Group will be guided by the Technical Guidance for the Building Sector, which indicates (paragraph 2.13) that consideration of energy and water embodied in building materials is part of the analysis of green building seals or certifications.

5 The IDB Group has Technical Guidance for energy, water and sanitation, transportation, information and communication technology, manufacturing industry, buildings, agri-food sector, and financial intermediation.

operations and policy-based loans (PBLs).

1.10 In this regard, the topics developed in the technical guidelines for the manufacturing industries sector are consistent with the **Sustainable Energy Sector Guidelines** (GN-2613-1), and the **Energy Sector Framework Document** (GN-2830-8), specifically with the principle of energy sustainability, which includes the areas of EE, RE and CC. The decarbonization of the region's industry promotes the adoption of EE, RE or other measures related to concepts such as the circular economy that allow for displacing the consumption of fossil fuels and decoupling the link between manufacturing production and higher greenhouse gas (GHG) emissions; i.e. they make higher production possible without a proportional growth in energy use and GHG emissions.

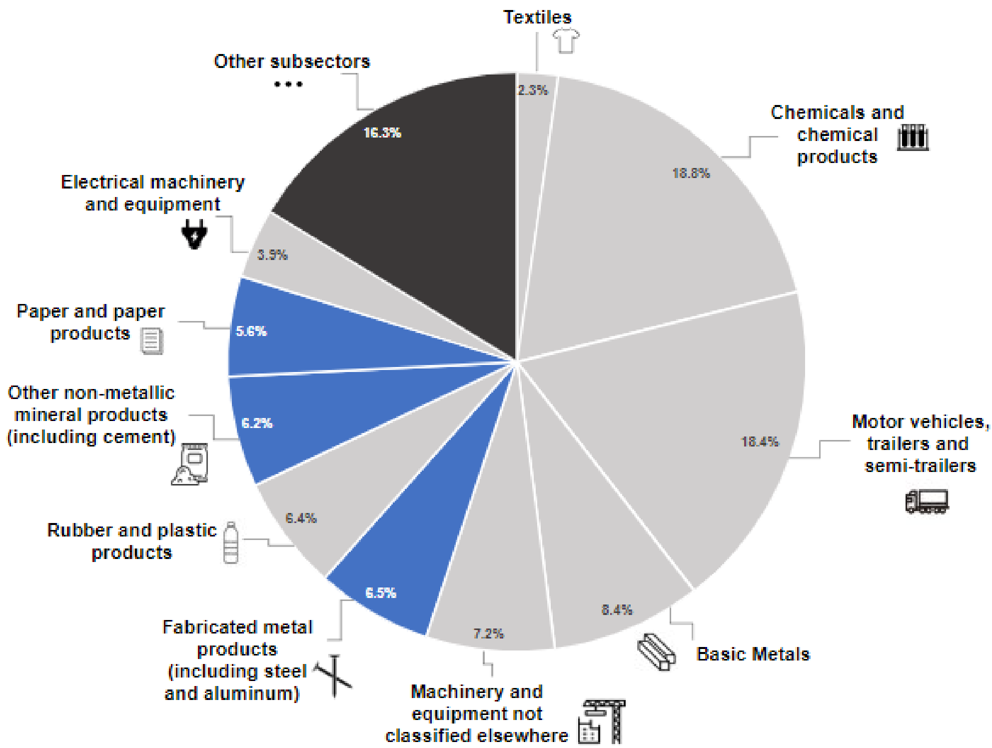
1.11 This guide is also aligned with the **Climate Change Sector Framework Document (GN-2835-13)** (GN-2835-13), by promoting the use of opportunities of climate transition to low emissions and resilience to increase the competitiveness of the LAC industry, through financing for its adaptation to climate change, reduction of its carbon footprint and incorporation of a circular economy approach. It is aligned with the **Extractive Industries Sector Framework Document** (GN-3028-2), specifically with strengthening institutional capacities, regulatory frameworks and fiscal regulations that reduce dependence and manage revenue volatility in the sector; and the **Labor Sector Framework Document** (GN-2741-12), for the opportunity to generate employment in clean energy, develop the necessary human capital and plan the upskilling and reskilling of the displaced labor force; as well as the **Integration and Trade Sector Framework** (GN-2715-11) by virtue of the development of trade and investment instruments that contribute to the resilience of countries and decarbonization; as well as addressing the issues of integration of energy markets.

1.12 If necessary, this document will be revisited by Management one year after approval and updated to reflect lessons learned by the IDB Group and other institutions as they work to align operations and other financial flows with the goals of the PA. Updates will respond to possible adjustments in the Joint MDB Framework, as well as to the need to incorporate the experience during implementation, and to consider technological and knowledge advances in the region, among others. Future revisions to this document will be agreed between IDB, IDB Invest and IDB Lab, and submitted for no objection to the IDB Operations Policy Committee and the IDB Invest Senior Management Committee.

II. THE MANUFACTURING INDUSTRY IN LATIN AMERICA AND THE CARIBBEAN (LAC) AND CLIMATE CHANGE

2.1 The manufacturing industry in LAC is a key driver of the region's economic development, contributing significantly to the generation of employment and the production of goods. It is estimated that the manufacturing sector contributes **15.7% of the gross domestic product of the countries in the region** and accounts for **20% of total employment** (IDB Invest, 2023).

Figure 1 Contribution to Manufacturing GDP (%), selected subsectors



Source: Adapted from IDB Invest, 2023.

2.2 Given the PA mitigation and adaptation goals, the manufacturing industry today faces the dual challenge of mitigating its impacts and managing its vulnerabilities to climate change to maintain its role in the region's economic development. In this regard, and like other sectors of the economy, the manufacturing sector needs to ***adapt*** to extreme weather events, the scarcity of natural resources and the vulnerability of the most disadvantaged communities, all of which are exacerbated by climate change. It also faces the rapid advance of technologies for ***decarbonization***, changes in the markets in favor of "green industries" and the emergence of regulations on CO_2 emissions.[6] Consequently, to remain competitive and contribute to sustainable development in the region, it is imperative that the manufacturing industry in LAC evolves gradually but decisively toward climate-resilient and decarbonized models.

A. Economic importance of EIIs in LAC

2.3 In LAC, energy-intensive industries have historically represented a key component of regional development. The following paragraphs provide a breakdown of the processes of the EIIs subsectors specifically covered in this Technical Guidance.

2.4 **Steel** is the third most produced material globally, after cement and wood. Its use is essential for the development of infrastructure, transportation, machinery, and consumer goods. ECLAC (2022) estimates indicate that demand for steel will continue to increase

[6] See for example the European Union's Carbon Border Adjustment Mechanism which applies as of January 1, 2024, to the import of selected carbon-intensive goods or goods presenting a carbon leakage risk: cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen.

as emerging economies develop and continue to transition demographically from rural to urban. World crude steel production reached 1,880 million metric tons during 2020 (1,951 Mt in 2021) of which LAC contributed 3% of total production, with Mexico, Brazil, Argentina, Chile, and Colombia grouping 96.7% of the region's production from thirty-six steel companies. Steel trading during 2020 in the region indicates that 12% of total steel imports and 33% of total steel exports to countries in the LAC region come from other Latin American countries; mainly to produce long-rolled steel, flat steel, and seamless pipes. The trade dynamics of the steel industry respond directly to the behavior of the steel market, in which China has a dominant position, with 56% of demand and 57% of supply (Donoso and Cantallopts, 2021).

2.5 **The steel production process** derives from the processing of iron ore, which is usually found as part of other minerals. To obtain elemental iron, the iron oxides must be removed and then a refining process must be conducted to remove impurities. Steelmaking is the process of transforming the iron ore raw material into steel. The steel industry uses two main inputs in the production of steel: iron ore and steel scrap for recycling.

2.6 **Aluminum** is the most abundant metal in the earth's crust and comprises more than 8% of its outer layers. Aluminum has multiple applications in transportation, production of mechanical and electrical devices, construction, and packaging. In contrast to other metals, the demand for aluminum does not depend on what happens with one or two end uses, making it more resistant to substitution by technological changes. In 2019, the region produced 3% of global aluminum demand and the size of the aluminum smelting market is expected to grow from USD 164 billion in 2019 to USD 244.4 billion by 2027 (IAI, 2022). Currently, 98% of the region's primary aluminum production is conducted in Argentina, Brazil and Venezuela, the latter two being the countries with a vertically integrated industry, ranging from bauxite production, alumina extraction, to the processing of raw aluminum. The aluminum recycling rate in countries such as Brazil averages 55%; however, it is presumed that this rate is lower due to the importation of products with high aluminum content that lack national registers.

2.7 **The aluminum production process** is based on bauxite ore. The bauxite is crushed and classified to obtain hydrated alumina, which then undergoes a chemical treatment and electrolysis process where the alumina is decomposed into oxygen and aluminum. Finally, the aluminum metal is transferred to alloying furnaces and then shaped into ingots or bars. This industry uses bauxite and aluminum scrap as main inputs.

2.8 **Cement** is highly consumed in the region (289 kg/inhabitant in 2021, according to statistics from the Inter-American Cement Federation, FICEM) and has applications in almost all types of construction, from housing and urban landscapes to dams and dykes. The countries in the region have cement industries of varied sizes and ages and production processes that integrate various stages of the value chain. Given its qualities, applications, and wide availability of raw materials, cement is likely to remain the world's preferred building material for decades to come. This also recognizes that cement is an intermediate material to produce other materials such as concrete.

2.9 **The cement production process** combines limestone, sand or clay, bauxite, and iron ore. Its manufacture consists of three stages. The first is the crushing of raw materials, complemented by a pre-homogenization by means of mixers that form the "raw cement". The raw cement is then heated in kilns to obtain clinker, which is transformed into cement when finely ground and mixed with a small amount of gypsum used to regulate the setting time of concrete.

2.10 Cellulose **pulp** comes from the processing of wood fibers and is the main raw material for making **paper**. In 2020, pulp production in LAC accounted for 16.1% of world production

(189 Mt), with a 42% growth in the last decade[7]. Ninety-six percent of the region's production is concentrated in Brazil (66%), Chile (19%), Uruguay (7.6%) and Argentina (3.2%). Pulp exports from the region grew by 77% in the 2010-2020 period and accounted for three-quarters of LAC's total production: with the European market being the main destination for 80% of the region's international pulp shipments (CEPI, 2022). In turn, paper production in LAC **accounts for** 6% of world production, which reached 401 Mt in 2020. For the same year, packaging paper dominated production in LAC, with an average share of 63%, and a growth of 21% during the 2010-2020 period. This is followed by the production of household and toilet paper (18%), printing and writing paper (14%), newsprint (1%), and other papers (4%).

2.11 **The pulp production process** takes advantage of cellulose and lignin fibers to manufacture paper (Rullifank *et al*., 2020). The pulp production stages include a chipping process (reduction of small pieces) of the debarked wood and subsequent sorting by size. Wood chips are separated into individual cellulose fibers by a mechanical method, which separates the fibers by grinding or refining; and a chemical process, which uses a digester with chemical solutions at high temperature and pressure to extract the fibers. Finally, pulp for papermaking goes through the stages of forming, pressing, and drying at high temperature, calendering and winding.

B. Energy-intensive industries and the mitigation goal of the PA

2.12 **The manufacturing industry has a key role to play in the alignment with the PA mitigation goal.** In the IDB Group's dialogue and programming process with governments and private sector clients, it is important to bear in mind that, for Latin America and the Caribbean, aligning with the PA in this regard implies investing in a manufacturing model that moves towards industry decarbonization and under a social inclusion approach.

This section focuses specifically on the role of the manufacturing sector in the gradual move toward net-zero GHG emissions by mid-century.[8] Recalling that, in order to do so, it is necessary to transcend the focus on reducing GHG emissions, and move towards decoupling economic development from: (1) the use of fossil fuels; (2) the loss of carbon sinks; and (3) the dependence of economic activities on models/technologies associated with high GHG generation.

1. Diagnosis

2.13 **In LAC, the industrial processes sector accounts for 19.99% of total GHG emissions in the region** (Gischler, et. al. 2023). Of the total emissions generated by the manufacturing industry, 89.8% belong to energy-intensive industries (including chemicals). The remaining (10.2%) corresponds to the other manufacturing, construction, and process industries.

2.14 The **steel sector** industry ranks first in CO_2 emissions and second in energy consumption. Globally, 60% of emissions come from the burning of fossil fuels for furnaces (Scope 1), and most of the remaining 40% are due to indirect emissions from fossil fuel-based electricity consumption (Scope 2). This industry in LAC accounts for an average of 262 $MtCO_2e$ of emissions per year, although during 2021 it accounted for 104 Mt CO2e[9] because of the global health crisis. In the last three decades, the total energy consumption

[7] FAOSTAT, 2023 https://www.fao.org/faostat/en/#search/pulp%20and%20paper

[8] According to the IPCC in its special report on global warming of 1.5°C indicates the need to achieve global anthropogenic net CO_2 emissions of zero by 2050 (interquartile range 2045-2055).

[9] Alacero Annual Report, 2021.

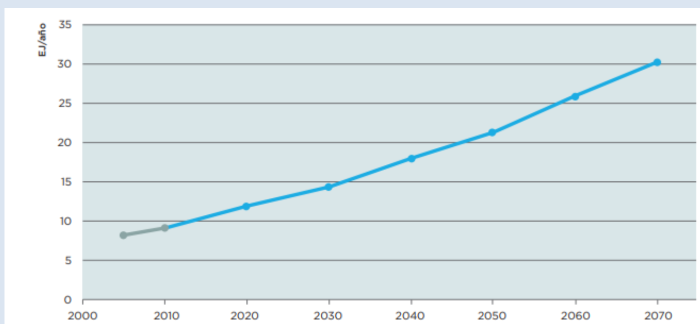
of the steel sector has doubled, and its main fuel continues to be coal because of its dual status as a fuel and a reducing agent. Although production in this period grew at a rate of 2.4x, showing productivity improvements, there are areas of additional opportunity to increase productivity levels by adopting new energy efficiency measures, maximizing waste material and electricity use in the smelting stages, as well as using low-carbon fuels.[10]

2.15 Energy consumption by the **aluminum industry** in LAC averages 64.4 GJ/t[11], with average annual emissions close to 33 $MtCO_2e$. Direct industry emissions (Scope 1) represent 44% of total emissions, while indirect emissions (Scope 2) represent the remaining 56%. Indirect emissions come from the industry's electricity consumption, while direct emissions occur mainly during the aluminum electrolysis process that releases CO_2 from the oxidation of carbon anodes in the reaction that converts aluminum oxide into metallic aluminum, as well as emissions generated by the manufacture of anodes and the generation of on-site thermal energy used in the refining and smelting processes.

Table 1 Trends for steel and cement

If the steel and cement sectors were countries, they would rank third and fourth worldwide in terms of GHG emissions, respectively, only behind China and the United States.

Projected energy use by industrial activities in LAC



Source: IIASA, 2012, cited in: Vergara et.al. (2016)

These activities are expected to continue to grow in the medium term, driven by higher rates of urbanization and demand for manufactured goods. By 2050, world cement production will increase by approximately 12% and steel production by 30%, compared to the values[12] in 2015.

See: IAI (2022): Primary Aluminum Smelting Power Consumption

2.16 In turn, the **cement industry** is the third largest industrial energy consumer worldwide and, in LAC it released 75 $MtCO_2e$ in 2018, which is equivalent to an average of 607 kilograms of CO_2e per ton of cement produced.[17] Direct emissions to produce cement come 56% from the processing of raw materials for the manufacture of clinker, followed by the consumption of fuels in kilns and outside kilns (36.7%). Lastly, indirect emissions from electricity consumption account for the remaining 7%.[18] About half of the cement industry's emissions globally (global emissions from the sector totaled 2.6 $GtCO_2e$/year in 2018) are related to CO_2 resulting from the chemical reaction required to transform limestone into clinker, with most of the remaining emissions originating from burning fossil

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10 Idem.
11 https://international-aluminium.org/statistics/primary-aluminium-smelting-power-consumption/
12 Energy Transition Commission, Mission Possible, 2018.

fuels to heat clinker kilns.[19] It is also relevant to recognize that other products that use cement as an input (concrete) have additional GHG emissions in their processes.

2.17 Finally, the **pulp and paper industry** is responsible for the emission of about 49 $MtCO_2$ per year in LAC, equivalent to 8.8% of total industrial sector emissions in the region. Within mechanical pulp production, the processes with the highest share of emissions are refining (50%), chip heating (20%), and pulp drying (16%). In the production of chemical pulp, digestion accounts for the largest share, with 30% of total emissions, followed by pulp drying with 22%. Finally, in the paper industry, drying achieves a share in emissions close to 90%, with the remaining percentage pertaining to paper forming and pressing processes (Furszyfer Del Rio, *et al.,* 2022; Rahnama *et al.*, 2021; Bajpai, 2018).

2.18 Table 1 below summarizes the average emission factors (direct and indirect) by industry in LAC:

Table 1 Average Emission Factors by Industry in LAC

	Emissions (tCO_2/t product)		
Industry	Direct	Indirect	Total
Steel	0.75	0.55	1.30
Aluminum	4.72	6.03	10.75
Cement	0.56	0.04	0.60
Pulp	0.25	0.49	0.74
Paper	0.29	0.11	0.40

Source: IDB technical notes for the aluminum, steel, cement, pulp and paper sectors (forthcoming).

2. Decarbonization

2.19 According to the International Energy Agency (IEA), the industrial sector will account for 37% of global energy consumption in 2022, up from 34% in 2002. "The growth in energy consumption over the past decade has been driven largely by continued increases in production in energy-intensive industrial subsectors" (IEA, 2022).

2.20 The IEA explains that, to get to net-zero emissions in 2050, by 2030, growth in total energy consumption in the industrial sector must be limited to less than 0.5% per year and energy productivity must increase by approximately 3% per year (IEA, 2022).

2.21 Energy-intensive industries individually need to adopt practices and technologies that together contribute to achieving the goal of net-zero Scope 1 and 2 emissions by 2050.[13] Despite the fact that this type of industry has decarbonization measures with short and medium-term applications, there are still barriers in terms of technological development and technical and economic feasibility that hinder their adoption. Table 2 below shows measures along the entire life cycle of the manufacturing process, with potential application for different sectors and processes in energy-intensive industries. It also shows the technology readiness level (TRL), which value reflects the scale proposed by the IEA indicating from an initial idea (1) to a stable and predictable growth technology (11) as detailed in Annex 1. The following paragraphs provide more detail in this regard.

[13] As appropriate, Scope 3 emissions should be considered in industries where they are significant (greater than 40% of the total). See: SBTi Criteria and Recommendations, 2021. https://sciencebasedtargets.org/resources/files/SBTi-criteria.pdf

Table 2. Decarbonization measures for energy-intensive industries

Pillar	Measures	Industry	Processes or technologies to which the measure applies or affects	TRL[14]
1. Reuse and efficiency	Recycling (second life)	Steel	Recycling reduces traditional energy-intensive processes such as blast furnace-basic oxygen furnace (BF-BOF).	5 - 9
		Cement	The use of secondary materials as raw materials (e.g. blast furnace slag, glass and pozzolans) and as an energy source (waste as a source for cement kilns) replaces energy-intensive primary processes and the use of fossil fuels.	4 - 6
		Aluminum	Recycling reduces the need for energy-intensive processes. It avoids alumina refining and aluminum electrolysis.	2
		Pulp and paper	Recycling displaces the mechanical and/or chemical production of pulp, significantly reducing energy consumption and emissions.	-
	Energy efficiency	Steel	Electric arc furnace (EAF).	5
		Cement	Calcination, clinker kiln, use of mills.	4
		Aluminum	Alumina refining (digestion and calcination).	3 - 4
		Pulp and paper	Digestion, black liquor recovery, fiber refining and paper drying.	5-6
2. Electrification	Electrification with renewable energies	Steel	Electric arc furnace (EAF), sintering.	5 - 9
		Cement	Raw material crushing, mixing, cement grinding.	4 - 6
		Aluminum	Aluminum electrolysis.	2
		Pulp and paper	Pulp grinding and/or refining, pulp and paper drying, paper forming and pressing.	9-10
	Process electrification	Steel	Direct reduced iron (DRI).	5

14 The presence of a dash in the table indicates that the associated TRL is not known, however, the measure is considered to have high potential and utility. On the other hand, the abbreviation N/A is used when it is determined that the application of the measure is not feasible for that industry.

Pillar	Measures	Industry	Processes or technologies to which the measure applies or affects	TRL[14]
		Cement	Calcination, clinker kiln.	4
		Aluminum	Alumina refining (digestion and calcination) and aluminum smelting.	3 - 4
		Pulp and paper	Fiber heating, digestion, blowing, drying, black liquor evaporation, recaustification and paper drying.	
3. Fuel change	Green hydrogen	Steel	Blast furnace (BF), direct reduced iron (DRI).	5
		Cement	Calcination, clinker kiln.	4
		Aluminum	Alumina refining (digestion and calcination) and aluminum smelting.	3 - 4
		Pulp and paper	Fiber heating, digestion, blowing, drying, black liquor evaporation, recaustification and paper drying.	N/A
4. Mitigate	CCUS[15]	Steel	Blast furnace (BF), direct reduced iron (DRI).	5 - 9
		Cement	Calcination, clinker kiln.	4 - 6
		Aluminum	N/A	N/A
		Pulp and paper	Recovery of black liquor.	5-6

Source: author's work.

2.22 ***Reuse (use of scrap).*** The use of scrap or recycled materials has a high decarbonization potential for the steel, aluminum and pulp and paper industries. Recycling displaces the need for energy-intensive primary production processes and GHG emissions. Globally, the technological readiness to raise the recycling levels of materials produced in energy-intensive industries, such as steel, is advanced. Proof of this is that approximately 85 to 90% of steel scrap is recovered. The transition to net-zero emissions requires adequate planning to establish recycling networks that accommodate not only existing scrap but also scrap to be generated in the coming decades. Regulations are also necessary requiring manufacturing products to be built to maximize their life cycle and promote reuse, which includes the increasing use of modular designs (IEA, n.d.). Recycling is limited in LAC mainly by access to information on the available stock and quality of scrap. Recycling has the potential to grow in the medium and long term to the extent that the final use of products from energy-intensive industries is monitored and the recovery and recycling of scrap metal is systematized, and that public policies promote the necessary incentives. In

[15] Carbon capture, use and/or storage (CCUS) is an activity that the IDB Group will review on a case-by-case basis under specific criteria for alignment with the Paris Agreement to ensure that technological dependence on fossil fuels is not created and stranded asset risks are managed. This is based on the understanding that in the global literature, it is well recognized that CCUS should not replace mitigation efforts, but rather complement them (LSE, 2023).

this regard, it is worth noting that the Science-Based Targets Initiative (SBTI) contains a specific focus on decarbonization of steel processes, seeking to reduce emissions intensity by increasing the proportion of scrap processing.[16]

2.23 ***Energy efficiency***. There are proven energy efficiency technologies that could decarbonize energy-intensive industry by 10% to 20%. Investments can be aimed at introducing operational changes and process optimization, in addition to interventions in new technologies and equipment. While energy efficiency cannot completely decarbonize the sector, its adoption has high payoffs by improving business competitiveness and effectiveness by decoupling the nexus between economic growth and GHG emissions.

2.24 ***Electricity based on renewable energies***. Scope 2 emissions from energy-intensive industries can be mitigated by ensuring that the electricity consumed comes from renewable energy sources. Although the LAC region has a high share of renewable energies in its electricity generation matrix, the emission factors of the systems maintain carbon emission rates that could be mitigated through new investments in installed capacity based on renewable energy. Other relevant options for the energy-intensive industry are the execution of long-term power purchase agreements (PPAs), on-site renewable energy generation, and in the case of countries with a regulated market, the purchase of renewable energy certificates evidencing renewable energy consumption.

2.25 ***Process electrification***. The displacement of fossil fuel consumption by electricity in heat and steam production processes at low temperatures has a high potential for reducing GHG emissions in the industry. Although some of the processes in the steel and cement industries use fossil fuels as raw materials in chemical reactions to obtain the end products, there are proven technologies that could displace part of the consumption of fossil fuels that are burned in conventional energy systems.

2.26 ***Green hydrogen (from renewable sources)***. In high-temperature industrial processes, where electrification is not yet feasible, green hydrogen emerges as a key alternative to replace the use of fossil fuels. It is generated from the electrolysis of water (H_2O), in which the hydrogen atom is separated from the oxygen atom by means of electricity (from renewable energies). Its adoption in energy-intensive industries can displace the use of fossil fuels such as natural gas used in furnaces and high-temperature heat production, with the main barrier to implementation being the lack of economies of scale to supply green hydrogen at competitive prices compared to fossil fuels. At present, with available technologies, the use of electricity from renewable sources to produce green hydrogen can triple its production costs compared to gray hydrogen (IEA, 2021a). However, there is significant scope for reducing production costs through technological innovation and further implementation. According to the Net-Zero Emissions Scenario for 2050 (IEA, 2021b), the cost of renewable hydrogen production can decrease to 1.3 USD/kg by 2030 in regions such as LAC and compete with the cost of hydrogen produced from natural gas with CCUS. Studies in the region indicate that Uruguay could be one of the first countries to reach a lower value of production, with 1.51 USD/kg by 2030. In Colombia, the cost of hydrogen varies according to the technology used, with the lowest cost being produced from wind energy, with an estimated 2.8 USD/kg, and an expected reduction to 2.2 USD/kg in 2030 (WEC, 2022). By 2050, green hydrogen costs are estimated to reach about USD 1 per kg. In the medium and long term, the decarbonization of steel, cement and aluminum production processes from green hydrogen can be integrated into the design of new infrastructure (greenfield) or existing facilities (brownfield). The introduction of hydrogen requires adapting existing technologies or rebuilding part of the processes to implement

[16] Global targets move from an average emissions intensity of 0.5 tCO_2/t rolled steel in 2020, to 0.37 in 2030, 0.24 in 2040 and 0.11 in 2050. See: SBTI (2023): STEEL SCIENCE-BASED TARGET-SETTING GUIDANCE https://sciencebasedtargets.org/resources/files/SBTi-Steel-Guidance.pdf

decarbonized energy systems. Their implementation varies according to the location of production plants, technical feasibility, existing infrastructure, market demand, operating costs, and the regulatory environment.

2.27 ***Carbon Capture, Use and Storage (CCUS).*** The CCUS process separates, traps and/or reuses CO_2 from industrial gases before it is released into the atmosphere. CCUS faces significant technological challenges regarding the safe geological storage of CO_2 that would be subject to national and/or regional assessments. At the implementation level, the low levels of carbon in the flue gases of some energy-intensive industries or even within the same industry translate into high costs that make their implementation unfeasible from an economic point of view. From an approach of alignment with the PA, CCUS is a last resort to be deployed only until all possible alternatives, such as those mentioned in previous paragraphs, have been exhausted, and provided that such practice is satisfactorily regulated in the country in question. The above, on the understanding that global literature is well aware that CCUS should not replace mitigation efforts, but is complementary to them (LSE, 2023).

2.28 ***Industrial groups***. These are associations or groups of related companies and entities that share a common interest in decarbonization. These industrial groups, also known as industrial clusters, are primarily aimed at taking advantage of synergies and fostering collaboration between their constituent sectors. They provide several benefits for integrating multiple decarbonization schemes, aggregating demand and identifying economies of scale, which reduces the cost per unit ton of carbon reduced. Interest in the development of industrial group initiatives is growing, as seen in the three global clusters (from Australia, the United Kingdom and Spain) that initially signed the World Economic Forum's global initiative, "Industrial Cluster Transition to Net-Zero Emissions," launched in collaboration with the Electric Power Research Institute (EPRI). Initiatives such as this could provide a model for energy-intensive industries in the region.

Table 2 Coal use in the steel industry

At present, according to the IEA, globally coal covers around 75% of the steel sector's demand for energy and raw materials, a percentage comparable to that of the last decade. Along with increased use of bioenergy, low-carbon electrification must accelerate rapidly to replace coal in the NZE scenario [net-zero emissions scenario by 2050], increasing by more than 5 percentage points between now and 2030 through increased production based on scrap (often referred to as "secondary production"), electrolytic hydrogen and electric arc furnaces. This contrasts with an increase of only 1 percentage point over the last decade. (IEA, 2022)

2.29 In conclusion, heat generation processes in the steel, cement, aluminum and pulp and paper industries can adjust their production chains to move towards the total or partial displacement of the use of fossil fuels in kilns, dryers, and crushers (referring mainly to the substitution of coal and fuel oil for now, although recognizing that the use of others such as natural gas could have viable substitutes in the future[17]). These processes involve costs for the transition; fuels to be considered include sustainable biomass,[18] sustainable biofuels both liquid and gaseous,[19] green hydrogen, as well as electric power.

[17] Today, the use of natural gas in the manufacturing industry is difficult to replace. Its viability may change in the coming years as fuels such as ammonia and hydrogen become economically and technically feasible.

[18] Sustainable biomass, according to the Energy Technical Guidance, refers to biomass from biogas or organic waste based on residues, or based on sustainable forestry, according to ESPF Environmental and Social Performance Standard #6 (¶25 and ¶26); validating that no competition with food crops or risk of inducing expansion into areas of high carbon stock or high biodiversity is generated.

[19] Provided they are biofuels from sustainable sources, see quote above.

C. The manufacturing industry and the adaptation goal of the PA

2.30 In IDB Group's dialogue and scheduling process with governments and private sector clients, it is important to keep in mind that LAC is vulnerable to the geophysical and hydrometeorological hazards that climate change exacerbates, and this has implications for the alignment of investments in the manufacturing sector with the PA adaptation goal.

2.31 The PA also establishes as one of its main objectives to reduce vulnerability to the physical risks of CC, by increasing adaptive capacities and long-term climate resilience. Studies indicate that the frequency of natural disasters in LAC has tripled in the last 50 years.[20] The recurrence of these factors in LAC could cause direct damage by 2050, estimated at between 1.5% - 5% of GDP (Bicalho, 2021). In addition, cumulative effects produced by slow onset impacts such as the increase in average temperature, sea level rise, and the increase in the number of dry days per year, among others, threaten to affect the long-term efficiency and performance of many of these industrial processes.

2.32 Therefore, countries have emphasized the importance of integrating resilience into infrastructure investment planning, to overcome natural contingencies and adapt to changing climatic conditions at a lower cost. Resilience investments were estimated to account for 5% of regional GDP between 2015-2019.[21] For every dollar invested in resilient infrastructure, up to four dollars in economic benefits can be generated.[22] In this regard, the manufacturing industry should also integrate climate resilience into its investment planning and project design, in the understanding that anticipating, mitigating, and managing climate risks can bring significant economic benefits.

2.33 Aspects of climate change vulnerability relevant to investments in manufacturing industries include the impacts of climate events and natural disasters associated with them, which can cause: (i) an increase in risks to the security of energy supply, which is essential for energy-intensive industries; (ii) an increase in the physical risk to which physical facilities are exposed; (iii) impacts on supply chains and transportation and distribution networks; (iv) changes in precipitation patterns may affect the availability of water for processes and/or cause flooding in industrial zones, affecting water vulnerability; and (v) changes in average and maximum temperature may generate negative changes in the efficiency of many of the industrial processes in these industries where heat exchangers are used. The specific vulnerabilities of each project will depend on the context (location, type of industry, existing climate plans and strategies in the locality/country, effectiveness of environmental governance in the locality/country in question, availability and governance of water resources, resilience of the energy matrix, etc.).

2.34 Once climate vulnerabilities and risks have been identified, they must be managed. In the context of the IDB Group operations, this is covered under Environmental and Social Performance Standard 4 (ESPS 4) and under the Climate Risk Assessment as per IDB Invest's Environmental and Social Sustainability Policy. At a strategic level, adaptation and climate resilience actions should be coherent with national adaptation priorities in the country's Nationally Determined Contribution (NDC) and/or National Adaptation Plan (NAP), and ideally be coordinated between private sector actors, institutions in charge of

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[20] IDB. (2022). IDB and IDB Invest Provided $26 Billion in Climate Financing over Five Years. https://www.iadb.org/en/news/idb-and-idb-invest-provided-26-billion-climate-financing-over-five-years

[21] Infralatam. Public Investment in Economic Infrastructure in LAC. http://infralatam.info/

[22] IDB. (2022). IDB and IDB Invest Provided $26 Billion in Climate Financing over Five Years. https://www.iadb.org/en/news/idb-and-idb-invest-provided-26-billion-climate-financing-over-five-years

industrial zone management, and the city/municipality/region involved, as each actor has a different field of action as explained in Table 2 (GIZ, 2019)[23].

Table 3 Examples of climate change adaptation measures for the industry

Level of performance	Examples of climate change adaptation measures
Company	• Design and implement facilities that are highly resistant to extreme weather conditions; • Develop water-efficient products and processes in areas affected by water scarcity; • Diversify supply networks and consider alternative markets.
Industrial zone	• Reduce vulnerability through relocation to areas with less vulnerability to climate change (applicable to the strategic planning phase of new industrial zones); • Build flood protection works in areas with this risk (applicable to the management and requalification phases in existing industrial zones); • Integrate green spaces in industrial areas with high concrete use to improve ambient temperatures while improving conditions for employees and facilitating water infiltration during periods of heavy rainfall.
Municipality or city	• Increase the volume of water stored underground, in anticipation of drought periods; increase infrastructure capacity for such purpose; • Installation of early warning systems for extreme weather events; • Develop Basin Management Plans and/or Comprehensive Water Resources Management Plans, to establish uses and availability of the water resource committed to the industry and incorporating climate change scenarios in different time horizons.

Source: Adapted from (GIZ, 2019).

2.35 In the planning stage of industrial facilities, adaptation involves selecting the project site considering the exposure and vulnerability to natural hazards resulting from the specific geography, sector, and context, as well as scenarios that anticipate how climate change may exacerbate physical risks. Adaptation measures worth highlighting for consideration in the design of industrial sector projects/investments include (as applicable) using construction materials that are resistant to high temperatures, hurricanes, strong winds and/or torrential rains, ensuring that there is a good drainage and sewerage system in industrial areas prone to torrential rains (which measure should be coordinated with the city/municipality/region in question), using technologies to optimize water supply and energy efficiency, and efficiently using and recycling resources.[24]

2.36 In this context, the industrial sector is identified as an adaptation priority in several NDCs in the LAC region, such as Argentina, Colombia, Costa Rica, the Dominican Republic, and Mexico. For example, Argentina's NDC establishes as an adaptation measure to increase the resilience of industrial areas to extreme climate events and Colombia's NDC establishes a target of increasing the number of companies that have and implement

[23] GIZ. (2019). *Methodological Guide for the Adaptation to Climate Change of Industrial Zones: A guide on climate risk and opportunity management for the use of those involved in managing existing industrial zones. https://www.climate-expert.org/fileadmin/user_upload/Climate_Expert_Industrial_Zones_Guide_English.pdf*

[24] GIZ. (2019). *Methodological Guide for the Adaptation to Climate Change of Industrial Zones: A guide on climate risk and opportunity management for the use of those involved in managing existing industrial zones. https://www.climate-expert.org/fileadmin/user_upload/Climate_Expert_Industrial_Zones_Guide_English.pdf*

adaptation strategies. These NDCs highlight the importance of identifying and managing climate vulnerabilities and risks for the industrial sector.

2.37 In addition, it is worth mentioning some industries that are high consumers of water resources where support for their development should prioritize the consideration of adaptation criteria for resilience to climate change. For example: textile processing; milk pasteurization, livestock, and wine industry (to be reviewed jointly in light of the Technical Guidance for the Agri-Food Sector); manufacture of alkalis, adhesives, paints and synthetic dyes. It is also advisable to promote the management of sludge in the industry in general, including those associated with the steel industry, since its inadequate disposal represents an environmental liability and a risk for the industry.

III. ASSESSMENT OF OPERATIONS: ALIGNMENT WITH THE PA MITIGATION GOAL (BB1)

3.1 The joint MDB methodology serves as a basis for determining the alignment of operations with the PA. The application of the methodology will result in two possible scenarios: "aligned" or "non-aligned". In this context, an operation is "aligned" if it does not go against the PA mitigation (BB1) and adaptation and resilience (BB2) goals. **This section shows and describes the procedure for determining alignment with the PA mitigation goal.**

3.2 The alignment of manufacturing industry projects with the PA mitigation objective implies ensuring consistency with a decarbonization trajectory towards net-zero emissions by mid-century, in the context of the country where the project is located; this implies not hindering or impairing the transition to a decarbonized economy, both nationally and globally.

3.3 **In operations with targeted use of proceeds[25]**, the MDB use an assessment approach in which the first step is to identify whether the types of investments are considered "universally aligned" or "universally non-aligned" with the mitigation objective in the PA. In a second step, projects that do not fall into either category require a detailed analysis considering the country's Nationally Determined Contribution (NDC) and Long-Term Strategy (LTS), the global decarbonization pathways for the sector, a carbon lock-in analysis and a transition risk analysis. This procedure is described in detail in Table 5 and sections A-D below in this document.

3.4 **For financing without targeted use of proceeds**, comprising budget support (PBL), operations through financial intermediaries, working capital, equity investment or other use of corporate funds, the general principles and technical reference of paragraphs A- D of this document will be taken as a reference, but applying the MDB approach already adapted for each case: policy-based operations, financial intermediary operations (in conjunction with the *IDB Group Technical Guidance for Financial Intermediary Operations* GN-3142-2), and general corporate purpose finance (GCPF - see paragraph E in this section).

3.5 The key principles in IDB Group's PAIA (section II.C) outline that these criteria must be applied to the manufacturing sector in analysis that is based on the best information available, commensurate to climate risk in the operation, and that promotes continuous learning. The IDB, IDB Invest and IDB Lab will individually determine the implementation arrangements for each type of case. Considering that historically most of IDB Invest's operations in the manufacturing sector occur via corporate financing, paragraph E of this particular sector guidance goes into detail in explaining the process of applying GCPF to transactions in the manufacturing sector.

[25] Loans or global credit operations with eligibility lists. In the case of the IDB, the "defined use of funds" category includes the Multiple Works operations (GOM) even though the details of the entire list of works are not known in advance. In these cases, alignment with the PA is assessed using the same sample of projects studied for the application of the ESPF.

A. Activities that the IDB Group will not finance (universally not aligned)

3.6 Per the MDB Framework, coal-based energy extraction and generation and peat-based energy extraction and generation are considered universally not aligned with the PA mitigation goal.

3.7 In accordance with the Exclusion List of IDB's Environmental and Social Policy Framework (ESPF)[26] and IDB Invest's Environmental and Social Sustainability Policy (ESSP), the following activities will not be financed:

a. Coal:[27] exploration and production (upstream), neither in new capacity (greenfield) nor in existing capacity (brownfield); its export (midstream), import, transportation, distribution and power generation with coal (midstream and downstream), neither in greenfield nor in brownfield[28]; and uses for access to energy services[29].

b. Oil and gas exploration and production (upstream) will not be financed in either greenfield or brownfield.

3.8 In this regard, the IDB Group will not directly or indirectly finance companies (including MSMEs) whose business model directly contributes to the exploration and production (upstream), refining, export, import, transportation and distribution or power generation with fossil fuels or access to technical services, inputs or high, medium or low complexity equipment and technological specialization in the hydrocarbon sector (midstream, downstream) or oil and gas byproducts such as methane, butane, propane or pentane. These types of companies may be financed when the resources are allocated to energy transition plans aligned with climate change commitments at the country level and not to activities excluded by the ESPF and ESSP.

3.9 Consistent with these exclusions and with section B, **financing is eligible** for projects that comply with the ESPF and ESSP aimed at supporting:

a. Companies (including MSMEs) that currently depend on energy from fossil fuels for their production processes; even in instances where they do so significantly[30], where decarbonization solutions must be pursued.

b. Investments in industrial electricity and/or industrial heat generation that relies on fossil fuels (recognizing that coal-fired electricity generation is on the exclusion list of the ESPF and ESSP).

c. Specific investments and technical assistance in energy transition plans of companies that are part of the coal, oil and gas value chain, provided they are aligned with country-level climate change commitments and global decarbonization pathways (see Energy Technical Guidance).

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[26] The Exclusion List contains activities that are incompatible with IDB Group's commitments to address climate change in coal, oil and gas issues.

[27] A distinction is made between coal, which refers to fossil fuels that in their natural state are extracted from the subsoil by manual or mechanical means in underground or open-pit mines; and charcoal, which is obtained artificially by burning wood for cooking. Access to energy services for vulnerable populations does not include the financing of extraction and production (upstream) activities.

[28] PBLs with significant macroeconomic or development reforms that may indirectly support these activities will be considered on a case-by-case basis.

[29] This applies to projects and related facilities which primary purpose is related to the production, trade or use of coal for power generation, or to the transmission of power generated by a coal-fired power plant (e.g., a transmission line intended solely for that purpose).

[30] Aspect to be reviewed on a case-by-case basis; when, based on expert judgment, the dependence is significant, they will have to comply with the criteria of the specific assessment of alignment with the PA of MDB.

B. Activities universally aligned with the PA mitigation goal

3.10 According to the MDB List of Universally Aligned and Universally Non-Aligned Activities, some activities will be considered coherent with the PA decarbonization goal in all countries and under all circumstances. Table 4 lists the activities considered universally aligned in the manufacturing sector provided that: i) their economic feasibility does not depend on external fossil fuel exploitation, processing, and/or transport activities; ii) their economic feasibility does not depend on fossil fuel subsidies; and iii) their operation does not significantly depend on the direct use of fossil fuels. Otherwise, a specific assessment (Table 5) will be carried out to -among other aspects- identify whether there are alternative decarbonized technologies that are technically and economically viable.

Table 4. Activities of the Manufacturing sector considered universally aligned to the mitigation goal of the Paris Agreement

Sector	Typology considered universally aligned	Conditions and guidelines
Manufacturing	Non-energy-intensive industry (the chemical[31], iron and steel, cement, pulp and paper and aluminum industries are excluded from this definition)	Consider the nature of the product (carbon content, life cycle, reuse/recycling potential).
	Manufacture of electric vehicles; manufacture of non-motorized vehicles; electric locomotives; non-motorized vehicle fleet	
	Manufacturing of components for renewable energy and energy efficiency	

Source: Group of Multilateral Development Banks (2023): List of activities considered universally aligned with Paris Agreement mitigation objective. Available here.

3.11 Furthermore, the Joint MDB Assessment Framework suggests that the design of operations should reinforce the preservation of areas of high value for their biodiversity and high carbon stocks (HCS)[32], an aspect that should be reviewed in conjunction with the IDB's Environmental and Social Policy Framework (ESPF) and IDB Invest's Environmental and Social Sustainability Policy (ESSP), as applicable.

3.12 **Universally aligned activities of the IDB Group.** *Based on Table 4 and IDB Group's active portfolio, the following activities in the industrial sector do not require specific assessment to be declared aligned with the PA mitigation goal:*

3.13 **Financing to non-energy-intensive industry activities**[33], whenever they are determined not to be significantly dependent on fossil fuels[34] and any appropriate due diligence verifies that they do not exceed 25,000 tCO_2e per year, during operation and regarding GHG emissions classified in scopes/categories 1 and 2 of the GHG inventory standards.

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31 Since this document does not currently include guidelines for the chemical industry, projects in this sub-sector will be analyzed with technical specifications to be validated on a case-by-case basis.

32 Under this approach, it is recognized that secondary forests offer essential carbon storage services and forest products to local communities that are often not considered to be of conservation value and therefore are not protected.

33 By virtue of this document, the production processes associated with the following cannot be considered universally aligned: steel, food, cement, aluminum, pulp, and paper; as well as chemicals and petrochemicals (including plastics), glass, lime, copper and ceramics.

34 Aspect to be reviewed on a case-by-case basis; when, based on expert judgment, the dependence is significant, they will have to comply with the criteria of the specific assessment of alignment with the mitigation goal of the PA as per the MDB.

3.14 In the energy-intensive industry, financing aimed at:

a. early, planned and orderly replacement of carbon-intensive production processes, using zero-emission substitutes, and in a manner that evidences effective displacement of GHG-intensive options and addresses social and competitiveness impacts for a just transition;

b. electrification based on renewable energy;

c. the use of green hydrogen;

d. introduction of clean fuels such as sustainable biomass;[35]

e. introduction of circular economy measures, reducing the extraction of raw materials and avoiding waste[36] (e.g., investments to increase the recycling rate); and

f. implementation of energy efficiency measures, provided they do not contribute to extending the useful life of GHG-intensive infrastructure.

3.15 It should be clarified that an operation can only be considered "universally aligned" when all fundable activities under all components are classified under the universally aligned categories.

3.16 Wherever possible, including in universally aligned transactions, the IDB Group will seek to encourage as much decarbonization of the manufacturing industry as possible and mobilize climate finance to achieve this.

C. Activities that must validate their alignment with the mitigation goal of the PA

3.17 Industrial activities requiring specific assessment focus on processes and technologies that give continuity to the significant consumption of fossil fuels, among others.

3.18 Financing to industries classified as energy-intensive: iron, steel, aluminum, cement, pulp and paper production (among others, such as chemicals, not explicitly covered in this guidance since they do not represent IDB Group's portfolio) should be specifically assessed as explained below.

3.19 The following is a non-exhaustive list of activities that would require a specific assessment of alignment with the PA mitigation goal under the direct investment methodology:

a. Financing activities in non-energy-intensive industries that are significantly dependent on fossil fuels and/or exceed 25,000 tCO_2e per year during operation and regarding GHG emissions classified in scopes/categories 1 and 2.

b. Financing activities in energy-intensive industries other than those listed in section 3.11, e.g., those that support industrial processes that rely significantly on fossil fuels and/or activities in energy-intensive industry processes that release high GHG emissions, such as:

i. The replacement of coal-fired furnaces with natural gas-fired technologies and the use of alternative fuels with a high carbon footprint (gray hydrogen).

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[35] Sustainable biomass, according to the Energy Technical Guidance, refers to biomass from biogas or organic waste based on residues, or based on sustainable forestry, according to ESPF Environmental and Social Performance Standard #6 (¶25 and ¶26); validating that no competition with food crops or risk of inducing expansion into areas of high carbon stock or high biodiversity is generated.

[36] Getting to Zero Net Emissions: Lessons from Latin America and the Caribbean. IDB (2019). (Original title:*Cómo llegar a cero emisiones netas: Lecciones de América Latina y el Caribe)*

ii. In the steel industry: HISarna technology, DRI-EAF[37] based on natural gas.

iii. In the aluminum industry: use of hydrogen from non-renewable sources; hybrid generation systems; remelting and casting processes.

iv. In the cement industry: use of hydrogen from non-renewable sources as fuel in kilns; carbonation of concrete fines; calcination of clays based on fossil fuels.

v. In the pulp and paper industry: gasification incorporating fossil fuels for heat supply. In addition, considering the provisions of IDB's ESPF and IDB's ESSP on sustainable management of living natural resources.[38]

c. Financing low-emission hydrogen. It should be noted that according to the joint MDB assessment framework only green hydrogen, i.e. from renewable energy such as solar or wind, can be considered universally aligned with the PA mitigation goal. In this regard, low-emission hydrogen requires a specific assessment when coming from non-renewable sources. In the case of low-emission hydrogen that originates from fossil fuels and meets all the requirements established by the IDB Group in the Hydrogen Certification Implementation Guide for LAC, for it to be considered "low-emission", the specific assessment shall duly justify how the corresponding criteria are met.

3.20 The specific assessment also applies to energy-intensive industries[39] financed under the counterparty approach of the GCPF methodology (used for working capital, investment funds, etc.). These are one of seven indicative types[40] of business model that require a detailed analysis of how their development is aligning with the PA mitigation goal.

D. Criteria for the specific assessment

3.21 It should be emphasized that activities or investments requiring a specific assessment may consist of a combination of technologies which, **while consuming fossil fuels and/or generating GHG emissions, can achieve zero-net emissions by 2050 and be aligned with the PA.**

a. In the case of direct investments or with targeted use of proceeds where activities that cannot be considered universally aligned are identified, the five criteria agreed with other MDB outlined in **Table 5** will be applied.

b. In the case of transactions requiring a counterparty approach (e.g. general corporate purpose finance) and where due diligence determines that the entity[41] engages in activities that require a specific assessment (on a case-by-case basis), the general principles of criteria in Table 5 shall be applied according to the adapted version of

[37] HISarna is a method of iron production that avoids the conventional sintering process, which involves crushing iron ore and mixing it with limestone, coke dust, slag-forming agents, and fluxes, followed by exposure to high temperatures. Instead, HISarna relies on direct reduced iron (DRI), followed by smelting in an electric arc furnace (EAF) to obtain crude steel.

[38] The ESPF states that: for borrowers involved in the primary production or harvesting of living natural resources, (including, but not limited to, food and fiber commodities) where production is known to occur in regions where there is a risk of substantial conversions of natural or critical habitats, verification systems and practices shall be adopted as part of the borrower's environmental and social management system to assess its key suppliers.

[39] The following non-exhaustive list is included in the MDB methodology: chemical industries, hydrochlorofluorocarbons (HCFCs), iron and steel, pulp and paper, non-ferrous materials such as aluminum and copper, as well as non-metallic minerals such as cement, lime and glass.

[40] As well as: fossil fuel industries; fossil fuel dependent industries and activities; aviation; transportation as a core business; animal product companies; sectors or activities that may directly impact the expansion into areas with high biodiversity and/or carbon sequestration value.

[41] The legal entity that signs the financing agreement with the IDB Group or alternatively, another counterparty that has control over the project activities. See section 2 of the GCPF methodology.

the methodology described in paragraph E of this section.[42]

Table 5 Specific criteria of Joint Methodological Principles for the assessment of alignment with the Paris Agreement - direct investment

Specific criteria (SC)
SC1: Review of the Nationally Determined Contribution Is the operation/economic activity inconsistent with the NDC of the country?
SC2: Review of the Long Term Strategy of the country Is the operation/economic activity, in its lifetime, inconsistent with the LTS or other similar long-term low GHG, national, sectoral or regional strategies that are coherent with the mitigation objective of the Paris Agreement?
SC3: Review of sector-specific global decarbonization pathways (see Appendix 1.). Is the operation/ economic activity inconsistent with sector-specific global decarbonization pathways in line with the mitigation objective of the Paris Agreement, considering the common but differentiated responsibilities of countries and their respective capabilities? In the case of the manufacturing sector, the sectoral reference pathways include those developed by international organizations, think tanks, academia, and industry associations.
SC4: Do not hinder the transition. Does the operation/economic activity obstruct opportunities for the transition towards Paris aligned activities, or does it mainly support or rely directly on non-aligned activities in a specific country/sector context? When the risk of "carbon lock-in" is estimated to be considerable, the application of this criterion implies an analysis of alternatives preferably validated by a third party.
SC5: Economic feasibility given the transition risks. Is the operation/economic activity unfeasible, taking into account the risks of stranded assets and the transition risks in the national/sectoral context?

Note: As established in the PAIA (GN-3142-1), a positive response to at least one of the questions above will lead to consider the operation incompatible with the PA mitigation goal. Limitations in the information availability will not lead to a non-alignment decision; instead, the assessment will rely on other specific criteria for which information is available. Assessing SC4 is considered possible in all cases.

Source: Author's work based on the Joint MDB Framework for the Paris Agreement Alignment Analysis of Direct Investment Operations.

3.22 **SC1. Review of the country's NDC**. It involves analyzing the country's NDCs and, if applicable, other national and/or subnational plans or policies that support them, to ensure that the investment does not contravene them. In other words, the type of investment to be financed would have to be excluded or be inconsistent with these instruments for the criterion to be considered as not met. For the review of this criterion, it will be especially relevant to compare with the objectives and goals of the countries in terms of industries, clean energy, green hydrogen, energy efficiency, waste management and circular economy for industrial processes.

3.23 **SC2. Review of the country's Long-Term Strategy (LTS).** It involves analyzing the LTS or other national and/or subnational long-term plans or policies consistent with the PA mitigation goals to ensure that the investment does not contravene them. In other words, the type of investment to be financed would have to be excluded or be inconsistent with

[42] As explained in the GCPF methodology, if the entity already structures its financings based on the principles of sustainability-linked bonds (SLB), it is not necessary to apply the specific criteria in Table 5.

these instruments for the criterion to be considered as not met. For the review of this criterion, it will be especially relevant to compare with the objectives and goals of the countries in terms of industries, clean energy, green hydrogen, energy efficiency, waste management and circular economy for industrial processes.

a. If the country has an LTS, it is reviewed to detect if there could be any inconsistency with the goals and mechanisms for decarbonization in the sector (and subsector, if any) as defined by the country itself.

b. If the country does not have an LTS or equivalent plan, the answer is "Not Applicable".

3.24 **SC3. Review of global low-emission development pathways**. For operations in this sector, data and findings from global sector literature and IEA net-zero emissions scenarios are considered. This will be complemented by considerations related to the principle of common but differentiated responsibilities, in the context of analysis under SC4. Likewise, decarbonization strategies and roadmaps will be consulted by industry type such as Net-Zero Steel[43], Net-Zero Aluminum[44], Net-Zero Concrete[45], among others. See Appendix 1. .

3.25 **SC4. No obstruction of the transition.** To meet this criterion, it is necessary to conduct an analysis of alternatives that considers locked-in GHG emissions associated to the investment. It must always be verified that there are no technically and economically viable lower GHG emission alternatives in the market where the investment is being made. In this regard, the main guiding questions will be:

a. Based on a robust analysis of alternatives preferably validated by a third party, has the option to be financed been proven to be the only one considered technically and economically feasible to provide the same service or produce the same good?

b. What is the useful life of the asset? Even with lower-emission alternatives likely to replace it in the coming years, is it expected to continue to operate in a GHG-intensive manner by 2050? What kind of arrangements will allow it to adapt its operation to reduce emissions over its lifetime?

c. Does the investment to be financed prevent the development of lower GHG emission alternatives? For example, by discouraging the entry into the market of bidders with lower carbon solutions.

d. Would it be cost-effective for the IDB Group to seek to expand access to concessional resources to accelerate the viability of a low-emissions solution in this context?

3.26 The carbon lock-in assessment should demonstrate a robust analysis of economically and financially viable alternatives in the context where the investment will be made, which considers best practices and emerging standards for the industry in LAC (see Table 5 for illustrative examples).

3.27 For example, these activities coincide with different energy efficiency measures aimed at reducing fossil fuel consumption, which, in combination with complementary measures in perspectives such as CCUS, manage to mitigate much or all of the emissions from production processes at a rate compatible with that established by professional associations that assess climate change ambition in the industry (e.g. SBTI). Other investments of this type include hybrid generation systems, optimization of processes to

[43] https://missionpossiblepartnership.org/action-sectors/steel/
[44] https://missionpossiblepartnership.org/action-sectors/aluminium/
[45] https://missionpossiblepartnership.org/action-sectors/concrete-cement/

increase energy efficiency, replacement of equipment (furnaces) with more efficient fossil fuel technologies, and recycling of materials (use of scrap), among others. Investments of this type will be assessed in their specific contexts to verify the coexistence of their profitability with the mitigation of GHG emissions.

3.28 **Specific considerations for application of SC4 by industrial sector.** When it is necessary to assess the financing of energy generation from non-renewable sources (e.g. non-green hydrogen, first generation bioenergy, gas with use of carbon capture and sequestration); the Energy Sector Technical Guidance should be followed. In other cases, alternatives will be considered according to the best economically and technically feasible practices in the LAC industry. Table 6 summarizes examples of how to avoid carbon lock-in.

Table 6 Non-exhaustive list, subject to updates, of solutions to be assessed in the alternatives analysis required under SC4

Activity/measure to be assessed in the alternatives analysis	**Conditions and technical guidelines to be assessed under MDB criteria 4-5**
Steel industry	
HISarna with CCUS	HiSarna technology combined with CCUS reduces GHG emissions by approximately 90%, making it a low-emission alternative.
Natural gas-based DRI-EAF with CCUS	In combination with CCUS in DRI and electricity from renewable sources, emissions are reduced by 85%, making it a low-emission alternative.
Use of charcoal in furnaces	The use of charcoal from native forests could have significant consequences related to deforestation and increased CO2 emissions. This would require additional assessments and certifications to ensure compliance with the Paris Agreement mitigation goal.
Aluminum industry	
Hydrogen for use as a reductant, originating from non-renewable sources and applying carbon sequestration	The use of non-green hydrogen should consider the possibility of securing "low-carbon" certification using a guarantee-of-origin scheme (see the Hydrogen Certifications Implementation Guide for LAC). Blue hydrogen (from natural gas with carbon capture) will be particularly scrutinized, as it is extracted from natural gas fields. If it proves to be the only viable alternative, preventing the release of CO_2 to the surface, it represents a low-emission alternative. However, its production under zero-emission conditions raises costs, so for the time being it is not considered competitive for project developers in the industry.
Hybrid generation systems	The installation of systems that combine renewable-based electricity generation plants with gas-based generation can displace the use of bunker or diesel-based generation systems, and therefore represents an alternative to be considered.
Improved process efficiency of aluminum recycling plants	For aluminum recycling plant processes, the specific assessment of alignment with the PA will review whether, in addition to achieving efficiencies in energy consumption, it is feasible to migrate to the use of electric power, renewable energy and/or alternative low GHG emission fuels.
Cement industry	
Co-processing from municipal solid waste (MSW)	Co-processing from MSW avoids CO2 emissions that would otherwise be generated in landfills. However, in order to totally or partially offset direct emissions resulting from the combustion of MSW in the cement industry, it will be necessary to establish mechanisms

Activity/measure to be assessed in the alternatives analysis	**Conditions and technical guidelines to be assessed under MDB criteria 4-5**
	to prove the offsetting of emissions from the use of MSW. Additionally, the integration of co-processing with carbon capture technologies can result in negative net emissions for the industry.
Hydrogen from non-renewable sources (with carbon capture) as fuel in cement kilns	The use of non-green hydrogen should consider the possibility of securing "low-carbon" certification using a guarantee-of-origin scheme (see the Hydrogen Certifications Implementation Guide for LAC). Blue hydrogen (from natural gas with carbon capture) will be particularly scrutinized, as it is extracted from natural gas fields. If it proves to be the only viable alternative, preventing the release of CO_2 to the surface, it represents a low-emission alternative. However, its production under zero-emission conditions raises costs, so for the time being it is not considered competitive for project developers in the industry.
Process electrification (cement kilns) based on renewable energy sources	This measure can displace direct emissions from the use of fossil fuels in cement kilns, with the potential to achieve reductions of up to 35%. Depending on the context of each country and the industry in particular, it is strongly recommended to explore electricity generation from renewable energies.
Concrete recycling: uses of carbonated concrete fines as supplementary cementitious material (SCM).	The use of carbonated concrete fines as SCM results in a proportional reduction of CO2 emissions in the cement manufacturing process. In addition, this process can successfully capture between 130 and 190 g of CO2 per 100 g of carbonated concrete fines (Wu et al., 2022). However, it should be noted that carbonation of concrete fines involves additional energy consumption related to CO2 capture and utilization, as well as the heat generation necessary to achieve effective carbonation. In this context, it is essential to assess whether the energy sources used are consistent with the industry's decarbonization strategies.
Use of calcined clays as supplementary cementitious material (SCM).	To align the use of calcined clays with the cement industry's zero-emission objectives, it becomes imperative to assess the shift from traditional heat supply sources to low or emission-free energy alternatives. This involves the transition to more sustainable heat sources, such as renewable energy or the implementation of carbon capture and storage technologies. Traditionally, clay calcination has been based on the use of fossil fuels, with a significant carbon footprint.
Pulp and paper industry	
Pulp production from recycled fibers	Recycling paper for pulp production can reduce energy consumption compared to the production of chemical or mechanical pulp from virgin fibers (wood), respectively. However, it needs to be reviewed to ensure that it leads to effective decarbonization.[46]
Gasification from black liquor	Gasification brings additional value to energy production by providing gas that can be used in thermal or electrical generation. However, it is worth

[46] Regardless of the origin of pulp fibers, the pulp and paper production process is heat-intensive, so a specific assessment should indicate whether it is feasible to replace the fuel that generates this heat with options such as sustainable bioenergy or electricity. See: https://www.iea.org/energy-system/industry/paper

Activity/measure to be assessed in the alternatives analysis	Conditions and technical guidelines to be assessed under MDB criteria 4-5
	noting that, under certain circumstances, gasification would require the incorporation of fossil fuels, such as natural gas or coal, to supply the heat required during the process. This means that, in some cases, it would not completely replace the use of fossil fuels. Therefore, it will be necessary to combine measures such as carbon capture and storage to move towards more sustainable energy production within the industry. In addition, it is essential to keep in mind that gasification itself entails a significant investment demand in its implementation, which represents a constraint to its large-scale adoption.

Source: author's work.

3.29 **SC5: Economic feasibility given the transition risks**. This criterion involves analyzing the climate transition risks (i.e., those associated with a future scenario that keeps the rise in temperature well below 2°C), and monetizing - to the extent possible - the associated costs and benefits. An operation will be considered non-aligned if, once the quantitative or qualitative implications of climate change have already been incorporated into the analysis, the project does not meet the economic and financial viability thresholds required by the IDB Group. To meet this criterion, it is necessary to determine whether there are material transition risks in the operation's subsector, and if so, to incorporate them into the financial sensitivity analysis, estimating their impact on the project's feasibility, to then assess whether the design is considered robust to the transition. In this regard, the main guiding questions will be:

a. **What is the project's contribution to GHG emissions and, therefore, to what extent could it be impacted by policies and regulations?** Considering: i) the volume of emissions associated with the investment; and ii) how would it be affected by policies (e.g., a carbon price) or regulatory restrictions (e.g., a maximum GHG emissions threshold) aimed at achieving the PA goals? This means that an asset may face risks and even become stranded if there is a legal restriction prohibiting or limiting its operation due to carbon intensity. A concrete example of this type of risk is the "Carbon Border Adjustment Mechanism"[47] (CBAM) in the European Union (EU), which began its transitional application phase on October 1, 2023 and initially covers cement, iron and steel, aluminum, fertilizers, electricity and hydrogen. Figures for 2019, for example, show that in that period, Brazil was among the top ten countries of origin of EU steel imports (6% of EU steel imports),[48] therefore the implications of the CBAM may be particularly relevant to the steel industry in Brazil. Another example is the elimination of fossil fuel subsidies, which would impose a new cost on fossil fuel-dependent manufacturing companies, reducing their future revenues and thus the present value of their business.

b. **What is the potential impact of low GHG emission technology improvements in the industry?** Review: (i) current and emerging substitute technologies in the specific market of the operation; (ii) possible evolution of their technical and economic competitiveness[49] in the short (less than one year) or medium (up to 5 years) term;

[47] The Carbon Border Adjustment Mechanism (CBAM) is a carbon pricing system for imports into the European Union. Its objective is to adjust the price of certain imported products to the amount of CO2 emissions incorporated in them, to equalize the cost of carbon between EU products and these imports. https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

[48] International Trade Administration. (2019). Steel Imports Report: European Union. https://legacy.trade.gov/steel/countries/pdfs/imports-eu.pdf

[49] These estimates should also consider the likely evolution of operating costs.

also in the specific market and considering the costs of climate change externalities (for example, using a carbon shadow price).[50] Based on this, assess whether any of the options could provide the same service as the option being considered for financing, but with lower GHG emissions. The analysis of CO_2 price projections towards 2050 is crucial to compare whether technologies close to maturing in the market become economically viable given the expected evolution of operating costs.

c. **What is the potential impact of changes in the markets?** Transformations related to global decarbonization pathways impact the decisions of investors and governments.[51] To understand the transition risks associated with the evolution of markets related to energy-intensive industries, it is necessary to consider the segmentation of these markets according to the levels of GHG emissions associated with the energy assets/solutions considered in the investment. Market differentiation (domestic and international) associated with GHG emissions intensity is expected to grow; the same asset produced in different ways (with different emissions levels) should have different markets and prices. This market segmentation is a consequence of the companies' strategies (and how they perceive their consumer market's preference).

3.30 **Traceability of materials that are potentially associated with deforestation**. The use of materials from a value chain that cannot be proven to be free of deforestation risks can be problematic, potentially generating undesirable impacts on ecosystem services such as carbon capture. Therefore, reviewing the traceability of materials directly or indirectly (e.g. through zero deforestation or responsible sourcing certifications) is considered a valuable practice for risk mitigation. This is reviewed under IDB's ESPF Standard 6 and IDB Invest's ESSP.

E. Methodology for working capital investments or capital expenditures using the GCPF methodology

3.31 The joint MDB methodological principles for assessing alignment with the Paris Agreement in general corporate purpose finance (GCPF) projects described in Figure 1 focus on the corporate-level analysis of the counterparty and the alignment with the Paris Agreement of the sustainability policies that companies in energy-intensive manufacturing industries have in place.

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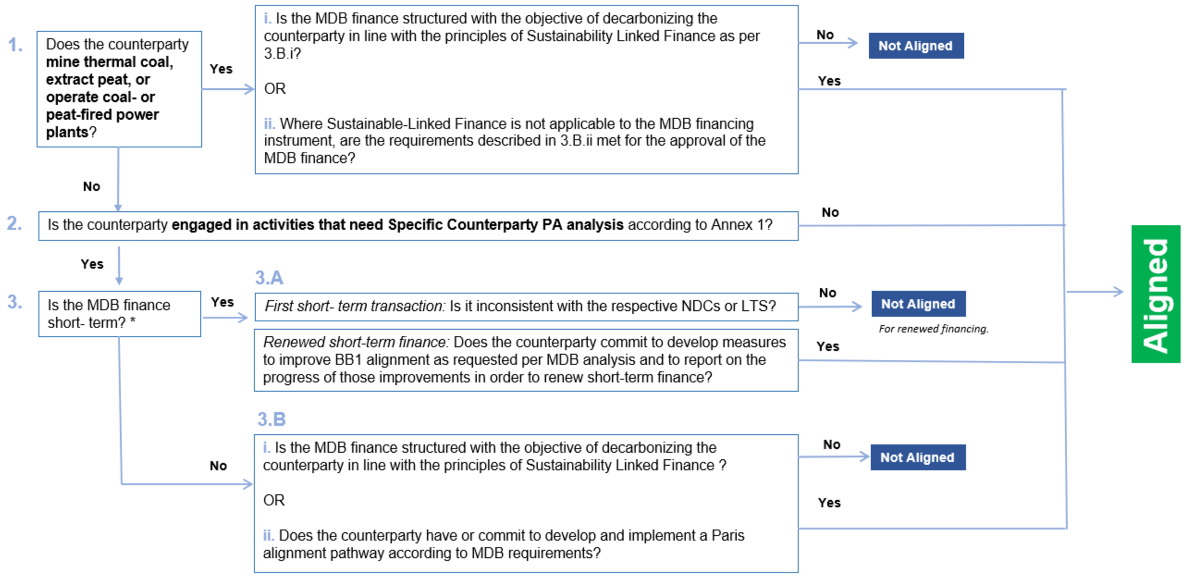
[50] Although the IDB does not have a mandatory policy or guideline for the use of carbon shadow pricing, project teams that include it in their analysis are encouraged to use low and high estimates consistent with the Report of the High-Level Commission on Carbon Pricing. In this regard, SPD recommends starting with a price of US$40/tCO2 and US$80/tCO2, respectively, in 2020 and increasing it to US$50/tCO2 and US$100/tCO2 by 2030. The low and high carbon price values are extrapolated from 2030 to 2050 using the same growth rate of 2.25% per year that is implied between 2020 and 2030, resulting in values of US$78/tCO2 and US$156/tCO2 by 2050.

[51] See: OECD (2021), ESG Investing and Climate Transition: Market Practices, Issues and Policy Considerations, OECD Paris, https://www.oecd.org/finance/ESG-investing-and-climate- transition-Market-practices-issues-and-policy-considerations.pdf

Figure 1. Decision tree for aligning general corporate purpose finance with the PA mitigation goal



** If the operation considers both long-term and short-term finance, the MDB shall consider the requirements for long-term finance for alignment under BB1.*

3.32 The first step in the analysis is to review whether the company carries out activities deemed as universally non-aligned (see Section A). If appropriate, the methodology will require the development of a decarbonization strategy by the company, if not already in place.

3.33 In cases where the company has a decarbonization strategy, the analysis will focus on the robustness of such strategy with emphasis on the company's activities that fall into the specific assessment category (Section C) and taking into account the SC1-SC5 criteria mentioned above (Section D), to ensure consistency with the Paris Agreement.

3.34 If there is no decarbonization strategy at the time of analyzing the operation, it will be requested within a predefined term, considering the company's conditions and its data and information generation capabilities. The decarbonization strategy should be technically and economically feasible in line with industry best practices, considering specific local contexts.

3.35 Based on the analysis of capacity characterization of the region's manufacturing industries carried out by the IDB Group in 2022, industries can be categorized into three groups: (i) **Group A**, those companies that do not have information or data necessary to generate a robust decarbonization strategy; (ii) **Group B**, those companies that have initial data on for example their carbon footprint, but lack internal modeling capabilities in the development of decarbonization strategies; and (iii) **Group C**, companies with a higher level of progress, which can develop their strategies based on existing information and modeling capabilities.

Table 7 Timing of decarbonization strategies for EIIs manufacturing companies, IDB Group

GROUP	Characterization of companies	Development time of Decarbonization Strategy
Group A	• Does not have a carbon footprint and carbon intensity per production unit. • Not aware of comparative carbon intensity information with industry best practices.	Using industry global decarbonization pathways compatible with the Paris Agreement goals as a reference, the client must develop a decarbonization strategy within 6 years of signing the loan.
Group B	• Has initial information. • Lacks the capacity to model the evolution of the decarbonization strategy.	Within 5 years from the signing of the loan.
Group C	• Advanced capabilities to develop, monitor and report progress on its decarbonization strategy	Within 2 years from the signing of the loan.

Source: author's work.

3.36 The IDB Group develops specific decarbonization best practice documents for these industries. The compilation of good practices identified and developed in the documents in question will have specific recommendations for industrial sectors with high difficulty in abating GHG emissions.

IV. ASSESSMENT OF OPERATIONS: ALIGNMENT WITH THE PA ADAPTATION GOAL (BB2)

4.1 The evaluation of alignment with the PA adaptation goal (BB2) focuses on establishing whether the long-term achievement of the operation's development objectives is vulnerable to climate change effects, and whether the activities are consistent with the climate resilience pathways, and specific to the context defined by national or subnational stakeholders.

4.2 **In operations with targeted use of proceeds**[52], the MDB assessment framework focuses on the application of the three criteria indicated below. In the case of the **IDB and IDB Lab**, criteria 1 and 2 are already covered in the operations in which the IDB's Environmental and Social Policy Framework (ESPF) is applicable**.** In these cases, "IDB's Disaster and Climate Change Risk Assessment Methodology for Projects" (DCCRA) will determine those instances where greater consideration of the physical impacts of climate change are necessary to ensure the alignment of manufacturing projects. All projects that comply with the application of the DCCRA methodology will be considered aligned with the adaptation goal of the PA under the first two alignment criteria established by the MDB.

[52] This term refers to loan and global credit operations with clear eligibility criteria in the use of financing. In the case of the IDB, the "targeted use of proceeds" category includes the Multiple Works operations (GOM) even though the details of the entire list of works are not known in advance. In these cases, alignment with the PA is assessed using the same sample of projects studied for the ESPF application.

The third criterion will be additionally applied during project formulation as explained in the PAIA document. In the case of **IDB Invest**, the alignment in terms of the first two criteria will be done in accordance with the provisions of the Environmental and Social Sustainability Policy (ESSP) and the Climate Risk Assessment (CRA) methodology of IDB Invest:

a. **Criterion 1 - Risk context and climate vulnerability.** Determine whether the operation is vulnerable to CC by identifying and assessing exposure to physical climate impacts. Depending on the type of operation, these may be impacts on assets, services to be provided, human and natural systems, and/or beneficiaries. If the operation is considered to be at risk, Criterion 2 is assessed. Operations with low or immaterial risk may omit Criterion 2 and go directly to Criterion 3.

b. **Criterion 2 - Definition of climate resilience measures**. Have adaptation and climate resilience measures been identified and incorporated into the operation to manage the assessed physical climate risks and/or contribute to climate resilience?

c. **Criterion 3 - Does not contravene climate resilience plans.** Depending on relevance and availability, consider policies, strategies and plans at territorial, local, national, or regional levels, as well as community or private sector priorities. The operation must not be inconsistent with them.

4.3 **In financing without targeted use of proceeds**, when flows constitute budget support (PBL), sub-credits through financial intermediaries, working capital, equity investment or other use of corporate funds, the general principles and technical reference of the three criteria outlined above (¶. 4.2) will be taken as a reference but applying the MDB approach already adapted for each case: policy-based operations, financial intermediary operations, (in conjunction with *IDB Group's Technical Guidance for Financial Intermediary Operations* GN-3142-2) and general corporate purpose finance (GCPF).

4.4 Specifically in the case of transactions involving **General Corporate Purpose Finance** (GCPF), a counterparty -based approach assessment will be followed, considering:

a. **Loan term:** A short-term transaction (equal to or less than 390 days) is considered aligned, while a long-term transaction requires detailed analysis according to the three criteria detailed above.

b. **Level and materiality of physical climate risk**: Counterparties whose climate risk exposure is considered low or immaterial, for example, based on sector sensitivity or geographic location, are considered aligned.

c. **Counterparty capacity to manage material physical climate risks**: When the IDB Group considers the climate risk to be material or when the exposure of such risk cannot be determined, the counterparty must demonstrate and document progress in identifying and assessing climate risks, in the identification of adaptation measures and in the implementation of appropriate processes to execute and monitor the effectiveness of said adaptation measures to material climate risks.

A. Considerations for the assessment of alignment with the adaptation goal of the PA in the manufacturing industry

4.5 **Given that the industry depends on the extraction and handling of raw materials, its production capacity could be diminished by the impact of climate change on these**

resources.[53] Droughts and natural disasters such as hurricanes may cause shortages and/or volatility in various industry inputs**.** Therefore, ensuring a climate-resilient development of the industry in the long term will require increasing strategic planning. These plans should incorporate future scenarios of how climate change will affect industrial facilities and their value chains, putting into perspective the resilience of different sources of inputs and logistics networks, including those linked to the circular economy.

4.6 **To ensure long-term alignment with the PA objectives, the Joint MDB Framework advises on the importance of avoiding maladaptation.**[54] **In order to address the potential risks of maladaptation in the sector, the high uncertainty of climate change impacts must be dealt with.** Strategic planning of industrial zones and their technological evolution must consider flexible and adaptive approaches. Solutions which, in the interest of achieving decarbonization and/or climate adaptation of the sector, promote dependencies that in the long term limit the capacity to deal with the variable impacts of climate change, should be avoided. For example, critical manufacturing systems which production and logistics networks are highly concentrated in certain geographies or subject to the existence of certain materials, which in turn are vulnerable to climate change. Another risk of maladaptation could be linked to initiatives to retrain employees from certain industries for their participation in other industries that are equally sensitive to climate change impacts, but that are selected for offering good economic rewards in the short term.[55]

B. Opportunities to help transition towards climate-resilient pathways

4.7 **Additional opportunities to strengthen climate resilience.** In addition to strengthening the alignment with the PA in operations where this methodology is implemented, its application allows for the identification of additional opportunities for support and dialogue with the countries. These are opportunities that contribute to the achievement of PA goals and whose implementation may require non-reimbursable resources. For example, for developing robust, inclusive, and ambitious private climate resilience plans, as well as to initiate dialogue and engagement on relevant critical issues. Several resilience actions to address water risks in manufacturing activities are provided below.

4.8 **Water risks and vulnerabilities.** Climate change is affecting the availability of water resources and precipitation patterns. Certain areas in the countries of the region are experiencing more frequent droughts. For this reason, the relevance of incorporating approaches to sizing the water footprint of the manufacturing activities to be financed should also be considered, and in parallel, the water availability (seasonal, short, medium and long-term) of the sites where the activity could be carried out should be analyzed. The analysis of water availability should also consider the competition (current and future) between users for water resources in the area. It is very important that the selection of a site for the activity considers the water vulnerabilities of the region, and the water needs of the activity in question.[56] All of the above, in light of the fact that cases of water scarcity

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[53] UNIDO. (2015). *Promoting climate resilient industry*. https://www.unido.org/sites/default/files/2015-12/01._UNIDO_Promoting_Climate_Resilient_Industry_0.pdf

[54] Maladaptation refers to climate adaptation actions that increase current or future climate vulnerabilities within the boundaries of an operation, shift vulnerabilities from within the boundaries of an operation to an external or surrounding system (causing adverse effects on social, environmental, economic or physical aspects of the system) or undermine sustainable development. Maladaptation occurs when an adaptation action undermines the coping capacities of existing systems, diminishes the capacities of future generations to respond to climate vulnerabilities, or imposes a disproportionate burden for climate action on current or future external stakeholders.

[55] E. Lisa F. Schipper. (2020). *Maladaptation: When Adaptation to Climate Change Goes Very Wrong*, https://doi.org/10.1016/j.oneear.2020.09.014.

[56] GIZ. (2019). *Methodological Guide for the Adaptation to Climate Change of Industrial Zones: A guide on climate risk and*

can generate social conflicts between the affected communities and other water consumers in the area such as the industry, which is why identifying and managing hydraulic risks also represents a way to avoid future social conflicts that could affect the industry and its "social license" to operate.

4.9 Industries (especially those with high water consumption such as the cement, steel and paper industries) are encouraged to incorporate technologies to optimize water consumption in their processes, promote water efficiency, analyze the possibility of treating and reusing water, promote water-saving behaviors among employees, and develop and implement a water consumption reduction and management plan.[57] Today there are many analytical approaches that help generate information to support decision-making related to the equitable and sustainable distribution of water resources, such as the NEXO approach that seeks to integrate the food, energy and water production sectors in the implementation of public policies that lead to water, food and energy security. Intensive industries usually have a high energy and water demand with a strong interdependence in their production processes. Obtaining, treating, and transporting water requires a significant amount of energy, while various industrial processes depend on the efficient supply of water. In this context, the NEXO approach seeks to identify synergies and trade-offs between water and energy use, promoting efficient practices and technologies that maximize the overall sustainability of intensive industries.

4.10 For example, in the U.S., water consumption in pulp and paper mills is approximately 17,000 gallons per ton of paper, but the most efficient kraft mills (e.g., with a system incorporating restrictive water circuits) use 4,500 gallons per ton.[58] For the steel industry, studies indicate that in the casting process the optimal design and arrangement of cooling spray nozzles can reduce water consumption by 10-20%, while the use of nano fluids shows potential to double the heat transfer performance in spray cooling, thus reducing water consumption[59]. In the cement industry, water is key, as this resource is one of the main components of concrete, accounting for approximately 25% of the mix.[60] The World Business Council for Sustainable Development recommends dry kiln processes for producing cement dust to reduce water consumption[61]. Studies show that, in China, the modernization of the cement industry, specifically the incorporation of dry manufacturing processes in NSP rotary kilns, has represented a significant reduction in the industry's freshwater consumption (47% reduction by 2021 compared to 1996)[62].

4.11 Likewise, the Integrated Basin Management Plan is a key and highly participatory instrument in the preparation of which the communities living in the basin are involved and which purpose is to plan the coordinated use of water, flora and fauna, soil, and socio-ecosystem management in the basin. These plans seek to establish a common vision to improve the functionality of the basin and increase or maintain the quantity and quality of ecosystem services in a context of climate change - which means aligning economic activities within the basin with territorial adaptation and mitigation goals at the subnational

opportunity management for the use of those involved in managing existing industrial zones. https://www.climate-expert.org/fileadmin/user_upload/Climate_Expert_Industrial_Zones_Guide_English.pdf

57 GIZ. (2019). *Methodological Guide for the Adaptation to Climate Change of Industrial Zones: A guide on climate risk and opportunity management for the use of those involved in managing existing industrial zones. https://www.climate-expert.org/fileadmin/user_upload/Climate_Expert_Industrial_Zones_Guide_English.pdf*

58 University of Minnesota. *Water use in pulp and paper mills.* http://www.mntap.umn.edu/industries/facility/paper/water/

59 Klimes, L. et al. (2019). *Possibilities for the reduction of water consumption in steel industry and continuous steel casting: an overview*. https://www.aidic.it/cet/19/76/036.pdf

60 CN Cemnet. (2021). *The cement industry must tackle water management head on.* https://www.cemnet.com/News/story/171382/the-cement-industry-must-tackle-water-management-head-on.html

61 CEO Water Mandate. *Good practice in cement production: dry process kilns*. https://ceowatermandate.org/resources/cement-production-dry-kiln-processes/

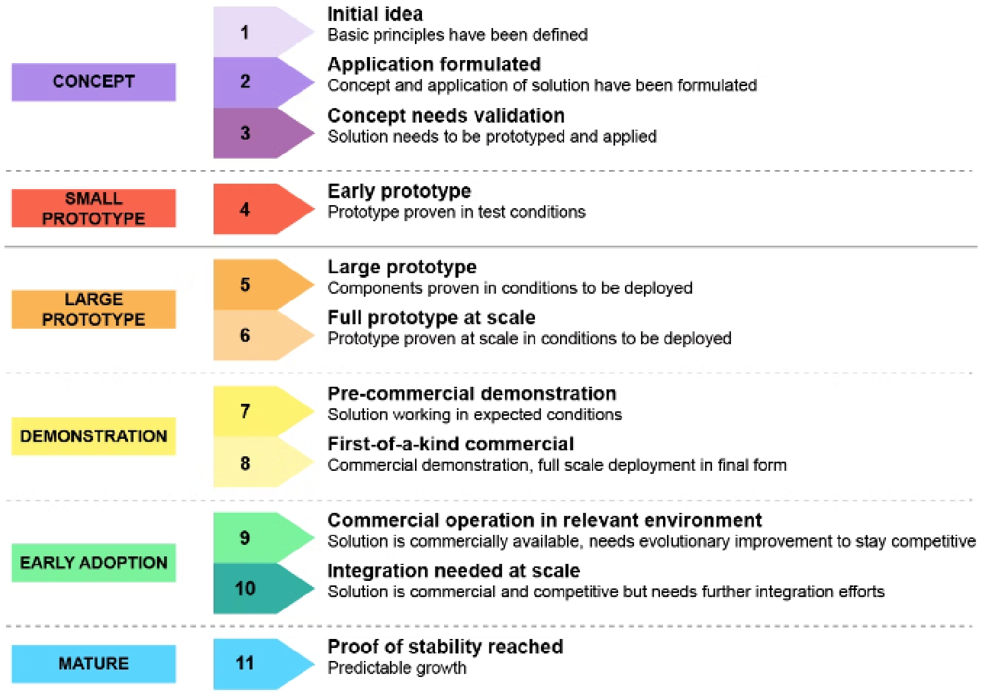
62 Xu, X. et al. (2022). *Modernizing cement manufacturing in China leads to substantial environmental gains*. https://doi.org/10.1038/s43247-022-00579-3

level (municipalities that are part of the basin). On the other hand, an Integrated Water Resources Management Plan is also a management tool that seeks to consider all types of uses and users of the resource in the basin with a view to achieving sustainability, promoting active participation of all water users in decision-making, including water conservation and protection of catchment sites much more effectively than with centralized regulation and monitoring. Given the management nature of these types of instruments, they become an ideal space for mainstreaming the issue of climate change. Specifically, considerations related to projected changes in the quantity and quality of water resources should be included in the Plan.

APPENDIX 1. LOW-CARBON PATHWAYS RELEVANT TO THE MANUFACTURING SECTOR

Sector or sub-sector	Source
Manufacturing sector (general)	Rogelj, J. et al. (2018). "Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development", in Masson-Delmotte, V. et al. (eds) Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above preindustrial levels
	IEA 2021, p. 92 - IEA (2021): Net Zero by 2040 – A Roadmap for the Global Energy Sector.
Cement	W. E. F. (2022, November 9). *Cement and concrete commitment*. Cement and Concrete - Weforum. Retrieved June 12, 2023, from: https://www3.weforum.org/docs/WEF_FMC_Cement_Concrete_Commitment.pdf S. B. T. (2022, September 30). *Cement Science Based Target Setting Guidance*. Cement Sector Guidance. Retrieved June 12, 2023, from https://sciencebasedtargets.org/sectors/cement
Steel	SBTI (2023): Steel Science-Based Target-Setting Guidance. Version 1.0. Retrieved September 23, 2023, https://sciencebasedtargets.org/resources/files/SBTi-Steel-Guidance.pdf W. E. F. (2022, November 9). *Steel commitment*. Steel - Weforum. Retrieved June 12, 2023, from https://www3.weforum.org/docs/WEF_FMC_Steel_2022.pdf IEA (2020), Iron and Steel Technology Roadmap, IEA, Paris https://www.iea.org/reports/iron-and-steel-technology-roadmap, License: CC BY 4.0
Aluminum	W. E. F. (2022, November 9). *First Movers Coalition – Aluminium commitment*. Aluminum - Weforum. Retrieved June 12, 2023, from https://www3.weforum.org/docs/WEF_First_Movers_Coalition_Aluminium_Commitment_2022.pdf S. B. T. (2020, January 31). *Understanding and Addressing the Barriers for Aluminum Companies to Set Science-Based Targets*. Guidance for the Aluminium Sector. Retrieved June 12, 2023, from https://sciencebasedtargets.org/resources/legacy/2020/06/SBTi-Aluminum-Sector-Memo-FINAL.pdf I. A. (2021, September 30). *Aluminium Sector Greenhouse Gas Pathways to 2050*. Retrieved June 12, 2023, from https://sciencebasedtargets.org/resources/legacy/2020/06/SBTi-Aluminum-Sector-Memo-FINAL.pdf
Pulp and paper	IEA (2022), Pulp and Paper, IEA, Paris https://www.iea.org/reports/pulp-and-paper, License: CC BY 4.0

APPENDIX 2. TECHNOLOGY READINESS LEVELS (TRL) FOR CLEAN TECHNOLOGIES



Source: IEA. ETP Clean Energy Technology Guide. https://www.iea.org/data-and-statistics/data-tools/etp-clean-energy-technology-guide

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