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TECHNICAL GUIDANCE TO ALIGN IDB GROUP OPERATIONS WITH THE PARIS AGREEMENT

BUILDING SECTOR

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ABBREVIATIONS

CC	Climate Change
CCAP	IDB Group Climate Change Action Plan
CO_2e	Carbon Dioxide Equivalent
COP	Conference of the Parties
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
IPCC	Intergovernmental Panel on Climate Change
LAC	Latin America and the Caribbean
LTS	Long-Term Strategy for Climate Resilience and Decarbonization
MDB	Multilateral Development Bank
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
PA	Paris Agreement
PAIA	Paris Alignment Implementation Approach
PBL	Policy-based Loans
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

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 the 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 the 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 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 regarding 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 building sector**. In this document, the building sector is understood to include, but is not limited to, **the design, construction, expansion, retrofitting and improvements of all buildings financed within IDB Group**[3] programs, highlighting (but not limited to) the following sectors: education (preschools, schools, universities, training centers); health (hospitals, health centers,

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1 It is emphasized that, in cases of discrepancy, the Joint Methodological Principles for analyzing alignment with the MDB PA prevail over the PAIA, except for the exceptions explicitly provided by the latter. Available at IDB 2023: https://www.iadb.org/en/who-we-are/topics/climate-change/climate-change-finance/paris-alignment

2 In case this document presents discrepancies with the Joint MDB Framework, the second prevails except in cases explicitly justified in this guidance.

3 In other words, activities where financing is allocated to buildings; in cases where financing is allocated to activities that transform materials relevant to the construction of buildings, such as the production of aluminum, cement, and steel, the Technical Guidance for the Manufacturing Industry should be used.

laboratories, early childhood centers, residences for the elderly); tourism (tourist centers, hotels, lodging, convention centers, museums); housing (including social housing); agriculture (such as farms and production plants); trade and integration (border crossings, inspection centers, customs control, migration, phytosanitary inspection, laboratories); recreational and citizen service (cultural centers, sports complexes, community centers, employment or training centers); administrative or commercial (ministerial or government headquarters, administrative headquarters, offices); and others (warehouses, storage centers, passenger terminals, heritage buildings, police stations, among others).

1.7 For those activities in operations that differ from the building sector defined above, the corresponding technical guidance[4] will be applied simultaneously and complementarily, always adhering to the materiality principle. If 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 the 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 buildings 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 building sector includes direct financing to activities and companies in such sector, as well as policies and enabling actions by the public and private sectors for building development. For instance, support for building codes, extending mortgage credit lines, vocational training programs, etc.

1.9 **Relation to other IDB Group documents:** In 2020, the IDB Group Climate Change Action Plan (CCAP) (GN-2848-9) 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 CCAP recognizes that infrastructure, including buildings, serves as a catalyst for inclusive growth in the Latin America and the Caribbean (LAC) region and identifies a potential role for the Bank within the trends of green and climate-resilient building in a world moving towards net-zero emissions.[5]

1.10 The **Climate Change Sector Framework Document** (GN-2835-13) recognizes the importance of buildings for decarbonization and climate resilience, highlighting, among other aspects: (i) the urgency to transition from fossil fuels to building electrification; (ii) the role of urban planning in the environmental performance and resilience of buildings; and (iii) the pressing need to promote enhanced building codes, circular economy measures, and technologies to improve resource management (water and energy). The **Housing and Urban Development Sector Framework Document** (GN-2732-11) explores the integration of urban planning with greener mobility and building systems to diminish urban greenhouse gas emissions, and efforts to reduce the vulnerability of urban residents to severe climate events. The **Health** (GN-2735-12), **Skills Development** (GN-3012-3), and **Integration and Trade** (GN-2715-11) **Sector Framework Document** underscore the importance of promoting sustainable and resilient infrastructure. In 2018, the IDB Group developed the **Energy Sector Framework Document** (GN-2830-8) which includes

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

[5] Net Zero Emissions are achieved when anthropogenic GHG emissions released into the atmosphere are balanced by anthropogenic removals over a specified period.

energy sustainability as one of its four pillars, covering topics such as energy efficiency (EE), renewable energy (RE), and climate change adaptation (CC). It emphasizes the Bank's commitment to promote EE and RE to achieve sustainable and climate-resilient development in LAC. Furthermore, in 2022, the Social Infrastructure Group and the Climate Change Division, with support from experts from IDB, IDB Lab, and IDB Invest, published "*Green Buildings - Guidelines for the Incorporation and Accounting of Mitigation and Adaptation Measures to Climate Change*" (IDB, 2022), This publication defines green buildings for the IDB Group and presents strategies to achieve them.

1.11 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 BUILDING SECTOR AND CLIMATE CHANGE

A. Introduction

2.1 The building sector is experiencing unprecedented growth, with an estimated 230 billion square meters of new buildings projected worldwide in the next 40 years. In LAC, a 65% growth is expected by 2050, with around 11 billion square meters primarily in residential buildings (IEA, 2017). This implies that the high construction rates of 3-5% per year will continue and likely increase, underscoring the need to ensure that new buildings are constructed to high-performance standards (IEA, 2020).

2.2 Globally, buildings account for 36% of final energy consumption and approximately 30% of global CO_2 emissions related to processes (IEA, 2020).[6] In LAC, the building sector contributes to climate change by representing approximately 24% of final energy consumption and 21% of CO_2 emissions related to processes (see: IEA, 2019). Simultaneously, the sector grapples with the impacts of climate change.

2.3 LAC is the second most prone region worldwide to experience environmental and climate disasters (OCHA, 2020). Climatic and geophysical events resulted in the loss of 312,000 lives and directly affected over 277 million people in the region (WMO, 2021). The impacts of climate events on the building sector are substantial, especially in highly vulnerable Caribbean countries. Most damages are concentrated in the housing sector (46%), followed by transportation (20%) and tourism (16%) (IDB, 2022).

2.4 With the PA, countries have agreed on the common goal of keeping global temperature rise well below 2 degrees Celsius, and preferably no more than 1.5 degrees Celsius, by the end of the century. According to the latest UNEP Emissions Gap Report, to reach the 1.5 degrees target, the world needs to reduce emissions by more than 50% by 2030 and move towards carbon neutrality by 2050 (GlobalABC/IEA /UNEP, 2020).

2.5 Given its significant contribution to final energy consumption and related global CO_2 emissions, the building sector must play a crucial role in achieving the temperature or decarbonization goal of the PA[7]. This scenario, coupled with the region's high vulnerability and exposure to climate events exacerbated by climate change, urgently pushes an

[6] The figure would rise to 39% of energy and process emissions when considering: (1) the production of concrete, steel, and aluminum to be used in buildings construction, adding an additional six percentage points; and (2) the production of glass and bricks to be used in building construction adds another 3 percentage points (see: UNEP, 2022).

[7] Decarbonization is understood as the process by which countries, individuals, or other entities aim to achieve a zero fossil carbon existence. It typically refers to a reduction of carbon emissions associated with electricity, industry, and transportation.

approach to both public and private sector projects financed by the IDB Group that focuses on delivering quality, sustainable, low carbon, and resilient infrastructure.

B. The building sector and the mitigation goal of the PA

2.6 **The building sector plays a crucial role in aligning with the mitigation goal of the PA.** In the dialogue and programming process of the IDB Group with governments and private sector clients, it is essential to bear in mind that, for LAC, aligning with the PA in this context implies investing in a building model that advances towards the sector decarbonization, guided by a social inclusion approach.

This section specifically focuses on the role of the building sector in gradually advancing towards net-zero greenhouse gas (GHG) emissions by mid-century[8]. Bearing in mind that to achieve this it is necessary to transcend a focus on GHG emissions reductions, and move towards decoupling economic development from: (1) the use of fossil fuels; (2) the loss of carbon sinks; and (3) the dependence on economic activities tied to models/technologies associated with high GHG generation.

2.7 According to *Net Zero by 2050* scenarios modeled by the International Energy Agency (IEA), to reduce emissions in over 50% by 2030 and work towards carbon neutrality by 2050, the building sector will have to address specific challenges and commitments, including: by 2030, achieving nearly zero carbon emissions in new and existing buildings, renovating half of the existing buildings in developed countries, and a third in developing countries. Additionally, it involves banning the sale of new fossil fuel-fired boilers and standardizing the use of heat pumps and other high-efficiency technologies (Cabeza, L.F. et al., 2022; IEA, 2020c). This implies that new buildings should be “net zero emissions ready"[9] to the extent possible.

2.8 The above is of particular relevance for cities. According to *C40 Cities*, buildings in member cities[10] of this network represent nearly 60% of cities' emissions on average, and up to 80% in some cases[11]. Consequently, C40 cities have committed to assessing the current energy demand and carbon emissions of their municipal buildings, identifying reduction opportunities, and establishing a roadmap to achieve the goal of having municipal buildings with zero net emissions.[12]

2.9 The GHG Protocol provides a standard framework and defines emissions as direct or indirect depending on their scope. This classification is applied as follows to measure GHG emissions attributable to buildings: (i) Scope 1 (direct operational emissions), referred to fuel combustion in the building, for instance, on-site gas usage for cooking, water heating and/or space heating, and refrigerant leakage; (ii) Scope 2 (indirect operational emissions) includes emissions from electricity purchased from the grid and other centralized energy sources; and (iii) Scope 3 (incorporated emissions), associated with the extraction and production of materials, waste disposal, commutes and travels, as well as the consumption and disposal of water, among others. *Operational GHG emissions* in buildings cover Scope 1-2, and are estimated based on the amount of electricity, gas and other fuels consumed during operation.

2.10 In this phase, it is worth highlighting the impact of space conditioning for thermal comfort. Heating, Ventilation and Air-Conditioning (HVAC) systems, as mentioned in the previous

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8 According to the IPCC in its Special Report on Global warming of 1.5°C, there is a need to achieve global net anthropogenic CO_2 emissions equal to zero around 2050 (2045–2055 interquartile range).

9 A net zero emissions ready building meets high efficiency standards and uses renewable energy or an energy source that can be fully decarbonized by 2050, such as electricity or district heating. (IEA, 2021b)

10 For instance, Guadalajara, Ciudad de Mexico, Medellin, Bogota, Quito, Lima, Salvador, Rio de Janeiro, Sao Paolo, Curitiba, Buenos Aires, y Santiago.

11 See C40 Cities https://www.c40.org/what-we-do/scaling-up-climate-action/energy-and-buildings/

12 See C40 https://www.c40.org/accelerators/net-zero-carbon-buildings/

paragraph, because of energy consumption (indirect impact) and potential refrigerant leaks into the atmosphere (direct impact), produce, at a global level, 4.400 million tons of CO_2-eq, or 10% of total global CO_2-eq emissions. It is estimated that 29% of the climate impact of HVAC equipment comes from direct emissions and 71% is through indirect emissions resulting from the electricity use based on fossil fuels. Therefore, for the building sector, encouraging the use of renewable energy for self-generation or through the signing of contracts for the supply of renewable energy for operation, as well as the integration of sustainable air conditioning practices (use of refrigerants with low GWP, use of systems with high energy performance coefficients, connection to district energy systems, among others) is crucial to mitigate these impacts (UNDP, 2022).

2.11 *Embodied emissions* refer to GHG emissions released during the manufacturing, transportation, construction, and end-of-life phases of materials used in building construction. They are commonly known as *embodied carbon.*[13] Global emissions from buildings in 2019 reached 12 $GtCO_2$-eq, with 81% comprising operational emissions (24% direct emissions and 57% indirect emissions), and 18% were embodied emissions from construction materials such as cement and steel (Cabeza, L.F. et al., 2022). However, the projection for new buildings in the period 2020-2050 estimates that 49% of GHG emissions will be attributed to embodied emissions, contrasting with 51% for operational emissions (Brightworks & WAP, 2023).

2.12 At present, in contrast with these challenges, 97% of commercial buildings worldwide do not support the transition to net-zero emissions, and 80% of the buildings that will be standing in 2050 have already been constructed (Londra, C., Sim L., 2022). On the other hand, low renovation rates and the limited ambition of retrofitted buildings hinder the low-emission pathways that would meet the PA goals.

2.13 In global scenarios, according to modeling conducted by the United Nations' top panel of experts (IPCC), effective policy packages combining ambitious measures of sufficiency,[14] energy efficiency,[15] and renewable energy are required for existing retrofitted buildings and buildings yet to be constructed to approach net-zero GHG by 2050. These policies should also address and remove barriers to decarbonization, with challenges related to electrification standing out.[16] Conversely, low ambition policies increase the risk of lock-in buildings in carbon for decades (Cabeza, L.F. et al., 2022; IPCC, 2022).

2.14 Building sufficiency interventions should include the optimization of the use of building, multi-functionality to allow adjusting the size of buildings to the evolving needs of their occupants, and the reuse of existing buildings to avoid using GHG-intensive materials and additional land (IPCC, 2022). Indeed, circular economy measures in buildings, and the inclusion of concepts such as incorporated emissions in public and business policies, are urgent actions to encourage the reduction of emissions in the sector.

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[13] Generally, these emissions correspond to Scope 3 under the concepts of Purchased Goods and Services (Brightworks & WAP, 2023) and especially highlights the transformation process of materials such as cement and steel (see: Carbon Leadership Forum: Embodied Carbon 101). Although the alignment with the PA of the production processes of these materials is covered by the Technical Guidance of the Manufacturing Industry of the IDB Group, it is acknowledged that government and business policies must play a role in sending regulatory and market signals to industrial groups to invest in solutions that reduce GHG emissions from these materials.

[14] Sufficiency policies are a set of measures and daily practices that avoid demand for energy, materials, land and water while delivering human well-being for all within planetary boundaries (IPCC, 2013).

[15] Energy efficiency is the use of less energy to perform the same task or achieve the same result. Energy-efficient homes and buildings consume less energy for heating, cooling, and operating electrical and electronic appliances. Similarly, energy-efficient manufacturing facilities use less energy to produce goods (U.S. Department of Energy).

[16] Building electrification is a crucial action in preparing buildings to achieve zero carbon emissions by gradually discontinuing the direct use of fossil fuels. Electrifying buildings involves the elimination of appliances that operate on fossil fuels, including those used for space heating, water heating, and cooking. (Center on Global Energy Policy at Columbia, 2023).

2.15 Regarding energy efficiency, the IPCC indicates measures, among which the following stand out: (i) the use of sustainable building codes,[17] energy codes, and mandatory or voluntary energy efficiency guidelines, as well as the use of green building certifications or labels; (ii) the use of construction materials with low GHG[18] emissions, including the reuse and recycling of existing materials, and the use of local materials and technologies; (iii) high energy performance of electrical/electronic systems and equipment, and the implementation of labeling systems; and (iv) energy audits and management systems to guarantee operational energy performance, especially in buildings with high energy demand (IPCC, 2022; IPCC, 2023).

2.16 On this specific point, the IEA establishes that, to strengthen and guide the building sector towards net zero emissions, a dramatic increase in the presence of energy codes worldwide is required (IEA, 2021). By 2022, 40% of countries had voluntary or mandatory energy codes for new buildings, but most do not have specificity for existing buildings and very few are strict enough to guarantee compliance with the PA (Climate Action Tracker, 2022). In LAC, 47 mandatory national energy codes for buildings were identified; however, most of them do not have formal mechanisms for their application (IDB, 2023) (Appendix II).

2.17 There are also sustainable or green building certifications that recognize higher standards of construction and energy performance, as well as broader sustainability metrics, especially in countries that do not have their own energy codes. As of 2021, 74 green building certifications have been identified worldwide (UNEP, 2022). In LAC, at least 23 labels and voluntary certifications that assess the energy performance of buildings were identified (Appendix II).

2.18 Another relevant measure is the incorporation of renewable energy self-generation systems into the architectural project or connection to a renewable energy system. Design approaches to the construction and retrofitting of buildings, considering the above, have increasingly led to examples of *zero-energy buildings*[19] or *net-zero-emissions buildings*[20].

2.19 The IPCC also identifies actions to eliminate barriers to decarbonization, including: providing information on practices and technologies that can reduce energy demand and increase energy efficiency, increasing investment in technological solutions, promoting change in habits and practices to reduce energy expenditure and optimizing the energy services provided (e.g. electricity and gas from the network) (IPCC, 2023).

2.20 As the buildings sector transitions to a low-carbon economy, certain elements of its value chain will need to adjust in response to new regulations, technologies, investor perceptions, and shifts in supply and demand. Consequently, new challenges, known as *transition risks,* emerge, and some activities may become financially unviable or be replaced as more viable low-GHG emissions options become available in the local context.

2.21 The transition to green buildings presents economic opportunities. A study by the IDB confirms that in the LAC region, is feasible to reduce emissions from buildings from 300 $MtCO2_e$ in 2020 to less than 5 $MtCO2_e$ by 2050. This transition also brings net benefits on the order of $150 billion (IDB, 2023). On the other hand, an IFC report found that "green

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[17] Sustainable building codes are based on bioclimatic design principles, tailored to the climatic conditions of the site. For instance, some design measures include orientation guidelines, efficient insulation, ventilation and natural lighting, thermal, acoustic, and lighting comfort levels, among others.

[18] Decarbonization measures associated with embodied energy in materials are addressed in this Technical Guidance through the analysis of green building certifications, many of which include material considerations. On the other hand, the Technical Guidance for the Manufacturing Industry analyzes decarbonization strategies for steel, aluminum, and cement industries, applicable to occasions in which the IDB Group collaborates directly with suppliers of materials for new constructions.

[19] Energy-efficient building that produces enough renewable energy on-site or nearby to meet the net annual energy consumption of the building's operations (Becqué, R., 2019).

[20] An energy-efficient building that produces on-site or acquires sufficient carbon-free renewable energy to meet the annual energy consumption of the building's operations, excluding embodied carbon.

buildings represent a significant low-carbon investment opportunity in emerging markets: $24.7 trillion by 2030." The report underscores that "green buildings are a higher-value and lower-risk assets than standard structures. Apart from reducing energy consumption and thus operational costs, green buildings often command higher resale premiums and attract and retain more tenants, ensuring a more continuous revenue stream." Furthermore, the report notes that green buildings "consume, on average, between 20% and 40% less energy and water than traditional buildings, enabling owners to save, on average, between 15% and 20% on their utility bills." According to the IFC, the LAC region represents the second-largest emerging market for green buildings (following the East Asia and Pacific region) with total opportunities valued in $4.2 trillion (IFC, 2023).

2.22 As indicated by the PAIA, the IDB Group's operations in the building sector should finance low-carbon buildings (*non-emission-intensive assets*) compared to similar buildings in their context. These buildings should mitigate transition risks and avoid *carbon lock-in*[21] that could undermine the temperature goal of the PA.

2.23 From this context, aligning the buildings financed by the IDB Group with the mitigation goal of the PA will entail ensuring that the policies and companies supported by the Bank, along with the buildings directly financed, are planned, designed, and constructed with sufficiency measures, and integrate energy efficiency and renewable energy measures as mandated by sustainable or energy building codes and/or recognized green building certification requirements. This approach ensures the progress of the building sector towards low-carbon models or carbon neutrality by 2050. (Section III.A will provide specific details on the requirements.) In this sense, the absence of proactive efforts would not only undermine global endeavors to address the causes of climate change but would also jeopardize economic sustainability and diminish the quality of the infrastructure financed by the IDB Group.

C. The building sector and the adaptation goal of the PA

2.24 During the dialogue and programming process of the IDB Group with governments and private sector clients, it is important to consider that LAC is vulnerable to geophysical and hydrometeorological hazards exacerbated by climate change. This has implications for aligning investments in the building sector with the adaptation goal of the PA.

2.25 According to the report *"Roadmap for Climate Action in Latin America and the Caribbean 2021-25,"* climate-related stocks, such as hurricanes, storms, droughts, fires, and floods, are becoming increasingly frequent and intense in LAC, which combined with other factors, make LAC one of the most vulnerable regions to the effects of climate change. These events result in substantial economic losses, with annual costs due to infrastructure disruptions to power and transportation systems equivalent to 1% of Regional GDP and up to 2% in several Central American countries (GBM, 2021).

2.26 The impact of these events on the building stock is also noteworthy. In the Caribbean, for instance, potential impacts range from 4.79% of the total capital stock in the Bahamas to less than 0.5% in Guyana, with a regional average of 1.9%. This implies that, due to the damage caused by climate phenomena, Caribbean countries would need to fully replace their buildings every 50 years on average, and every 20 years in more affected countries, such as The Bahamas, -well below the expected useful life of most infrastructures (IDB, 2022b)."

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[21] "In this context, "carbon lock-in" refers to financing a building using techniques, materials and technologies for which there are already viable alternatives in the local market that are less GHG intensive. Generally, the concept refers to the expectation that a GHG emissions-intensive asset will continue operating in a context where there are already less emissions-intensive options that are feasible – and economically preferable. This is due to technical, economic and/or institutional factors associated with the investment.

2.27 Likewise, the impact on social infrastructure is also relevant. In LAC, 9 out of 10 children live in high-risk places, where at least two types of climate and environmental shocks overlap, which hinders their access to education (UNICEF, 2021a). Studies conducted by the Pan American Health Organization (PAHO) estimate that 67% of health facilities are at risk (PAHO, 2006; PAHO, 2018a). The impact on informal neighborhoods is also significant, as they are often located in areas prone to flooding or landslide with precarious construction and substandard materials (Williams et al., 2019). Furthermore, if trends do not change with concrete climate actions by 2050, more than 17 million people (2.6% of the region's population) could be forced to move regionally to avoid the impacts of climate change, becoming 'internal climate migrants' (GBM, 2018) in search of immediate housing solutions.

2.28 UN Environment (2021) explains that measures taken today to improve the resilience of buildings to a changing climate will provide benefits, "*even if uncertainty remains over the exact degree of warming or climate change that may occur in the future. We must not only consider measures that reduce vulnerability today, but also think about the challenges of the future. (…) "Adaptable" design can be very important considering multiple future scenarios."*

2.29 In general, building codes in developing countries often lack adequate incorporation of climate adaptation measures, which represents a significant opportunity for improvement in this area. To effectively reduce climate vulnerability, building codes must be well-designed and include the following features: (i) consider future impact modeling, (changes in frequency and intensity of precipitation, heatwaves, etc., under global warming scenarios); (ii) establish new legal construction requirements supported by the best available science; (iii) promote broad dissemination channels of said requirements, enabling builders, architects, and product suppliers to learn and, consequently, apply the new building requirements; and (iv) require compliance thorough inspections of the design and construction of buildings (UN Environment, 2021)."

2.30 Governments must also promote an enabling environment for the successful implementation of adaptation measures in the building sector. " Adaptation at-scale will not be possible without the governments' good will to introduce the necessary changes to building standards, promote risk awareness, subsidize adaptation measures in existing buildings, and encourage skills training in the construction sector" (UN Environment, 2021).

2.31 The IDB Group has a consolidated track record of promoting climate resilience measures in the buildings it finances[22]. Additionally, it collaborates with governments in the LAC region to encourage improved regulations and policies that incorporate resilience and adaptation measures to climate change in the sector. Examples include the delimitation of safe construction zones, the establishment of construction restrictions in areas prone to flooding, landslides, or other phenomena, the implementation of building codes with climate resilience criteria, and the promotion of water reuse and recycling in buildings, as well as systems for the collection, treatment and reuse of rainwater or gray water.

2.32 Given this context, the IDB Group must not only continue to incorporate resilience issues into its operations, but also promote greater ambition in updating regulatory instruments, training labor skills, managing technological transition, and collaborating with the private sector to design constructive and financial solutions that promote long-term climate resilience in the sector.

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[22] "Green Buildings - Guidelines for the Incorporation and Accounting of Mitigation and Adaptation Measures to Climate Change" *(Original title: Edificios verdes: lineamientos para la incorporación y contabilización de medidas de mitigación y adaptación al cambio climático)* presents adaptation strategies that can be applied to different climate vulnerability scenarios. Among them, the following stand out: reinforced envelope, protection on doors, glass, and windows (to resist hurricane winds); elevation of the ground floor, inclusion of permeable areas or rain gardens (to resist flooding); Cool or green roofs (to offset urban heat island effects).

D. Synergies between climate change mitigation and adaptation, and the development of the building sector

2.33 Mitigation strategies in the building sector are directly linked to the way in which buildings adapt to the impacts caused by climate change and strengthen their resilience. Some important synergies include:

a. Adequate planning and efficient design enable buildings to adapt to climatic conditions and environmental vulnerabilities, promoting the reduction of GHG emissions associated with construction materials[23] and energy demand during the use phase. Simultaneously, these design considerations (such as energy and water efficiency strategies), have the potential to enhance the resilience of buildings in the face of climate vulnerabilities such as heatwaves, droughts, increased levels of water bodies, increased intensity and frequency of precipitation or increase in strong hurricane-force winds. Additionally, proper use and maintenance of facilities contribute to the optimal functioning of the building, minimizing GHG emissions, and ensuring the correct performance of adaptation measures.

b. From an energy autonomy perspective, the incorporation of renewable energy in buildings enables a reduction in the generation of GHG emissions associated with the use of energy from fossil sources. On the other hand, in terms of climate adaptation, on-site clean energy generation in buildings allows increasing resilience and energy security, fostering autonomy, especially after the occurrence of extreme climatic events or natural disasters.

c. The reduction of green areas in urban contexts, resulting from increased construction, along with GHG emissions and the accumulation of heat on surfaces, directly impacts the *urban heat island* [24] effect. Green buildings reduce energy demand for cooling and/or heating spaces, thereby mitigating associated GHG emissions. Furthermore, climate adaptation strategies in buildings envelopes (such as cool or green roofs) can reverse the urban heat island effect, promoting buildings and urban contexts that are more resilient to the global temperature increase. Some studies estimate that Nature-Based Solutions (NbS) [25], such as trees and vegetation in outdoor or covered areas, reduce surface and air temperatures, making them 11 to 25 °C cooler than maximum temperatures of unshaded materials (U.S. EPA, 2018).

d. On the other hand, the use of native materials or local production as a mitigation measure, especially in isolated intervention areas, also allows reducing time and costs associated with the supply and transfer of materials, while simultaneously boosting local economic activity within a territory.

2.34 In terms of territorial and urban planning, as well as building design, these goals open a whole new agenda to work on with the construction value chain[26], promote innovation in materials and technologies, encourage the adoption of Nature-Based Solutions (NbS),

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[23] Likewise, the use of timber materials, for example, that come from forest areas covered by an independently verified forest management certification system can contribute to SDG Indicator 15.2 “promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally” (UN Department of Economic and Social Affairs, 2021).

[24] Urban Heat Island (UHI): The relative heat of a city with respect to surrounding countryside areas, frequently associated with changes in runoff, effects on heat retention, and variations in surface albedo (the capacity that surfaces have to reflect solar radiation) (IPCC, 2013)

[25] See specific strategies in IDB Publications: Urban Green Infrastructure II: Implementing and Monitoring of Solutions *(Original title Infraestructura Verde Urbana II: Implementación y seguimiento de soluciones),* Increasing Infrastructure Resilience with Nature-Based Solutions (NbS) Building a more Resilient and Low-Carbon Caribbean: Report 4: Infrastructure Resilience in the Caribbean through Nature Based Solutions.

[26] The construction value chain is complex and involves various stakeholders with expertise in diverse processes, including architectural and engineering designs, professional and industrial services for construction, production, transportation, and supply of materials and equipment; as well as public regulation, marketing, and financial services, all the way to reaching the end user.

and increase the retrofitting of existing buildings[27]. All these initiatives contribute to the generation of new green jobs in the sector, even for workers in the informal economy (Saget et al., 2020).

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

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

3.2 The alignment of buildings with the PA mitigation goal implies ensuring consistency with a decarbonization pathway towards net-zero emissions by mid-century, in the country where the project is located; it implies not hindering or harming the transition to a decarbonized economy, both at the country and global levels.

3.3 **In operations with targeted use of proceeds**[28], 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 not aligned" with the PA mitigation goal. In a second step, projects that do not belong to 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 risks analysis. This procedure is described in detail later in this document.

3.4 **For financing without targeted use of proceeds** comprised by budget support (PBL), operations with financial intermediaries, working capital, capital investment, or other uses of corporate funds, the general principles and technical reference of sections A-C in this document will be taken as reference, but applying the MDB approach already adapted for each case: Policy-based lending operations, Financial intermediaries, (in conjunction with the *IDB Group Technical Guidance for Operations with Financial Intermediaries* GN-3142-2), and General Corporate Purpose Financing (GCPF).

3.5 The key principles in IDB Group's PAIA (section II.C) outline that these criteria must be applied to the building 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**.**

A. Activities universally aligned with the PA mitigation goal

1. General framework established by the MDB

3.6 In accordance with the List of Universally Aligned and Universally Non-Aligned Activities of the MDB, some activities will be considered consistent with the PA decarbonization goal across countries and under all circumstances. Table 1 captures universally aligned activities in the Buildings and public Installations sector:

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[27] Regarding the retrofitting of existing buildings, the IPCC indicates that "In modelled global scenarios, existing buildings, if retrofitted, and buildings yet to be built, are projected to approach net zero GHG emissions in 2050 if policy packages, which combine ambitious sufficiency, efficiency, and renewable energy measures, are effectively implemented and barriers to decarbonization are removed. Low ambitious policies increase the risk of lock-in buildings in carbon for decades while well-designed and effectively implemented mitigation interventions, in both new buildings and existing ones if retrofitted, have significant potential to contribute to achieving SDGs in all regions while adapting buildings to future climate" (IPCC, 2022).

[28] In the case of the IDB, the "targeted use of proceeds" category includes Global of Multiple Works Operations (GOM), although the details of the entire list of works are not known in advance. In these cases, alignment with the PA is evaluated using the same sample of projects that is studied for the application of the ESPF.

Table 1: Activities of the Buildings and public Installations sector considered universally aligned to the mitigation goal of the Paris Agreement

Sector	Eligible operation type	Conditions and guidance
Buildings and public Installations	Buildings (education, healthcare, housing, offices, retail, etc.).	Needs to meet green building certification criteria as established by each individual MDB.[29]
	LED street lighting.	
	Parks and open public spaces.	Excluding energy-consuming installations.[30]

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

3.7 As established in the MDB methodology, these activities are universally aligned as long as: "(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) the operation does not depend significantly on the direct use of fossil fuels.

3.8 According to the above, for the activities of the building sector to be considered universally aligned with the PA mitigation goal, it is necessary that the buildings (i) meet the requirements of a green certification system recognized by the IDB Group, and (ii) their activities do not depend on the use of fossil fuels during their operation (such as systems for cooking, water heating, heating, or similar). Otherwise, they require specific analysis to determine their alignment (section B).

3.9 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)[31], 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.

2. **Activities of the building sector** universally aligned in the IDB Group

3.10 The IDB Group aims to promote a just transition approach regarding the requirements of green certification systems, based on the reality of the countries in the region. Therefore, more ambitious criteria will be applied for buildings that imply a high risk of hindering the transition, that is, **energy-intensive buildings.** For the IDB Group, these are defined as those whose energy demand is equal to or greater than 400 MWh per year[32],in accordance with the calculation guidelines described in detail in Appendix I. In this sense and as part of due diligence, the project's originating team must confirm the energy intensity category of the building infrastructure to be financed as early as possible. If such confirmation is not received, the evaluation with the Paris Agreement will proceed under the principle of conservativeness of the MDB, applying the criteria of energy-intensive buildings until evidence to the contrary is presented.

[29] MDBs are working on the approach to assess the Paris alignment of buildings and the role of certification schemes. This approach can also take into account the impact of materials on the alignment of buildings with the low-carbon pathways envisioned by the Paris Agreement.

[30] Energy-consuming installations are those beyond lighting and routine maintenance such as watering. Examples are major built-up area (i.e., buildings) or energy-intensive installations (e.g., fountains or playground and recreational equipment that need a non-renewable power source).

[31] 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.

[32] This value is calculated considering the energy consumption estimated by the Energy Star Technical Reference based on building typologies and the estimated construction area of the project in question. Subsequently, a prescriptive and statistical analysis was developed for a sample of 100 operations (86 from the IDB and 14 from IDB Invest), that include a total of more than 3,000 buildings of different typologies financed by the IDB Group. In the analysis, the lowest quartile results in consumption of less than 400 MWh per year and is consequently considered non-energy-intensive and has a low risk of hindering the transition. Appendix I provides greater details on the methodology used for the calculation.

3.11 Table 2 details the necessary conditions and guidelines, according to intervention typology, so that buildings are considered universally aligned with the PA mitigation goal in the IDB Group:

Table 2 Universally aligned[33] building sector activities and assumptions depending on the use of fossil fuels

Type of building/eligible activity	**Energy demand** (for calculation, refer to Appendix I)	**Conditions and guidelines for UNIVERSALLY ALIGNED BUILDINGS**	**Does the building contemplate the use of fossil fuels during its operation?**	**Additional alignment conditions with PA in mitigation**
New construction, expansion, or major retrofitting of buildings	≥ 400 MWh[34] per year = **energy-intensive** buildings	**YES** *They meet the requirements of a green certification system recognized by the IDB Group*	**NO**	No specific assessment is required.
			YES	A specific assessment is required only for fossil fuel-dependent activities.
	< 400 MWh / year = **Non-energy-intensive** buildings	**YES** It comprehensively includes minimum criteria for bioclimatic design, energy efficiency, renewable energy and incorporates low carbon materials**	**NO**	No specific assessment is required.
			YES	A specific assessment is required only for fossil fuel-dependent activities.
Retrofitting, repair, or minor improvement **activities** [35]	N/A	**YES** They include sustainable criteria, where applicable.	**NO**	No specific assessment is required.
			YES	A specific assessment is required only for fossil fuel-dependent activities.

*Note that to consider the activity universally aligned, the MDB methodology requires that the project meets – not obtains – green building certification criteria validated by the Bank. The IDB Group adheres to the guidelines established by the MDB to validate acceptable certification systems. These guidelines include *"(i) Its statement of climate performance requirements must be clear, exhaustive and strict; (ii) Require quality control by at least two independent experts from the certifying entities in each phase of certification; and (iii) Require final certification after construction*[36]".

The certification systems, which comply with these guidelines, include all those recognized by the World Green Building Council (WorldGBC), and/or national certifications, energy or sustainable construction codes identified by the IDB Group in LAC and detailed in Appendix II .).

For data centers hosted by a building, please note there are green building certifications that also cover the data center. For example, LEED BD+C: Data Centers, LEED O+M (for operational data centers), EDGE Building (applied to data centers), BREEAM (applied to data centers) and Energy Star (data centers; starting from of a rating of 75 points). In this sense, and in accordance with the Technical Guidance for the Information and Communication Technologies Sector, if the requirements of any of these certifications are met, the building will be considered universally aligned, and the data center aligned in accordance with the aforementioned Technical Guidance (with the understanding that data centers always require specific analysis).

[33] It should be noted that an operation can only be considered "universally aligned" when all its financeable activities are classified under universally aligned categories.

[34] This indicative threshold may vary according to specific studies by region, country, and segment.

[35] They include, but are not limited to activities related to painting, maintenance, and replacement of carpentry, sealing, and plastering on walls and floors, non-structural roof changes, maintenance of lighting systems or mechanical equipment. In these cases, if applicable, an early dialogue with the executor or client will be encouraged to incorporate best energy efficiency and sustainability practices.

[36] Guidelines taken from "Common Principles for Climate Mitigation Finance Tracking", published in 2021 by the Joint Climate Finance Tracking Group of multilateral development banks (MDB) and referred to in the working draft "Implementing the MDB' Characterization Framework for Alignment with the Paris Agreement's Mitigation Goals" that MDB are working to harmonize their approach to assess the Paris Alignment of buildings and the role of certification schemes.

** *Appendix III outlines the criteria that should be considered as part of the planning, design, and construction of non-energy-intensive buildings. It is considered that, depending on the context and established local climate zoning, the comprehensive incorporation of these strategies will achieve savings equivalent to at least 20% of energy and water resources with respect to the baselines established by the EDGE certification. These strategies were determined based on research and exploratory results in architectural prototypes for Hospital, School, and Passenger Terminal infrastructure in approximately 30 cities in LAC.*

3.12 Although the buildings listed in Table 2 are considered universally aligned, the IDB Group acknowledges the importance of promoting ambitious strategies that reduce any risk of carbon lock-in as part of its dialogue with the country/client. This includes advocating for higher standards, such as more ambitious green certification levels, electrified buildings, net-zero buildings, and other climate-friendly building practices; in addition to the adoption of mandatory building codes to achieve "net-zero emissions ready" buildings. The above, with the understanding that the promotion of said strategies is even more relevant for energy-intensive buildings, in which case the IDB Group must aim to raise the ambition with counterparties, as part of its Paris Agreement alignment approach.

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

3.13 Projects that include buildings that do not meet the requirements of a green certification system recognized by the IDB Group, and/or that include activities dependent on fossil fuels, as described in **Table 2**, will require a specific assessment to determine their alignment to the PA mitigation goal.

C. Criteria for the specific assessment

3.14 For activities that cannot be considered under the universally aligned list, there are five specific criteria to be analyzed, as noted in **Table 3**. In order to consider those types of operations as aligned with the mitigation goal of the PA, the answer to ALL questions from the specific assessment must be "No".

Table 2 Specific criteria of the MDB Joint Framework for Alignment with the PA-Direct Investments

Specific Criteria (SC)
SC1: Is it inconsistent with the Nationally Determined Contribution of the country? *The NDC of the country should not explicitly or implicitly phase-out this type of activity.*
SC2: Is it inconsistent with the Long-Term Strategy of the country? *The LTS (or similar long-term low-GHG strategy) of the country should not explicitly or implicitly phase-out this type of activity in its lifetime.*
SC3. Is it inconsistent with the global sector-specific decarbonization pathways in line with the PA, considering countries' common but differentiated responsibilities and respective capabilities? *The operation/activity should be checked against widely accepted findings in the global literature to inform the analysis, given the local context and equity.*
SC4: Does it prevent the transition to PA-aligned activities or primarily support or directly depend on non-aligned activities? *The type of operation/ activity should be compared to lower-carbon alternatives and consider the risk of (i) carbon lock-in or (ii) preventing future deployment of Paris-aligned activities.* *When the risk of carbon lock-in is deemed considerable, the application of this criterion involves an analysis of alternatives, preferably validated by a third party.*
SC5: Do transition risks or stranded assets make it economically unviable? *Once climate change considerations are included in the economic and/or financial analysis of the operation, it should meet IDB Group's viability thresholds.*

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: Own elaboration based on the Joint MDB Methodological Principles for Assessment of Paris Agreement Alignment of Direct Investment Lending Operations

3.15 Table 4 details the methodological treatment and documentation required for the different conditions that can be verified in projects including buildings. This table is intended to guide the specific analysis under different circumstances, in correspondence with what is described in Table 2.

Table 4 Specific criteria of the Joint MDB Principles for PA alignment – direct investment, buildings

Building Typology	Conditions	Methodological treatment and documentation
New construction, expansion, or major retrofitting of **energy-intensive** buildings (≥ 400 MWh per year)	**It does not meet** the requirements of a green certification scheme recognized by the IDB Group and is considered **HIGH risk** of hindering the transition.	**SC1-2: Demonstrate compatibility with the country's** decarbonization goals. The country's NDC and the LTS – if any – should not explicitly or implicitly phase-out this type of operation/activity. **SC3: Compare with relevant benchmarks at the local and regional level that are consistent with the decarbonization pathways to meet the PA (see paragraph ¶3.18) and consider national circumstances**. It is recommended to use market research to evaluate building decarbonization goals and measures that are reasonable targets in the context. **SC4-5: Demonstrate feasibility with a robust analysis of alternatives (preferably verified by a third party) that considers carbon lock-in and transition risks in technical and economic feasibility**[37]. The justification for alignment with the PA must cite a study that compares options based on their GHG emissions and their implication for the selection of the technically, economically, and financially viable option with the lowest emissions (considering embodied emissions, unless there is a justification indicating that this is not possible in the context).
New construction, expansion, or major retrofitting of **non-energy-intensive** buildings < 400 MWh per year	**It does not** comprehensively include minimum criteria for bioclimatic design, energy efficiency, renewable energy and incorporates low-carbon materials indicated in Appendix III, but is considered to have **LOW risk** of hindering the transition.	**SC1-2: Demonstrate compatibility with the country's decarbonization goals.** The country's NDC and the LTS – if any – should not explicitly or implicitly phase-out this type of operation/activity. **SC3: Compare with relevant benchmarks at the local and regional level that are consistent with the decarbonization pathways to meet the PA (see paragraph ¶3.18) and consider national circumstances**. Use literature and evidence from similar contexts immediately available. **SC4: Simple comparison of alternatives,** of those elements with an impact on the building's performance. The review of alternatives with the counterparty will be considered as sufficient justification to argue no risk of carbon lock-in. It is always preferable to incorporate technical and economic modeling data to substantiate feasibility. **SC5: Qualitatively consider transition risks for end users**. For example, the estimated impact on household economy that the absence of bioclimatic design and efficient technologies would have should energy prices rise.

[37] To assess carbon lock-in, the useful life of the asset (building) is reviewed to determine whether it will continue to operate in an GHG-intensive manner by 2050, particularly given any probable emergence of lower-emission alternatives that may replace it in the coming years. The mitigation of this risk can be achieved by considering arrangements that will allow it to adapt its operation to reduce emissions throughout its useful life. Regarding transition risks, these can be regulatory, technological and/or market-related; the financial analysis of the project must qualitatively identify if there are material transition risks for the project; if so, these should be incorporated in quantitative terms into the analysis (for example, modeling the effect of taxes on the CO_2 content; applying lower rates of return or capital gains associated with carbon-intensive building, among others, and checking whether viability thresholds are met).

Building Typology	Conditions	Methodological treatment and documentation
Building activities include dependent on the use of fossil fuels during its operation.	**Activities dependent on fossil fuels** (for example, systems for cooking, water heating, heating, cooling, refrigeration, or similar, as well as diesel backup power systems).	**SC1-2: Demonstrate compatibility with the country's decarbonization goals.** The country's NDC and the LTS – if any – should not explicitly or implicitly phase-out this type of operation/activity. (e.g. systems for cooking, water heating, heating, cooling and/or refrigeration). **SC3: Compare with relevant benchmarks at the local and regional level that are consistent with the decarbonization pathways to meet the PA (see Energy Sector Technical Guidance) and consider national circumstances.** In the case of cooking systems, it is recommended to consult the IEA Clean Cooking Report **SC4-5: Demonstrate feasibility with a robust analysis of alternatives (preferably verified by a third party) that considers carbon lock-in and transition risks in technical and economic feasibility.**[38] For example, LP gas (liquefied petroleum gas), natural gas, electric, biogas and ethanol cooking solutions will have to be compared to determine the option with the lowest risk of carbon lock-in, transition risks and stranded assets.

Source: Own elaboration, based on the Joint MDB Methodological Framework for Assessment of Paris Agreement Alignment of Direct Investment Operations.

1. Details for specific assessment

3.16 **SC1 - SC2: Review of the Nationally Determined Contribution (NDC) and the Long-Term Strategy (LTS):** the project and its activities must not contravene the NDC, LTS and other supporting plans linked to national climate commitments, including sectoral and subnational plans. These criteria include analyzing these instruments and ensuring that investment is not excluded or subject to a phase-out in such plans or policies, preferably contributing to them whenever possible. At this point, for example, the energy efficiency goals that countries include in their NDCs can be reviewed, as well as specific goals related to the building sector.

3.17 Some mentions related to the building sector in LTS of LAC at the time of writing this document are:

i. The LTS of Argentina includes the transformation of the energy system as a strategic line, emphasizing "*technological changes, as well as modifications both in the way in which energy is generated and in the rooted habits and behaviors that shape energy use, placing efficiency and energy savings policies as central axes of the decarbonization of domestic demand.*"

ii. The LTS of Belize includes the objective of reducing energy consumption in public buildings by 27.5% by 2040 and 50% by 2050, compared to the business-as-usual scenario.

iii. The LTS of Chile includes as one of its goals to achieve net-zero emissions by 2050 in all new residential and non-residential buildings.

iv. The LTS of Colombia includes a series of transformation options called "bets", one of them being the installation of solar panels for electricity production in 100% of

[38] The Technical Guidance of the Energy Sector indicates the following questions: Based on a robust analysis of alternatives, has it been verified that the option to be financed is considered the most technically and economically viable to provide the same energy service? What is the useful life of the asset? Even in the face of the probable existence of lower emissions alternatives that could replace it in the coming years, is it expected to continue operating in an intensive manner in GHG emissions by 2050? What kind of arrangements will allow the operation to adapt for reducing emissions throughout its useful life? Does the energy investment to be financed prevent the development of alternatives with lower GHG emissions? For example, by discouraging bidders from entering the market with lower carbon solutions.

new buildings in regions with potential for it. Additionally, it aims to ensure that 100% of both new and existing buildings achieve net-zero operational carbon emissions.

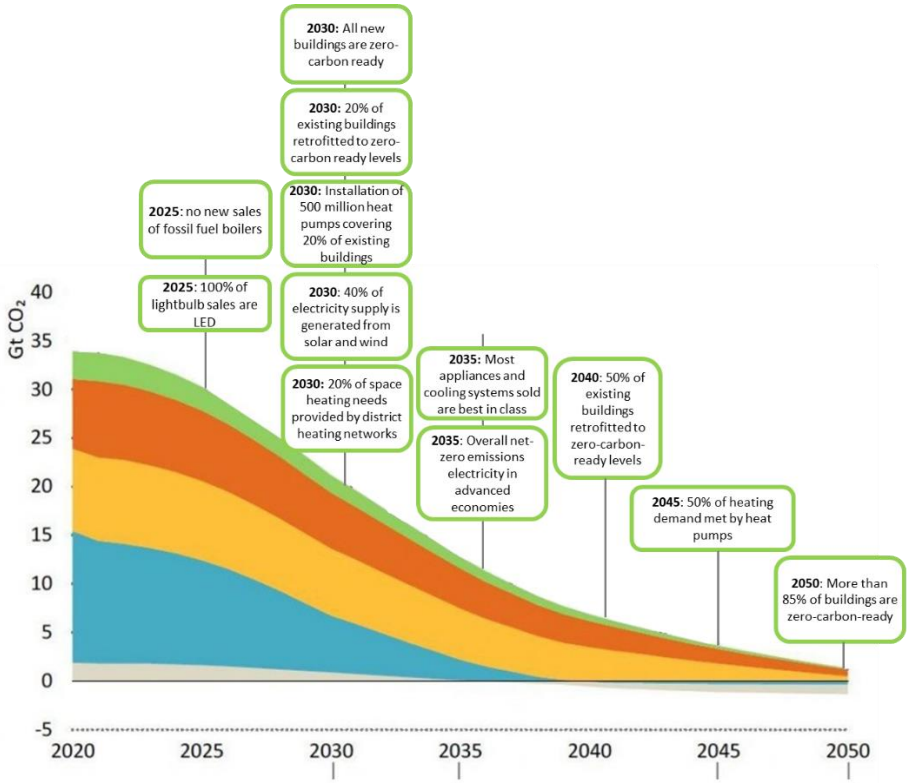
v. The LTS of Guatemala LTS includes energy efficiency in existing buildings as a mitigation priority.

vi. The LTS of Uruguay sets aspirational goals for achieving net-zero emissions in the residential sector by 2050, and in the commercial and services sector by 2045.

3.18 **SC3: Review of sectoral low carbon pathways (LCP):** in the context of the operation, the project must not be incompatible with sectoral LCPs such as those described below. This will be assessed with considerations related to the principle of equity and national circumstances, particularly considering the analysis of alternatives under SC4.

3.19 For the SC3 analysis of global low-emission development pathways, Figure 1 outlines specific decarbonization milestones in the building sector under the scenarios modeled for the IEA'S report *Net Zero by 2050* (IEA 2021), including "zero carbon ready" buildings.

Figure 1. Key milestones on the pathway to net zero in the building sector



Source: "Technology and Innovation Pathways for Zero-carbon-ready Buildings by 2030" IEA, 2022.[39]

3.20 Contextual factors to consider when responding to this criterion are described below, and others may exist according to the scope of each project:

a. Geographic context. For example, does it refer to building projects located in isolated communities and/or that have little availability of renewable energy resources on-site or on the grid? Does this condition make it more challenging to prove high performance in mitigation?

[39] Regarding district networks, the IEA highlights that aligning with the Net Zero Emissions by 2050 Scenario requires significant efforts to rapidly improve the energy efficiency of existing networks, switch them to renewable heat sources (such as bioenergy, solar thermal, heat pumps and geothermal)

b. Market context. For example, is there technology, materials, equipment, labor, or other value chain stakeholders available locally to adopt more advanced technologies? Are the associated costs feasible and affordable in the building context?

c. Context of regulatory or concessional resources and/or donations. For example, is there availability of resources to address the financial barriers that make it difficult to absorb the capital cost of adopting more advanced technologies? Are there regulations that hinder or slow down the incorporation of energy efficiency technologies? Would it be cost-effective for the IDB Group to seek expanded access to concessional resources to accelerate the viability of a low-emission building in this context?

3.21 **SC4 No obstruction of the transition ("carbon lock-in"):** In the case of buildings that do not meet the requirements described in Table 2, it is necessary to carry out an analysis of alternatives that considers locked-in GHG emissions associated to the investment. When the risk of carbon lock-in is considered significant, the application of this criterion implies a robust analysis of alternatives, preferably validated by a third party. The analysis of alternatives under this criterion must be carried out in accordance with the following considerations:

a. For projects that are not considered universally aligned, which also present a high risk of carbon lock-in since they are **energy-intensive** buildings (Appendix 1), **a robust comparison of alternatives** must be prepared, especially for those elements that have a major impact on the performance of the building (for example: envelope, energy performance of HVAC equipment such as air conditioning, heating, cooling systems). This analysis (to be included in the technical and economic feasibility studies of alternatives) must be conclusive on the feasibility/ infeasibility of reducing the consumption of resources (energy, water, materials) so that GHG emissions are minimized.

b. For projects that are not considered universally aligned, but present a low risk of carbon lock-in since they are **non-energy intensive** buildings (Appendix 1), **a simple comparison of alternatives** must be prepared, especially for those elements that have a major impact on the performance of the building (for example: envelope, energy performance of HVAC equipment such as air conditioning, heating, cooling systems).

c. For projects that include fossil fuel-dependent activities, a specific assessment will be required for such activity in accordance with the *Energy Technical Guidance* (Appendix IV and Appendix V). The analysis must be conclusive on the technical, technological, and financial feasibility/infeasibility of supplying energy with sources of lower GHG intensity and/or through the total electrification of the facilities, regardless of the energy matrix of the network. The assessment must be commensurate to the scale of fossil fuel-dependent activities. For instance, in the case of gas cooking installations, with gas cylinders/tanks or connection to an existing network, the analysis of market alternatives must be based on available information. In cases of high risk of lock-in (for example, financing of a fossil fuel-dependent asset with a larger lifespan, such as a gas distribution pipe), a comparison of alternatives with lower GHG emissions will be required as part of the technical and economic feasibility analysis of the project.

3.22 The market barriers identified through these analyses of alternatives will be included in the IDB's technical cooperation agenda with the country, to fill information gaps, guide and scale solutions that will enable the total abandonment of fossil fuels in the construction of

new buildings in the near future (refer to the next section) and that promote “net zero emissions ready” buildings.

3.23 **SC5: Economic viability given transition risks.** This criterion implies analyzing the risks of climate transition (that is, those associated with a future scenario that keeps the rise in temperature well below 2°C), and monetizing –to the extent possible– the costs and benefits associated with the level of GHG emissions of the financed building. An operation will be considered non-aligned if the economic analysis indicates that once the quantitative or qualitative implications of climate change have already been incorporated into the analysis, the project does not meet the thresholds of economic and financial viability required by the IDB Group.

3.24 In the case of buildings that are considered to have a low risk of carbon lock-in, that is, non-energy intensive buildings in accordance with Appendix 1, and therefore, do not require an exhaustive analysis of alternatives under SC4, it will be particularly relevant to address SC5 by advocating for measures that protect the end beneficiary[40] against transition risks.

3.25 The IDB Group, both in the public and private spheres, has begun to monitor the risks of climate transition in its portfolio based on internationally recognized methodological approaches. Mainly, the one established by the Task Force on Climate Related Financial Disclosures (TCFD)[41], which broadly covers three areas of change: a) changes in policies and regulations associated with the transition; b) technological improvements and innovations in the sector; c) potential changes in supply (for example, investor decisions) and/or consumer behavior, i.e., changes in the markets. Likewise, it is worth mentioning that specifically for the building sector, IRENA has already published a methodology to evaluate the risk exposure of stranded assets (See: IRENA, 2017). The latter includes, among other aspects, assessing the cost that would entail the retrofit of a building under energy performance standards to update it in accordance with the changes that climate change policies bring to the sector.

3.26 Therefore, to meet this criterion, it is necessary to determine if there are material risks for the transition in the sub-sector of the operation. If so, these will have to be incorporated in the financial sensitivity analysis, estimating their impact on the feasibility of the project. In this context, the main guiding questions will be the following:

a. Possible **regulatory changes** in order to transition to low GHG emissions pathways, these changes may have an impact on the operations of the IDB Group. For example, are the country's building codes expected to gradually include more stringent requirements to achieve net-zero emissions in the sector[42]? Could building codes include new retrofitting requirements for existing buildings to contribute to the goal of net-zero emissions? Is it likely that a greater tax burden will be imposed on less green buildings, or, on the contrary, that tax incentives will be established for green buildings?[43] Illustratively, there are examples of what occurs in the European market[44], but also in LAC: in Chile, for instance, regulations mandate that all biddings

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40 For example, when dealing with populations in poverty and vulnerability, it is important to consider what percentage of the family's income is allocated to energy consumption in the household.

41 See: “Recommendations of the Task Force on Climate-related Financial Disclosures” (2017).

42 For example, the Costa Rica’s LTS includes as a goal “strengthen the norms, standards and incentives for the effective implementation of sustainable construction practices in buildings and other infrastructure,” while Belize’s LTS recognizes that “the reform of the National Building Code is a long-standing challenge for Belizean construction industry and should include proactive climatic tiered standards that allow for quantification of energy efficiency in buildings”.

43 For example, Costa Rica’s LTS mentions the green tax reform and specifically “consider increasing taxes on the most polluting materials”, in addition to o revise the formulation of the electricity tariff in order to encourage a greater electrification in new and existing buildings. For its part, Belize’s LTS recognizes that incentive programs are critical to achieving energy efficiency in buildings.

44 In the European Union, a Buildings Directive was issued in 2010 requiring an Energy Performance Certificate (*Certificado de Desempeño Energético*) that monitors the heating and cooling of all properties in its member countries; Updated in 2018 and

processes or contests for public sector buildings include the parameters of passive design, energy savings, environmental comfort and water savings of the Standardized Terms of Reference (*Términos de Referencia Estandarizados*), which are updated at least every five years (see: Ceela Project, 2023).

b. Possible **technological changes and innovations** in the sector, and how they would impact investment decisions in projects. For example, current investments in commercial buildings that are unable to incorporate technological improvements in areas such as renewable energy, thermal insulation, among others, could face negative implications for their attractiveness to investors and subsequent profitability.

c. The potential impacts of **market changes** (changes in supply and/or consumer behaviors) in response to the climate transition. What effects could be expected from changes in the market? In the case of buildings, in the event of a future sale or rent, buyers/tenants are expected to increasingly have a greater preference for "net-zero emissions ready" buildings. Currently, buildings with on-site clean energy generation are already considered more profitable by appraisal professionals (Leskinen, N. t.al. 2020). For their part, energy consumption certifications have some implications in the valuation of building assets (Pascual R. et.al. 2017, Olaussen J.O. 2021), an aspect that is first evident in the real estate markets of cities in more developed economies (for example, the United Kingdom and Australia). Box 1 exemplifies some emblematic risks of the building sector.

Box 1 Climate Transition Risks in the building sector

Government regulators around the world are increasingly approving laws, rules, and ordinances regarding the performance and disclosure of real estate assets according to environmental, social, and governance (ESG) criteria. **These requirements are forcing real estate investors to measure and report – and in some cases publicly disclose –the energy and water use, waste, carbon emissions, and climate change risks of their assets, including buildings.**

It is these fast-paced developments in the regulatory landscape that will likely support the adoption of policies and practices toward low-carbon economy change over the next few years. These requirements are also instigating much innovation in the design, development, and construction of new buildings as well as renovation of existing stock with long lifespans ahead of them. Regulators are taking this stance because they are being demanded by the marketplace and the next generation of consumers and politicians to address climate change.

Source: Counselors of Real Estate: 2022-2023 Top Ten Issues Affecting Real Estate.

3.27 For the assessment and management of transition risks, energy-intensive buildings that are not considered universally aligned will have to consider a shadow carbon price [45] in the economic analysis of their construction and operation costs. This is essential to verify that the building's operation will not be compromised by higher maintenance costs. In the event that the economic analysis is not viable or shows inconclusive results, the design of the operation must include strategies considered sufficiently robust by the IDB Group to manage transition risks, such as:

a. Prioritization of passive design strategies that improve the energy efficiency of the building.

2021, it now requires a 55% reduction in GHG emissions by 2030 and recommends national governments only highly acquire energy- efficient buildings. In addition, the requirement to place solar technologies in all new buildings by 2028 is currently being evaluated (see: European Parliament March 2023).

[45] Although the IDB does not have a mandatory policy or guideline for the use of shadow carbon pricing, project teams that include it in their analyzes are recommended to use low and high estimates consistent with the Report of the High-Level Commission on Carbon Prices. In this sense, 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 values in the prices of carbon are extrapolated from 2030 to 2050 using the same growth rate of 2.25% per year that is implicit between 2020 and 2030, resulting in values of US$78/tCO2 and US$156/tCO2 for 2050.

b. Selection of energy or electrical equipment with energy efficiency labels or equivalent that are classified in the highest energy efficiency range, such as A++ or A+, or its equivalent.

c. Installation of on-site renewable energy production systems.

d. Selection of equipment that uses fossil fuels but is the easiest to replace with cleaner alternatives in the near future.

e. Documenting efforts to overcome identified market barriers and promote regulatory and technical improvements that enable the adoption of green or sustainable building standards at the municipal, state, or national level, and/or regulatory improvements for the implementation of mandatory building codes suitable to achieve "net zero emissions ready" [46] buildings, and/or institutional strengthening to ensure the enforcement and supervision of said codes.

3.28 **Transition risks due to the use and function of buildings.** It is highlighted that transition risks should also be analyzed considering whether the project depends directly on non-aligned activities in a specific country/sectoral context that could be affected in the future. For example, consider the case of a loan to a hotel whose guests are directly associated with the oil sector (having contracts with oil companies for the medium term). Due to its financial dependence on the oil sector and considering the hotel's lifespan, a transition risk is identified for it, since in a decarbonized economy the oil sector would decrease drastically. In cases like the aforementioned, it would be important to offer advice to analyze whether it is possible for the hotel to diversify the sectors from which its guests come from.

3.29 **Traceability of materials 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 material traceability directly or indirectly (for example, through zero deforestation or responsible sourcing certifications) is considered a valuable practice for risk mitigation. The above is reviewed under Standard 6 of the IDB ESPF and the IDB Invest ESSP.

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 climate resilience pathways, and specific to the context defined by national or subnational stakeholders.

4.2 **In operations with targeted use of proceeds**[47]**,** the MDB assessment methodology 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 ESPF is applicable. In these cases, the "Disaster and Climate Change Risk Assessment Methodology for IDB Projects" (DCCRA) will determine those instances where greater considerations of the physical impacts of climate change are necessary to ensure the alignment of building projects. All projects that comply with the application of the DCCRA

[46] According to the IEA, to achieve net zero emissions by 2050, energy codes for "zero carbon ready" buildings must be mandatory worldwide by 2030. It typically takes jurisdictions at least several years to analyze, develop and adopt new carbon energy codes for buildings, plus additional years for them to come into effect and be enforced by builders. Given the long lead times required, it is essential to develop new codes as soon as possible (IEA, 2022b).

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

methodology will be considered aligned with the adaptation goal of the PA under the first two alignment criterion established by the MDB. 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.

i. **Criterion 1–Climate risk and vulnerability context**. Determine if the operation is vulnerable to CC, identifying and evaluating its exposure to physical climate impacts. Depending on the type of operation, these may be impacts on assets, on the services it plans to provide, on human and natural systems, and/or on its beneficiaries. If the operation is considered to be at risk, it continues with Criterion 2. Operations with low or immaterial climate risk can skip Criterion 2 and go directly to Criterion 3.

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

iii. **Criterion 3–Does not contravene plans for climate resilience.** Depending on relevance and availability, consider policies, strategies, and plans at the territorial, local, national, or regional level, as well as community or private sector priorities. The operation should not be inconsistent with them.

4.3 **In financing without targeted use of proceeds**, when the flows constitute budgetary support (PBL), sub-loans through financial intermediaries, working capital, capital investment or other corporate fund usage, the general principles and technical guidance of the three criteria mentioned above will be taken as reference (¶. 4.2), but applying the **MDB** approach already adapted for each case: Policy-based lending Operations, Financial intermediaries, (in conjunction with the IDB *Group Technical Guidance for Operations with Financial Intermediaries* GN-3142-2), and General Corporate Purpose Financing (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 building sector

4.5 **To ensure long-term alignment with the adaptation goal of the PA, the Joint MDB framework advises on the importance of avoiding maladaptation**[48]. When climate variability and climate change factors are incorrectly considered in the project design, investment outcomes are reduced or become ineffective due to external impacts that can be estimated and mitigated. Climate risk depends on the vulnerability, or predisposition of a system to be negatively affected by a threat, and the severity of exposure to threats.

4.6 In the building sector, for example, maladaptive actions could result in errors in the estimation of the future climatic variations in large engineering projects that are inadequate in the future climate, or in the adoption of measures that ignore local relationships, traditions, traditional knowledge, or market availability that could lead to the failure of the measures (ECLAC, 2015).

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.

4.8 A more detailed description of different resilience investment actions is provided below (IDB, 2022; Climate Bonds, 2021).

a. Actions that improve the climate resilience of buildings during their lifespan: (i) incorporate resilient features in new infrastructure (for example, build to meet or exceed minimum requirements related to exposure and vulnerability to climate change impacts); (ii) upgrade and modify existing infrastructure to be climate resilient; and (iii) appropriately select siting sites or relocate, if possible, the at-risk infrastructure.

b. Actions that increase climate resilience: (i) Extreme Precipitation, Drought: flood defense, wetland protection, stormwater management, rainwater harvesting, relocation of wastewater treatment, reinforce water distribution systems, desalinization plants; (ii) Extreme Precipitation, Extreme Temperatures: green roofs and walls, water retention gardens, porous pavements, thermally insulated envelopes; and (iii) Strong winds, Hurricanes, Typhoons, Cyclones: grid resilience, back-up power generation and storage, strengthened data systems, climate monitoring and data collection applied to inform and build community resilience such as early warning systems, relocation or social networks.

c. Actions that sustain climate resilience: involve different stakeholders (for example: ministries, sector agencies and/or municipalities), consider specific changes that may be necessary based on investments, consider structural and non-structural climate resilience measures (for example, capacity building, tracking, and monitoring).

[48] 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/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 capabilities of future generations to respond to climate vulnerabilities, or places a disproportionate burden for climate action on present-day or future external actors.

4.9 In the specific case of actions in the public sector[49], it is recommended to explore as part of this mitigation and adaptation agenda:

a. Strengthen the information and processing collection to compile and disseminate examples of studies and good practices, inventories of technologies and solutions, which can help raising awareness of the available alternatives to increase sustainability and climate resilience and demonstrate their feasibility.

b. Raising awareness among the beneficiaries/users of the buildings. Coordinate efforts to carry out campaigns or activities that promote and raise awareness among citizens about the benefits of sustainable and resilient buildings.

c. Training in sustainable and resilient construction. Strategy to strengthen technical capacities for real estate developers and contractors, local authorities, suppliers, and professionals related to the industry (advisors, appraisers, supervisors).

d. Provide subsidies to cover the initial incremental cost of a green-resilient building, compared to a business-as-usual building, to incentivize green and resilient building practices.

e. Promote funding for research, development and innovation in construction materials and technology by governments and the private sector to increase the efficiency, sustainability, and resilience of the construction industry, contemplating circular economy options. For example, materials based on NbS and/or recycled materials favor the use of local and/or existing resources for constructions, thereby reducing the carbon footprint.

f. Encourage the use of information systems and digital platforms to finance sustainable construction practices and urban infrastructure, considering the entire life cycle of the building, including demolition. There are, for example, collaborative software solutions, which incorporate building information modeling (BIM) throughout the chain, introducing artificial intelligence or 3D printing systems, use of augmented and virtual reality, among others.

g. Use financial intermediaries for the supply of low-carbon buildings, which provide climate financing in co-financing schemes between developers, the public sector, and multilateral agencies, including direct co-financing, indirect co-financing, leverage, and concessional funds, for housing projects or other public buildings.

h. Changes in financial regulation: expansion of financial incentives and the spectrum of financial intermediaries: savings banks, social banking, and microfinance institutions.

i. Analyze how climate change could destabilize the insurance industry, increasing prices and causing insurers to abandon high-risk markets. There is also a need for parametric insurance, which uses objective climate data to determine payments, making it suitable for addressing climate change-related risks in an efficient and timely manner. Some countries in the region already incorporate this into the green taxonomies they are developing.

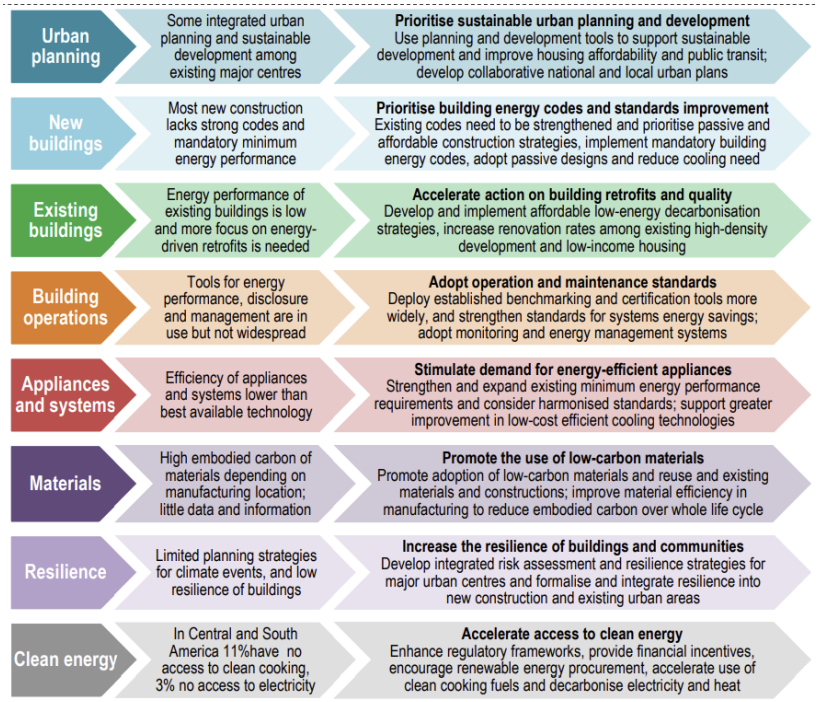
j. Facilitate and provide practical tools so that project developers, builders, the financial sector, and insurers can quantify the exposure and severity of climate risk to which construction projects are exposed.

k. Continue advancing the dialogue with countries so that these types of resilience solutions are included in the relevant National Adaptation Plans (NAP) and other urbanization, territorial planning, and local competency plans, so that they incorporate measures to encourage green resilient buildings, and prioritizing areas with lower climate risk.

[49] With the understanding that several of these actions may apply *mutatis mutandis* to the private sector.

4.10 Figure 2 describes actions identified as being key for achieving zero-emission, efficient and resilient buildings in LAC by 2050.

Figure 1 Roadmap for zero-emission buildings in Latin America



Source: Global ABC Regional Roadmap for Buildings and Construction (IEA, 2020)

APPENDIX I: GUIDELINES FOR THE CALCULATION OF ENERGY-INTENSIVE BUILDINGS

Energy-intensive buildings are those with an energy demand equal to or greater than 400[50] MWh per year[51]

Observations:

- *In the case of projects composed of more than one building on the same site, the sum of the total energy demand of each building located on the same site will be considered. For example, in the case of a university campus made up of 5 pavilions, the demand will be calculated for the total number of buildings.*
- *In the case of projects that finance several buildings in dispersed locations, the energy demand of each building or group of buildings will be considered for each location. For example, in the case of a project financing the construction of healthcare units located on different plots of land, the energy demand for each building will be calculated.*

How to calculate annual energy demand?

To calculate the annual energy demand[52], two possible scenarios are described below:

Scenario 1. If the annual energy demand (MWh/year) of all buildings to be financed by the IDB Group is known, this can be used as a reference value. Reference examples:

Typology	Primary Function	Detail	MWh/year	Result
Education	K-12 School	(1) Independent educational unit in a rural environment with approximately 2,500 m² in the state of Amazonas (Brazil).	**140***	Non-energy intensive
Healthcare	Hospital (General Medical & Surgical)	(1) Urban specialty center with 4,600 m2 in the city of San Salvador (El Salvador)	**684****	Energy-intensive
Healthcare	Hospital (General Medical & Surgical)	(1) Hospital and healthcare complex of 14,700 m2 in Costa Verde (Panama)	**1,320****	Energy-intensive

**Value provided by the executing agency*
*** Value obtained with EDGE simulation*

Scenario 2: If the annual energy demand of the buildings to be financed by the IDB Group is unknown, it can be calculated by multiplying the **Energy Intensity** according to the building typology (Table 5) and the *estimated gross floor area*[53] planned in the project.

Energy Demand (MWh/year) = LAC Energy Intensity (MWh/ m²/year) x Net building area (m²)

[50] This value is calculated considering the energy consumption estimated by the Energy Star Technical Reference based on building typologies and the estimated construction area of the project in question. Subsequently, a prescriptive and statistical analysis was developed for a sample of 100 operations (86 from the IDB and 14 from IDB Invest), encompassing various building typologies, including: single-family housing, multifamily or single-family housing complex, refrigerated and non-refrigerated warehouse, preschool, recreation, hotel, mall, residential care facility-senior living community, laboratory, office, police station, urgent care/clinic/other outpatient, hospital, other/specialized hospital, K-12 school, college/university, vocational school/adult school, transportation terminal/station, prison/incarceration centers, courthouse. The analysis considers more than 3000 buildings, determines the expected average maximum demand (Mwh/m²/year) based on the construction area and estimated consumption by typology. It is considered that the lowest percentile, with a consumption of less than 400 MWh per year, is non-energy-intensive and poses low risks of hindering the transition.

[51] The relevance of this indicative threshold may be reviewed in future versions of this Technical Guidance as part of the PAIA learning approach, based on the experience gained from the application of the PA analysis by region, country, and segment.

[52] This value may later be used to calculate the GHG contemplated in the IDB Group's Environmental and Social Policy Framework (ESPF). Environmental and Social Performance Standard 3: Resource Efficiency and Pollution Prevention (ESPS 3)

[53] The total closed area that results from adding all the built and covered spaces of a building.

Reference Examples:

Typology	Primary Function	LAC Energy Intensity (MWh/m²/year)	Net building area (m²)	MWh/year	Result
Healthcare	Hospital (General Medical & Surgical)	0.3696	5000 m²	1847.80	Energy-intensive
Education	K-12 School	0.0765	2000 m²	153	Non-energy intensive
Lodging	Multifamily Housing	0.0250	60 m² (*1 Single Family home*)	1.5	Non-energy intensive
Lodging	Multifamily Housing Complex	0.0940	6000 m² *(3 blocks of 2000 m2 c/u)*	564.04	Energy-intensive
Lodging	Hotel	0.1987	12170 m² (*Hotel and Convention Center*)	2418	Energy-intensive

Table 5 lists the referential values of Energy Intensity for estimation:

Table 5: Referential Values of Energy Intensity by Building Typology

Typology	Primary Function	Energy Intensity (US)* (MWh/m²)	Estimated Energy Intensity LAC** (MWh/m²)
Banking/Financial Services	Bank Office	0.1669	0.0834
	Bank Branch	0.2786	0.1393
Education	K-12 School	0.1530	0.0765
	Vocational School/ Adult Education/ Other	0.1653	0.0827
	Pre-school/Daycare	0.2044	0.1022
	College/University	0.2659	0.1330
Entertainment/Public Assembly	Recreation	0.1603	0.0801
	Convention Center	0.1770	0.0885
	Social/Meeting Hall	0.1770	0.0885
	Movie Theater, Museum, Performing Arts	0.1773	0.0886
	Stadium, Aquarium, Casino, Zoo, other	0.1773	0.0886
Food Sales & Service	Wholesale Club/Supercenter	0.1621	0.0811
	Bar/Nightclub	0.4123	0.2062
	Supermarket	0.6183	0.3091
	Food Sales	0.7300	0.3650
	Food Service	0.8527	0.4263
	Restaurant	1.0271	0.5136
	Convenience Store	1.1069	0.5535
	Fast Food Restaurant	1.2704	0.6352
Healthcare	Ambulatory Surgical Center / Outpatient Rehabilitation/Physical Therapy	0.1956	0.0978
	Urgent Care/Clinic/Other Outpatient	0.2035	0.1017
	Medical Office	0.3085	0.1543
	Residential Care Facility - Senior Living Community	0.3123	0.1562
	Other/Specialty Hospital	0.6521	0.3260
	Hospital (General Medical & Surgical)	0.7391	0.3696
Lodging/Residential	Single Family Home **		0.0250
	Multifamily or Single-Family Housing Complex	0.1880	0.0940
	Residence Hall/Dormitory-Barracks	0.1827	0.0913
	Hotel	0.1987	0. 1987
	Prison/Incarceration center	0.2205	0.1103
Manufacturing/Industrial	Manufacturing/Industrial Plant	0.0000	0.0000
Office	Office	0.1669	0.0834
Other	Other	0.1265	0.0632
Public Services	Mailing Center/Post Office	0.1511	0.0756

Typology	Primary Function	Energy Intensity (US)* (MWh/m^2)	Estimated Energy Intensity LAC** (MWh/m^2)
	Social/Meeting Hall	0.1770	0.0885
	Transportation Terminal/Station	0.1773	0.0886
	Fire Station	0.2003	0.1002
	Police Station	0.2003	0.1002
	Prison/Incarceration	0.2205	0.1103
	Library	0.2259	0.1129
	Courthouse	0.3192	0.1596
Religious Worship	Worship Facility	0.0962	0.0481
Retail	Convenience Store	0.1621	0.0811
	Wholesale Club/Supercenter	0.1621	0.0811
	Enclosed Mall	0.2073	0.1036
	Vehicle Dealership	0.2268	0.1134
	Other - Mall	0.3205	0.1603
	Lifestyle Center, Mall	0.3265	0.1633
	Supermarket/Grocery Store	0.6183	0.3091
Services	Data Center	0.0057	0.0029
	Personal Services (Health/Beauty, Dry Cleaning, Vehicle, Shoe, Locksmith, etc.)	0.1511	0.0756
Technology/Science	Other – Technology/Science	0.1265	0.0632
	Laboratory	0.3637	0.1819
Utility	Drinking Water Treatment & Distribution	0.0072	0.0036
	Wastewater Treatment Plant	0.0091	0.0046
	Energy/Power Station	0.1265	0.0632
	Other - Utility	0.1265	0.0632
Warehouse/Storage	Warehouse	0.0637	0.0319
	Distribution Center	0.0716	0.0358
	Non-Refrigerated Warehouse	0.0716	0.0358
	Refrigerated Warehouse	0.2653	0.1327

** Portfolio Manager Technical Reference: U.S. National Energy Use Intensity.*
https://www.energystar.gov/buildings/tools-and-resources/portfolio-manager-technical-reference-us-national-energy-use-intensity

***** This value has been modified considering a conservative scenario of consumption reduction based on per capita electric power consumption of LAC compared to that of the United States. According to World Bank data, LAC's per capita energy consumption is six times less than that of the United States. In a conservative scenario, for the purposes of estimating the consumption of new buildings in LAC, the estimated energy consumption has been reduced to half the value of the United States.***
https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=ZJ-US

**** Modified value from the original source, based on estimates of minimum energy needs ranging between 25 kWh and 105 kWh/month per capita for households composed of 4 inhabitants, under spatial considerations of social housing of 50 m2. How do households consume energy? Evidence from Latin America and the Caribbean / Raul Jimenez Mori, Ariel Yépez-Garcia. https://publications.iadb.org/es/publications/english/viewer/How-Do-Households-Consume-Energy-Evidence-from-Latin-American-and-Caribbean-Countries.pdf*

APPENDIX II: REFERENTIAL LIST (NON-EXHAUSTIVE) OF SUSTAINABLE CONSTRUCTION CODES, CERTIFICATIONS, AND LABELS IN LATIN AMERICA AND THE CARIBBEAN (LAC)[54]

According to the study "*Resilience and Sustainability in the Construction Codes of Latin America and the Caribbean*" (Alvear et al., 2023) although in LAC construction codes vary from one country to another many include provisions related to sustainability. This study included the analysis of 76 codes and 126 technical standards. From the analysis, it was possible to identify that 50% of the countries consider at least some sustainability parameter, and 36% establish mandatory application in their national contexts.

Country	Voluntary	Mandatory
Argentina	3	3
Bahamas	1	3
Barbados	5	2
Belice	1	2
Bolivia	8	3
Brazil	6	2
Chile	61	20
Colombia	4	2
Costa Rica		3
Ecuador		4
El Salvador	2	3
Guatemala	2	3
Guyana	3	3
Haiti	2	
Honduras	2	3
Jamaica	2	1
Mexico	3	3
Nicaragua	2	2
Panama	3	2
Paraguay	6	2
Peru	1	5
Dominican Republic	2	1
Suriname	3	
Trinidad &Tobago	2	
Uruguay	4	3
Venezuela	2	1

Technical Construction Codes and Standards with sustainability parameters by country (Alvear et al, 2023)

10 certifications[55] for sustainable buildings were identified; distributed in the following countries: Brazil (5), Chile (2), Colombia (1), Costa Rica (1), and Guatemala (1); and 13 labels or rating systems were distributed in Argentina, Brazil, Chile, Colombia, Mexico, Panama, and Uruguay. All of these are applicable to different types of buildings, both public and private. It is important to highlight that these results present a non-exhaustive list identified during the study preparation, and therefore there may be new labels or certifications under development.

54. Reference list drawn up as of 2022. Note that changes and updates could be possible.

55 A label is a badge or seal given to a building to indicate compliance with certain specific sustainability standards or criteria, while certification is the result of a formal independent evaluation and verification process that demonstrates a building meets those established sustainability standards. Certifications are more rigorous and require independent endorsement.

Figure 3: Countries with Sustainability Certifications and Labels

Source: (Alvear et. al, 2023)

Country	Name	Scope	Type of Project	Typology
Argentina	CREAS	Municipal	New and Existing	Public or private Offices and Buildings
Argentina	*Vivienda Sustentable* (Sustainable Housing)	National	New and Existing	Residential
Brazil	IPTU VERDE	Municipal	New and Existing	Residential, commercial, institutional, and industrial
Brazil	PROCEL edifica	National	New and Existing	Any public or private building
Brazil	Casa Azul	National	New	Residential
Brazil	EDIF	Statewide	New	Public Buildings
Brazil	CASA	National	New	Single-family residential
Brazil	CONDOMINIO	National	New	Multi-family residential
Brazil	ZERO ENERGY	National	New	Constructions and retrofitting
Brazil	GBC LIFE	National	New	Residential interiors
Chile	*Vivienda Sustentable* (Sustainable Housing)	National	New	Residential
Chile	*Edificio Sustentable* (Sustainable Building)	National	New and Existing	Buildings for public use

Country	Name	Scope	Type of Project	Typology
Chile	*Calificación Energética de Vivienda* (Housing Energy Rating)	National	New and Existing	Residential
Chile	SafeBuilding	National	Existing	Any public or private building
Chile	Comuna Energética	National	Existing	*Comunas* of Chile
Chile	Minergie	National	New	Single-family and multi-family residential
Colombia	CASA COLOMBIA	National	New	Residential
Colombia	*Bogotá Construcción Sotenible* (Sustainable Construction)	Municipal	New	Any public or private building
Guatemala	CASA Guatemala	National	New	Residential
Mexico	*Programa de cooperación financiera ECOCASA* (Finantial Cooperation Program ECOCASA)	National	New and Existing	Residential
Panama	Eco Protocolo	National	New and Existing	Any public or private building
Uruguay	*Certificación MAS* (MAS certification)	National	New	Residential, offices and institutional
Regional[56]	FAST-Infra	-	New and Existing	General infrastructure projects
Regional	ENVISION	-	New and Existing	General infrastructure projects
Regional	SMART HOSPITALS - PAHO	-	New and Existing	Hospitals. The countries participating in the program are Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia and Saint Vincent and the Grenadines.

[56] Regional: In addition to the certifications identified by the *World Green Building Council*, including: the FAST-Infra Label system in which IDB Invest participated in the technical working groups along with other MDB; ENVISION and SMART Hospitals certification.

APPENDIX III: MINIMUM REQUIREMENTS FOR NON-HIGHLY ENERGY-INTENSIVE BUILDINGS

This section describes the criteria that should be considered in the planning, design, and construction of non-energy-intensive buildings.[57]

A summary of the results obtained for the different climatic zones is presented below.[58]

Design Strategy	Extremely Hot	Very Hot	Hot	Warm	Mixed	Cool	Cold
	0 (A-B)	1 (A-B)	2 (A-B)	3 (A-B-C)	4 (A-B-C)	5 (A-B-C)	6 (A-B)
Orientation	Place most windows toward the least sunny front (north in the northern hemisphere, south in the southern hemisphere, and north or south at the equator). Minimize or eliminate west-facing windows to reduce heat gain during the afternoons			Maximize the window area on the sunny side (north in the southern hemisphere, south in the northern hemisphere), ensuring it can be shaded during the summer with an overhang. Avoid shading the north (in the southern hemisphere) and south (in the northern hemisphere) façades in windows intended for passive solar heating.	Orient the building with the longer faces towards north and south. Maximize sunlight entry into spaces to take advantage of natural lightning and passive heating in winter. Locate storage areas on the side of the building where the coldest winds hit. Design compact, multi-story buildings to help minimize heat loss during the winter. Include internal spaces protected from the wind but with high solar radiation, such as closed patios, terraces, solariums, etc.		
Sun Protection on windows **	Include sunshades or slats on all windows to reduce direct solar radiation.			Use parasols and overhangs to prevent			

[57] It is considered that, depending on the context, and established climatic conditions, the comprehensive incorporation of these strategies allows achieving a savings equivalence of at least 20% in energy and water resources compared to the baselines established by the EDGE certification. These strategies were determined based on research and exploratory results in architectural prototypes for hospital, school, and passenger terminal infrastructure in around 30 cities in LAC.

[58] Climate Zoning based on the ASHRAE 169-2021 standard classifies climate zones using criteria such as dry bulb, dew point, wet-bulb temperatures, enthalpy, humidity ratio, wind conditions, solar irradiation, latitude, longitude, and elevation for locations worldwide. In this way, it determines 9 climatic zones defined by the hours required for cooling or heating according to the temperature range. Apart from this criterion, there is a classification by the letters A, B, and C, which are used to denote humid, dry, or marine climates, respectively. For LAC, for the purposes of this document, 6 of the 9 climatic zones are considered.

Design Strategy	Extremely Hot	Very Hot	Hot	Warm	Mixed	Cool	Cold
	0 (A-B)	1 (A-B)	2 (A-B)	3 (A-B-C)	4 (A-B-C)	5 (A-B-C)	6 (A-B)
				overheating during summer months			
Solar exposure for passive heating				Passive heating by radiation during winter	Maximize sunlight exposure on the sunny side (north in the southern hemisphere, south in the northern hemisphere) during winter. Avoid shading the north (in the southern hemisphere) or south (in the northern hemisphere) façade in windows intended for passive solar heating.		
Thermal Insulation**	Include reflective thermal insulation to reduce the heat emission through the roof.			Keep spaces properly sealed and insulated, especially in ceilings.		Keep spaces properly sealed and insulated on exterior walls and ceilings	
Thermal mass	In humid climates, use low thermal mass walls (light walls), in dry climates, use high thermal mass walls.			Use lightweight construction and a concrete slab on the floor level, properly sealed and insulated, to quickly accumulate heat in the mornings. In cold, sunny climates, floors with high thermal mass are recommended.	Try to construct lightweight structures that are properly sealed and insulated to efficiently accumulate heat in the mornings. In cold, sunny climates, it is recommended to use a floor with high thermal mass, heated through radiation, which releases heat in winter afternoons/nights or maintains a coolness at night during summer days.		
Solar Reflectance**	Use light colors with high reflectance and emittance on exterior walls and ceilings				Use opaque colors on exterior walls and ceilings		
Efficient glasses	Install glass with a low coefficient of heat gain due to radiation in all directions, with operable windows without leaks.		Install glass with a low coefficient of heat gain by radiation on the east, west, and less sunny façade orientations (north for the northern hemisphere and south for the southern hemisphere). On the sunny side (south for the northern hemisphere and north for the southern hemisphere), use glass with a high coefficient to maximize heat gain.		Install windows with a low coefficient of heat gain by radiation on the east, west, and south (in the southern hemisphere) or east, west, and north (in the northern hemisphere), but with a high coefficient on the sunny side (north in the southern hemisphere and south in the northern hemisphere) to maximize passive heat gain. Install skylights to reduce energy use for lighting and air conditioning. It is recommended to use 3% of the area in areas with low cloud cover and 5% in areas with high cloud cover.		
Vegetation**	Use native plants or tree-lined areas, vertical gardens or green roofs with low maintenance and irrigation, use of rain gardens.						
Natural Ventilation**	Orient the windows towards prevailing winds, encourage natural cross-ventilation to facilitate air renewal, and use protective mesh against insects. Consider roof ventilation systems.				Selective natural ventilation will allow air renewal as long as excessive cooling and heat loss are avoided		
Mechanic Ventilation	Use of ceiling fans						
Air Conditioning Efficient Air conditioning**	Install high energy efficiency systems such as EER 11.2 and IEER 11.5 direct expansion systems with automatic shutdown and temperature adjustment.						
Air Conditioning Efficient Heating**				Install high-energy efficiency systems. For example, heat pumps with a minimum COP of 2.9, featuring automatic shutdown and temperature adjustment.			
Lightning **	Use an electrical system with LED bulbs equipped with photosensors or motion sensors in applicable spaces. Maintain a maximum indoor lighting of 8 W/m2 (minimum 100 lumens/W) and outdoor lighting not exceeding .83 W/m2."						
Efficient water consumption**	Use water-saving faucets and showers with built-in aerators, as well as low-water-consumption double or single discharge toilets.						
Rainwater	Rainwater harvesting and reuse. For instance, rainwater collection on the roof, storage and use in a gravity-fed irrigation system.						

Design Strategy	Extremely Hot	Very Hot	Hot	Warm	Mixed	Cool	Cold
	0 (A-B)	1 (A-B)	2 (A-B)	3 (A-B-C)	4 (A-B-C)	5 (A-B-C)	6 (A-B)
Renewable energy*	Use photovoltaic or solar thermal systems. For instance, systems that cover 25% of annual energy demand.						
Low carbon materials*	Use local and low-embodied-energy materials. It is recommended to explore new construction systems to reduce the amount of materials, especially concrete and steel, without compromising structural safety. Additionally, consider incorporating innovative low-emission materials like dry panels, green concrete, PET bricks, sustainable wood constructions, among others						

** Mandatory measure
* Recommended measure to promote buildings with low or zero energy consumption
Applicable to climatic zone
Not applicable to climatic zone

APPENDIX IV: ANALYSIS OF BUILDING FACILITIES THAT DEPEND ON FOSSIL FUELS

Heating and cooling systems, the deployment of cooking, water heating and heating equipment, as well as diesel backup systems, must be reviewed as per the Energy Technical Guidance.These type of initiatives are financially supported by the IDB Group in the context of its operations.

In its paragraph 3.7, this technical guidance considers the following to be universally aligned:

i. **District heating or cooling systems with negligible lifecycle GHG emissions**–that is, if they use a significant amount (greater than 50%) of renewable energy or waste or co-generated heat; or that include: (a) a modification to a lower temperature delta;(b) advanced pilot systems (energy control and management, etc.).

ii. **Cleaner technologies for cooking**, as long as they replace the use of open-air biomass (including improved biomass or electric/induction stoves).

In its paragraph 3.9, this technical guidance also underscores that the following types of investments require a specific assessment of alignment with the PA temperature goal according to the same five MDB criteria addressed in section III.C of this document:

i. **Petroleum-related:** investments in petroleum-based systems used as back-up for isolated renewable energy and/or heating systems.

ii. **Gas-related:** export (midstream); import, transportation, distribution, and generation (midstream and downstream), greenfield and brownfield. Also, activities related to **access to energy services** that include the use of oil or gas derivatives. This also applies to network expansion, heating and cooling generation systems from oil, natural gas, and cogeneration; as well as the deployment of cooking, water heating and heating equipment based on natural gas, liquefied natural gas, or liquefied petroleum gas that include the use of petroleum or gas derivatives.

The specific assessment of this type of activities is guided by the same five criteria of The MBD Joint Framework for Alignment with the PA; for easy reference, the following questions are shared and applicable for the analysis of " no obstruction of the transition (“carbon lock-in”) (SC4) and "transition risks and stranded assets" (SC5) in accordance with the energy technical guidance:

i. Based on a robust analysis of alternatives, has it been verified that the option to be financed is the only one considered technically and economically viable to provide the same level of energy service?

ii. What is the useful life of the asset? Even in the face of the probable existence of lower emission alternatives that could replace it in the coming years, is it expected to continue operating in an intensive manner in GHG emissions by 2050? What kinds of arrangements will allow the operation to adapt to reduce emissions throughout its useful life?

iii. Does the energy investment to be financed prevent the development of alternatives with lower GHG emissions? For example, by discouraging bidders from entering the market with lower carbon solutions.

iv. What is the contribution of the project to GHG emissions and therefore, to what extent could it be impacted by policies and regulations?

v. What is the potential impact of low GHG emission technology improvements in the subsector?

vi. What is the potential impact from changes in these markets towards low GHG solutions?

Specific considerations for petroleum and gas activities:

i. Has the impact of the investment on aspects of energy security, access to energy and impact on development been analyzed?

ii. Is the project located in a SIDS[59] country, or a country with a human development index[60] lower than the average for developing countries, or a fragile state?[61]

iii. What are the regulatory risks linked to public health and technological risks such as early obsolescence?

[59] Small Island Developing State (SIDS) based on the UN list of SIDS..
[60] United Nations Human Development Index (HDI).
[61] Fragile status based on OECD list until IDB defines its own list or adopts another.

APPENDIX V. EXAMPLES OF SPECIFIC ASSESSMENT EXTRACTS

Case Study 1: *Sao Paulo Educational Center (Brazil), which includes cafeteria spaces equipped with cookstoves with independent liquefied petroleum gas (LPG) tanks, without an existing distributed gas network.*

Justification and strategy to manage the risk of carbon lock-in if applicable:

According to several sources, the average lifespan of a domestic LPG cylinder in Brazil is 15 years. In the event of a transition to the use of electric cookstoves, the gas cookstoves planned to be used within this program framework can be replaced by electric cookstoves without the need for complex investments or adjustments.

Justification and strategy to manage transition risks and stranded assets:

As mentioned above, in the case of a transition to the use of electric cookstoves, the gas cookstoves meant to be used in this program can be replaced by industrial electricity-based cookstoves suitable for the volume of food daily prepared.

Case Study 2. *Single-family Social Housing Project in the state of Paraná (Brazil) that meets the EDGE green certification criteria and contemplates the use of cookstoves with gas tanks, without an existing distributed gas network.*

Argumentation for specific criteria SC3 to SC5

In this sense, (…) the use of gas cookstoves is not considered inconsistent with Brazil's NDC or with specific alignment criteria on global decarbonization pathways in the sector, considering the countries' differentiated capacities and responsibilities.

According to several sources, the average lifespan of a domestic LPG cylinder in Brazil is 15 years [62]. In the case of a transition to the use of electric cookstoves, the gas cookstoves that are planned to be used within the framework of this program can be replaced by electric stoves without the need for complex investments or adaptations, and no home gas connections will be made.

In this sense, program activities that are not considered universally aligned (gas cookstoves, (…)) do not prevent or hinder opportunities to transition to activities aligned with the Paris Agreement, do not support/depend on non-aligned activities in a national or sectoral context nor does the activity become economically unviable considering transition risks and stranded assets in the national or sectoral context.

It should be noted that several and productive conversations have been held with the executing agency (…) on the application of the green housing certifications available in the country for the social housing context, as well to consider the use of electric/induction cookstoves in the program. There was also a "consultancy for the preparation of recommendations and good practices, and a checklist of compliance with measures to mitigate and reduce the effects of climate change for the Program (...)".

Previous experience of the executor with the use of electric stoves

The executor has experience in the use of kitchen equipment with electrical systems in a condominium program to serve the elderly population. The decision to use electrical systems at that time was driven by security concerns. However, for financial and cultural reasons, this alternative was unviable, according to the reports of the heads of the regional offices and the on-site verification of the works, which were conducted shortly after the delivery of the housing units.

It was locally confirmed that gas cylinders were installed outside and even inside many units due to cost considerations related to the purchase of cooking equipment (electric appliances were found to be more expensive than traditional LPG stoves.)

[62] Sources: https://www.copagaz.com.br/blog/gas-de-cozinha-tem-validade/ , https://www.otempo.com.br/economia/botijao-de-gas-tera-data-de-validade-e-dados-do-produtor-1.224198

Another observation arising from the installation of electrical equipment forced (…), in its project, to anticipate that the energy input to the homes should be three-phased. Such option automatically excluded the housing unit from adhering to the Luz Solidária social program: "Luz Solidária Program: Program of the Government of the State of Paraná, established by Law 20,943/2021, which pays the bills of consumers enrolled in the Social Tariff of "Electric Energy, with consumption equal to or less than 150 kWh, representing a positive financial impact for the low-income population included in the program, due to the exemption from paying electricity costs." However, a consumption limit of 150 kWh per month means a maximum daily consumption of approximately 5 kWh, an extremely low amount. For example, in this context, the electric shower installed in these units has a power rating of 5.3 kWh. The combination of both devices inevitably disqualifies these housing units from the program, creating a second problem.

In light of these situations, for new senior housing developments, we have chosen to establish decentralized LPG gas plants and install gas sensors inside the housing units to address safety concerns.

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