Financing Pathways for the Energy Transition: A Regional Approach

Columbia Center on Sustainable Investment
A JOINT CENTER OF COLUMBIA LAW SCHOOL AND COLUMBIA CLIMATE SCHOOL

In collaboration with:

COUNCIL OF ENGINEERS FOR THE ENERGY TRANSITION
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ABOUT THE COUNCIL OF ENGINEERS FOR THE ENERGY TRANSITION (CEET)

COUNCIL OF ENGINEERS
FOR THE ENERGY TRANSITION

An independent advisory council to the
United Nations Secretary-General

The Council of Engineers for the Energy Transition (CEET) is an independent and impartial advisory council for the UN Secretary-General (UNSG) established with the aim of contributing to the UNSG's goal to build a coalition to achieve net zero emissions by 2050. The role of the Council is centered around communicating with global stakeholders and becoming a trusted and technology-agnostic source of information and guidance on the global energy transition.

ABOUT THE COLUMBIA CENTER ON SUSTAINABLE INVESTMENT (CCSI)

Columbia Center
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The Columbia Center on Sustainable Investment (CCSI), a joint center of Columbia Law School and Columbia Climate School at Columbia University, is a leading applied research center and forum dedicated to the study, practice, and discussion of sustainable international investment. Our mission is to develop and disseminate practical approaches and solutions, as well as to analyze topical policy-oriented issues, in order to maximize the impact of international investment for sustainable development. The Center undertakes its mission through interdisciplinary research, advisory projects, multi stakeholder dialogue, educational programs, and the development of resources and tools.

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Acronyms and Abbreviations

ADB	Asian Development Bank
AE	Advanced Economy
AfCFTA	African Continental Free Trade Area
AfEES	Africa Energy Efficiency Strategy
AfSEM	Africa Single Electricity Market
APAC	Asia and the Pacific
APEC	Asia-Pacific Economic Cooperation
APG	Association of Southeast Asian Nations Power Grid
ASEAN	Association of Southeast Asian Nations
AU	African Union
CABEI	Central American Bank for Economic Integration
CAF	Development Bank of Latin America
CAPEX	Capital Expenditure
CBAM	Carbon Border Adjustment Mechanism
CEET	Council of Engineers for the Energy Transition
CEF	Connecting Europe Facility
CMP	Continental Power Systems Masterplan
CRA	Credit Rating Agency
CSRD	Corporate Sustainability Reporting Directive
DRGR	Debt Relief for a Green and Inclusive Recovery
DSA	Debt Sustainability Analysis
DSF	Debt Sustainability Framework
EBRD	European Bank for Reconstruction and Development
EDF	Environmental Defense Fund
EGBSR	European Green Bond Standard
EGD	European Green Deal
EIB	European Investment Bank
EMDE	Emerging Market and Development Economies
EPC	Engineering, Procurement, and Construction
ESG	Environmental, Social, and Governance
ETS	Emission Trading System
FDI	Foreign Direct Investment
GEIDCO	Global Energy Interconnection Development and Cooperation
GSCI	Global Sustainable Competitiveness Index

Acronyms and Abbreviations

GERD	Grand Ethiopian Renaissance Dam
HIPC	Heavily Indebted Poor Countries
IDB	Inter-American Development Bank
IoT	Internet of Things
JET-Ps	Just Energy Transition Partnerships
LAC	Latin America and the Caribbean
MDBIL	Multilateral Development Bank Intermediated Loan
MDB	Multilateral Development Banks
MFF	Multiannual Financial Framework
NDBs	National Development Banks
NDC	Nationally Determined Contribution
NGEU	Next Generation EU
NZE	Net Zero Emissions
O&M	Operations and Management
ORC	Ordinary Capital
PA	Paris Agreement
PCI	Projects of Common Interest
PE	Private Equity
PMI	Projects of Mutual Interest
R&D	Research & Development
RD&D	Research, Development, & Demonstration
SCF	Strategic Climate Fund
SDG7	Sustainable Development Goal 7
SFDR	Sustainable Finance Disclosure Regulation
SIEPAC	Central American Electrical Interconnection System
SLB	Sustainability-Linked Bond
SPV	Special Purpose Vehicle
SSA	Sub-Saharan Africa
TAGP	Trans-ASEAN Gas Pipeline
UCITS	Undertakings for Collective Investment in Transferable Securities
UNSDSN	United Nations Sustainable Development Solutions Network
UNSG	UN Secretary-General
VC	Venture Capital
WB	World Bank

Executive Summary

The global financing pathways for the energy transition face significant barriers that must be addressed from a regional perspective. The transition to clean energy requires interconnected systems and collaborative frameworks, necessitating joint investments in large-scale clean energy projects to reduce costs, improve efficiency, and enhance resilience across regions.

In this context, the Columbia Center on Sustainable Investment (CCSI) and the UN-convened Council of Engineers for the Energy Transition (CEET), working together with the Global Energy Interconnection Development and Cooperation Organization (GEIDCO), the Environmental Defense Fund (EDF), regional UN Economic Commissions, Multilateral Development Banks (MDBs), and other regional stakeholders, launched regional working groups to address localized barriers to the clean energy transition and identify potential solutions, factoring in technological, political, and financial context.

This report, "Financing Pathways for the Energy Transition: A Regional Approach," underscores the importance of tackling these challenges through a regional lens. It delves into the main challenges and opportunities from a regional perspective, highlighting commonalities and differences in financing the energy transition across Africa, Asia and the Pacific (APAC), Europe, and Latin America and the Caribbean (LAC). It is worth noting that Europe, although predominantly composed of Advanced Economies (AEs) with conditions that differ significantly from the Emerging Markets and Developing Economies (EMDEs) in other regions, was included in this analysis because it remains a priority for the CEET.[1] The briefing builds on the ten-months regional working group discussions led by the CEET in each of the abovementioned regions. By analyzing these four regions, this work seeks to complement the CEET's efforts and offer insights that can further drive the energy transition from a regional perspective, while recognizing the unique financing conditions and challenges each region presents.

The first section highlights the current state of global climate investment, emphasizing the significant shortfall in financing needed to meet renewable energy targets. Current policies and market conditions are expected to cover less than two thirds of the spending needed to triple installed renewable capacity by 2030, leaving an annual gap of approximately USD 400 billion.[2] EMDEs will require USD 2.4 trillion annually by 2030, representing over a fivefold increase from 2020 levels.[3]

The second section delves into the common barriers hindering the energy transition across various regions, including Africa, APAC, Europe, and LAC. The high cost of capital for renewable energy projects, influenced by factors such as sovereign credit ratings and borrowing in foreign currencies, is a significant challenge. Alarmingly, a significant portion of the funding provided by developed nations to EMDEs to finance climate-related and renewable energy projects is absorbed in excessive costs tied to the loans. EMDEs are generally facing interest costs 700 to 1,500 basis points higher than developed markets.[4] High financing costs make it more expensive to finance energy transition projects, especially in EMDEs, which often rely on external financing due to inadequate domestic savings and limited fundraising capabilities. Competing demands

on public budgets for essential services limit governments' ability to allocate sufficient funds for the energy transition. High levels of public debt, lack of private financing and the conditions for accessing long-term financing create a detrimental financing gap, hindering investment in critical development areas. Inconsistent regulatory frameworks and policies pose significant challenges to the implementation of renewable energy projects. Outdated policies, complex permitting processes, and fragmented regulations across jurisdictions create uncertainty and increase costs, deterring investment and innovation. Despite these common challenges, each region possesses distinct opportunities influenced by their unique contexts, natural resources, and policy frameworks.

The third section of this report explores the potential of harnessing each region's context to expedite the energy transition process. Africa faces significant energy poverty and high financing costs but has vast renewable energy potential in solar and wind.[5] Initiatives like the African Continental Free Trade Area (AfCFTA), the African Union's (AU) Digitization Transformation Strategy, Africa Single Electricity Market (AfSEM), the Continental Power Systems Masterplan (CMP), and the Africa Energy Transition Strategy can enhance energy access and reliability. However, the region requires an investment of USD 4.22 trillion by 2050 to meet Agenda 2063—which is the region's strategic framework for achieving inclusive and sustainable development, fostering unity, and promoting economic growth, innovation, and prosperity across the continent over a 50-year period, culminating in a transformed and integrated Africa by 2063—and achieve SDG7 by 2030, highlighting the region's significant funding needs.[6]

In comparison, the APAC region represents the fastest-growing energy demand globally with the biggest climate funding gap.[7] While the region has immense renewable energy potential particularly for solar energy due to its high solar insolation levels, it is still very heavily reliant on fossil fuels, especially coal.[8] Regulatory and infrastructure challenges impede progress. Enhanced cooperation within ASEAN and regional frameworks like the APEC Renewable Energy Roadmap are crucial for improving energy security and sustainability. EMDEs in the region, including China and India, require an investment of at least USD 1.1 trillion annually to achieve net zero.[9] This represents an investment gap of about USD 800 billion annually for EMDEs in APAC by 2030.[10]

LAC is highly vulnerable to climate change but has a diverse energy mix and holds very large renewable energy potential, particularly in hydropower, which has historically been the dominant source of electricity.[11] The region needs substantial public and private investments to meet its energy transition goals. The climate financing gap is estimated to be around USD 232 billion annually by 2030.[12] Additionally, the LAC region faces a significant challenge with the average debt term decreasing sharply from 12 years pre-pandemic to just 5 years in 2023, reflecting increased financial strain and shorter borrowing periods in the region.[13] Strengthening regional energy markets and interconnections can enhance the integration of renewable energy sources and reduce generation costs.

In contrast, Europe has advanced regulatory frameworks and ambitious climate targets but faces financial hurdles due to tight monetary conditions and competing public budget demands. The EU's strategic financial and policy initiatives, such as the European Green Deal (EGD) and the REPowerEU Plan, aim to scale up clean energy deployment and position the region as a global leader in the energy transition.

The final section of the report provides key recommendations to accelerate the energy transition from a regional perspective. It includes:

1. Develop a Robust Regional Clean Energy Strategy

The first critical recommendation is the development of a robust regional clean energy strategy. This clean energy regional strategy is essential for guiding actions to phase out fossil fuels and avoid new fossil fuel infrastructure, which is fundamental in scaling access to affordable clean energy, reducing carbon emissions, and meeting climate goals. Establishing interconnected regional energy grids is also vital, as it facilitates energy trade, balances supply and demand, and supports large-scale renewable projects. Leveraging the energy demands of existing industries can help finance new renewable projects, creating a sustainable cycle of growth. The strategy's success relies on involving a broad range of stakeholders, including governments, regional development banks, and the private sector. National development banks play a key role by providing long-term capital and aligning investments with national priorities. Effective implementation requires stakeholder mapping, structured engagement, and regular monitoring to ensure collaboration, innovation, and sustainable growth.

2. Advance Structural and Regulatory Reforms

The success of the energy transition largely depends on creating a stable and predictable regulatory environment that attracts and sustains investments in renewable energy. Policymakers must tackle regulatory barriers that impede clean energy investments by modifying financial regulations to account for climate risks and revising the prudential framework to favor long-term investments. Though politically challenging, these reforms are crucial for facilitating the energy transition. Strengthening public institutions, improving governance, and creating an enabling environment can attract more investment by building trust and systemic credibility. Reducing reliance on fossil fuels should be paired with phasing out fossil-fuel subsidies to level the playing field for renewables. Harmonizing and streamlining regulatory frameworks across regions, standardizing contracts, and ensuring long-term policy stability are essential for reducing costs, accelerating project implementation, and enhancing investor confidence. Governments must prioritize a long-term regional energy transition strategy based on five key pillars: universalizing access to electricity, increasing the share of renewables, improving energy efficiency, strengthening regional energy integration, and enhancing system resilience. These actions will help build more efficient, resilient, and sustainable energy systems, crucial for achieving global climate goals.

3. Address the Debt Conundrum

The complex relationship between debt levels, cost of capital, and investment in renewable energy infrastructure highlights the need for comprehensive strategies that align economic and environmental goals. International financial institutions, developed countries, and private sector actors must collaborate to provide targeted financial support for renewable energy projects, while addressing the persistent debt challenges faced by EMDEs. Optimizing lending and borrowing practices, including restructuring debt to long-term maturities, is essential to avoid the low-growth, high-debt cycle many EMDEs face. Development loans should span at least 30 years to support long-term economic growth and avoid

liquidity crises. Establishing global or regional financial institutions, such as a global lender of last resort, could help manage credit risk and prevent debt crises. Credit enhancements and temporary debt service suspensions could also provide much-needed fiscal space for green investments.

Expanding debt relief initiatives to include middle-income countries investing in energy transition could enhance fiscal space and investment capacity. Debt-for-climate swaps, whereby a portion of a country's debt is forgiven in exchange for the country committing to specific environmental conservation efforts, offer the potential of a dual solution by reducing debt while promoting climate-related investments, although their effectiveness is limited by scale and transaction costs. Improving the fairness and accuracy of credit ratings, along with adopting flexible debt management approaches, could alleviate financial pressures on developing countries. Exploring alternative risk assessment methods, such as the Global Sustainable Competitiveness Index (GSCI), and reforming the IMF-WB Debt Sustainability Framework (DSF) to incorporate long-term growth and debt maturity considerations is critical.

4. Strengthen Innovative Financing Mechanisms

By expanding the issuance of green bonds, regions can attract a wider range of investors who are interested in supporting sustainable projects, thereby increasing the availability of capital for renewable energy initiatives. Additionally, the creation of Special Purpose Vehicles (SPVs) for cross-border projects can help pool resources from multiple stakeholders, share risks, and enhance financial collaboration. SPVs are particularly useful for large-scale infrastructure projects that require significant upfront investment and long-term commitment from various parties. Encouraging joint ventures between public and private sectors, as well as across borders, is another effective way to leverage complementary strengths and enhance the financial viability of renewable energy projects. These joint ventures can combine public sector oversight and private sector efficiency, resulting in more effective and sustainable project outcomes. Supporting early-stage clean energy technologies through venture capital (VC) is also essential for fostering innovation and reducing the costs of new technologies, making them more accessible and attractive to investors. By providing targeted support to innovative financing mechanisms, regions can significantly enhance their capacity to fund the energy transition.

5. Rethink Public Financing and MDBs

MDBs should be strategically deployed in key projects to maximize their impact and effectiveness. Increasing the availability of low-interest loans and grants, enhancing the flexibility of MDBs, and promoting effective tax systems and fiscal frameworks in recipient countries can significantly support the energy transition. By focusing on high-priority initiatives, MDBs can catalyze significant progress and development. Greater coordination among MDBs, including the harmonization of appraisal standards and strengthening reliance agreements, will streamline project approvals, reduce duplication, and improve overall project outcomes. Additionally, their involvement can attract private funding, as MDB participation can reduce investment risks and provide confidence to private investors. This strategic use of MDBs ensures that resources are efficiently allocated, driving the energy transition and economic growth.

6. Expedite Private Investment Influx

Mobilizing private finance is essential to funding clean energy projects without overburdening public budgets and can bring advantages such as efficiency and innovation. A combination of public and private efforts is crucial. Effective planning, a clear regulatory framework, and policy support are key to attracting more private investment. Policies themselves act as financial tools, unlocking private capital by making projects financially viable and aligned with broader objectives. Concessional finance and blended finance mechanisms, supported by MDBs, are vital in mitigating risks and improving the risk-return profile of projects, making climate-focused investments commercially viable. Institutional investors, particularly those providing debt capital, are essential for large-scale renewable energy projects, offering a pathway to low-carbon economies while achieving attractive returns. Private investors should not only diversify their portfolios to include renewable energy projects and engage in impact investing that prioritizes environmental and financial returns, but also have ambitious capital allocation strategies.

7. Accelerate Technology Advancements

Technological advancements are the driving force behind the energy transition, and financing these innovations is critical for enhancing the efficiency and reliability of energy systems. Investments in smart grids, energy storage, grid modernization, and renewable energy integration require substantial financial support. These technologies are essential for adapting to real-time changes in energy usage, ensuring a stable energy supply, and enhancing energy security. Supporting international collaborative research and development (R&D) programs is vital to maximize the benefits of technological advancements. Regional cooperation in R&D not only fosters technological innovation but also ensures that advancements are accessible to all participating countries, driving collective progress towards global energy sustainability goals.

Context

The success of the global energy transition critically requires a shift from a solely national focus to a regional perspective. Regional cooperation is not just a beneficial opportunity; it is an imperative for the future of sustainable energy. Clean energy solutions are inherently regional, necessitating interconnected systems and collaborative frameworks. This regional focus is essential for addressing the complex challenges of the energy transition, requiring comprehensive engineering, institutional, and financial solutions.

Joint investments in large-scale renewable energy projects lower costs in a variety of ways, as described in many reports of the Global Energy Interconnection Development Cooperation Organization (GEIDCO).[14] Large-scale transmission systems effectively channel high-quality renewable energy sources such as wind, solar, hydro, and geothermal from resource-rich areas to population centers. These extensive interconnections enhance the stability of power systems with large penetrations of intermittent energy resources, as well as mitigating resource imbalances exacerbated by climate change.[15]

Interconnection projects at a regional level improve efficiency by connecting resource-rich economies with low demand to adjacent resource-poor countries with high demand. This facilitates the efficient allocation and utilization of resources, benefiting both the resource-rich and resource-poor countries. It also helps balance the supply and demand of resources in the region and promote economic growth and development.[16] For instance, wind conditions may be strong in the North Sea while calm in the Black Sea, and vice versa, creating a more balanced and reliable energy supply.[17] Moreover, a larger grid mitigates demand variability by distributing energy usage across a broader base. This expansive network both increases resilience against extreme weather events, which might disrupt a single power source but not others, and also reduces storage and operation costs. The engineering and financial benefits of such a large, interconnected grid are well documented, particularly in regions with sufficient energy demand to offset the substantial costs of long-distance power transmission.[18]

Financial collaboration across countries is crucial for transboundary projects and for mobilizing the significant capital investments required for large-scale renewable energy projects, which often exceed the capacity of individual countries to finance independently.[19] For instance, should EU member states pursue reduction targets individually rather than collectively, the transition costs are expected to rise by about EUR 25 per tCO_2e.[20] Similarly, coordinated regional efforts can attract investment from international financial institutions, development banks, and private sector investors by presenting a unified and comprehensive approach to renewable energy development. These strategies can include the creation of regional green bonds, investment funds, and public-private partnerships that lower the financial risks associated with renewable energy projects. By pooling financial resources and presenting a larger, more attractive market for investment, regions can secure the necessary funding to advance their renewable energy goals.

Similarly, regional collaboration allows countries to share technological innovations, best practices, and financial resources, thereby accelerating the development and deployment of renewable energy projects.[21] This collective approach enhances the effectiveness of energy solutions, leveraging the diverse strengths of each participating nation to create more robust and innovative outcomes. Moreover, regional cooperation fosters collaboration and innovation, leading to the establishment of joint R&D initiatives. These partnerships can address common challenges such as energy storage, grid integration, and the intermittency of renewable energy sources more effectively than isolated national efforts. Innovation thrives in a collaborative environment, driving advancements in renewable energy technologies and enabling the development of cutting-edge solutions that are both efficient and scalable.

It is also important to address that while regional integration of power grids offers significant benefits, geopolitical issues can also create friction between neighboring countries due to differences in political agendas, regulatory frameworks, and economic interests. These differences can lead to a lack of cooperation and coordination, making integration difficult. Technical and operational challenges also play a role. Synchronizing different grids with varying technical standards and operational practices can be complex and costly. This complexity is compounded by the need for robust and resilient infrastructure to handle cross-border energy flows. Thus, to efficiently and effectively advance the energy transition from a regional perspective, contextual challenges must be addressed.

Under current policies and market conditions, the anticipated investment over the next seven years is projected to cover only about two-thirds of the spending needed to triple installed renewable capacity by 2030, translating into an 8% global GDP loss by 2070 due to inaction.[22] This leaves an annual gap of approximately USD 400 billion in required spending on renewables from 2024 to 2030.[23] Moreover, aligning with the IEA's Net Zero Emissions by 2050 Scenario (NZE Scenario) demands an additional USD 500 billion per year to completely bridge the gap, including investments in renewable power generation, grids, and battery storage.[24] Simply put, to keep the Paris Agreement (PA)'s targets within reach, global investments in renewable energy must double and spending on energy efficiency improvements must triple by the end of the decade.[25] Emerging and developing countries (EMDEs) alone will require USD 2.4 trillion annually, representing over a fivefold increase from 2020 levels.[26] This significant investment gap underscores the urgency for efforts to mobilize the necessary financial resources to achieve global climate and energy goals. Corresponding investment supply with demand remains a challenge due to the current mismatch between large-scale institutional investments and the need for small-scale equity for early-stage technologies and projects.

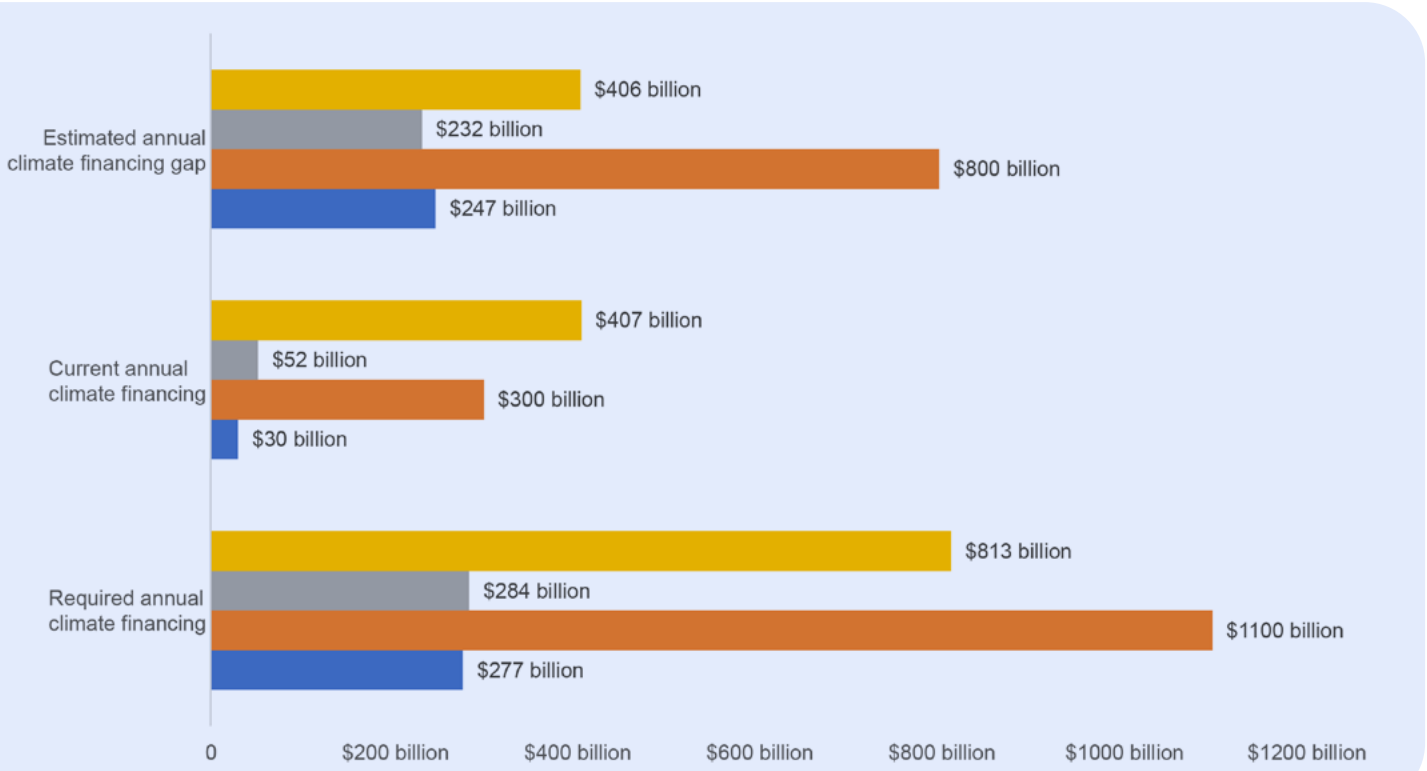

Figure 1: Estimated Climate Financing Gap by Region (Average annual by 2030 in USD)

Source: Author's elaboration based on CPI,[27] IMF,[28] UN ECLAC,[29] and EU.[30]

Understanding the current global climate finance gap, the need to harness public and private financing becomes imperative. The language used in climate accords, beginning with COP16, clarifies that the USD 100 billion pledged in the PA may encompass funding from both public and private sources. However, the accords do not explicitly outline the proportions of financing from these various sources, nor do they specify how different financial instruments should be accounted for. Moreover, the role and share of public and private climate financing varies significantly across countries. In the period of 2018-2023, public investors (governments or state-owned enterprises) accounted for half of global energy investments, compared to just 15% in AEs.[31] At a global level, private investors financed approximately 49% of total climate finance investments.[32]

Notwithstanding, the concept of 'climate finance' is not universally standardized, leading to contested definitions and claims.[33] This means that even the meager estimates of current financing levels likely overstate real investments in renewable energy and other climate-related investments. The persistent challenges and shortcomings in mobilizing and tracking financial flows, and in the credibility of existing commitments and financing mechanisms, undermine financing goals and warrant careful examination.

Common Challenges

Across the regions analyzed, several common challenges impede the advancement of financing pathways for the energy transition. Notably, substantial investment deficits in climate-related initiatives are compounded by elevated financing costs, restrictive fiscal conditions, and onerous regulatory hurdles. These impediments are not confined to any single region but are pervasive across Africa, APAC, Europe, and LAC. Despite variations in economic contexts and developmental stages, these barriers collectively exacerbate the global climate investment gap, underscoring a critical need for targeted policy interventions and innovative financial solutions to facilitate the transition to a sustainable energy future.

High Financing Costs and Debt Conundrum

Regardless of the region, one of the most significant barriers to the energy transition is the high cost of capital for renewable energy projects. The high cost of capital is influenced by several factors: sovereign credit ratings affecting country risk, short-term lending with high costs and liquidity issues, and borrowing in foreign currencies that can lead to increased costs due to currency depreciation and limited access to liquidity mechanisms such as central bank swaps. In parallel, the elevated levels of indebtedness can be attributed, in part, to the elevated cost of capital, thereby exacerbating the debt burden, which in turn perpetuates the heightened cost of capital. This relationship between the high cost of capital and increasing levels of debt forms a self-reinforcing loop, wherein each factor amplifies the other, making it more expensive to finance energy transition projects, especially in securing sufficient and cost-effective capital for essential grid expansion. On top of that, the high financial costs directly impact the final tariffs of countries, leading to increased electricity prices. This often necessitates the allocation of larger public funds for subsidies, exacerbating the issue of energy poverty.

Nominal financing expenses in EMDEs are generally 700 to 1,500 basis points higher compared to those in the United States and Europe.[34] Long-term government bond interest rates, which serve as a benchmark for estimating borrowing costs, experienced significant increases in numerous countries during both 2022 and 2023.[35] Borrowing costs in a country's own currency depend on its macroeconomic policies. In many EMDEs, high domestic interest rates caused by inflation make investment and financing more difficult. Borrowing in hard currency, however, typically involves the US borrowing rate plus a risk premium specific to the country. This situation weighs heavily, hindering investment opportunities.

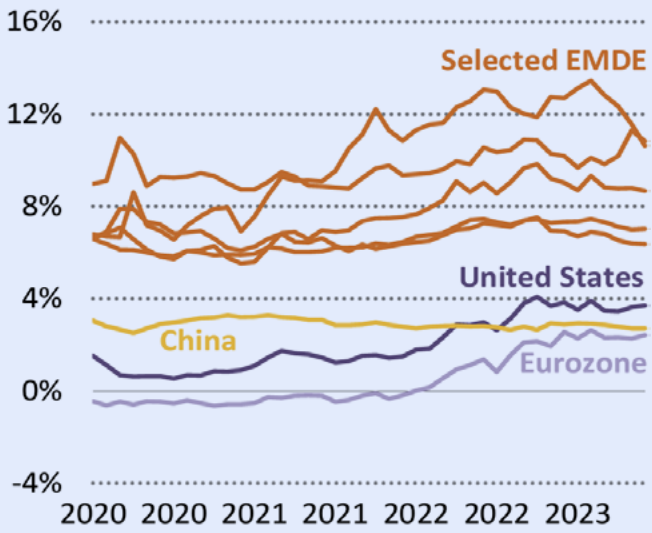

Figure 2: 10-year government bond yield
Source: IEA (2024) [36]

Especially when talking about private sector funding, high cost of capital can impede financing by harming the conditions and structure of such financing and reducing investor confidence. These factors influence the ability to pursue growth opportunities, often leading private investors to seek more economically attractive alternatives.

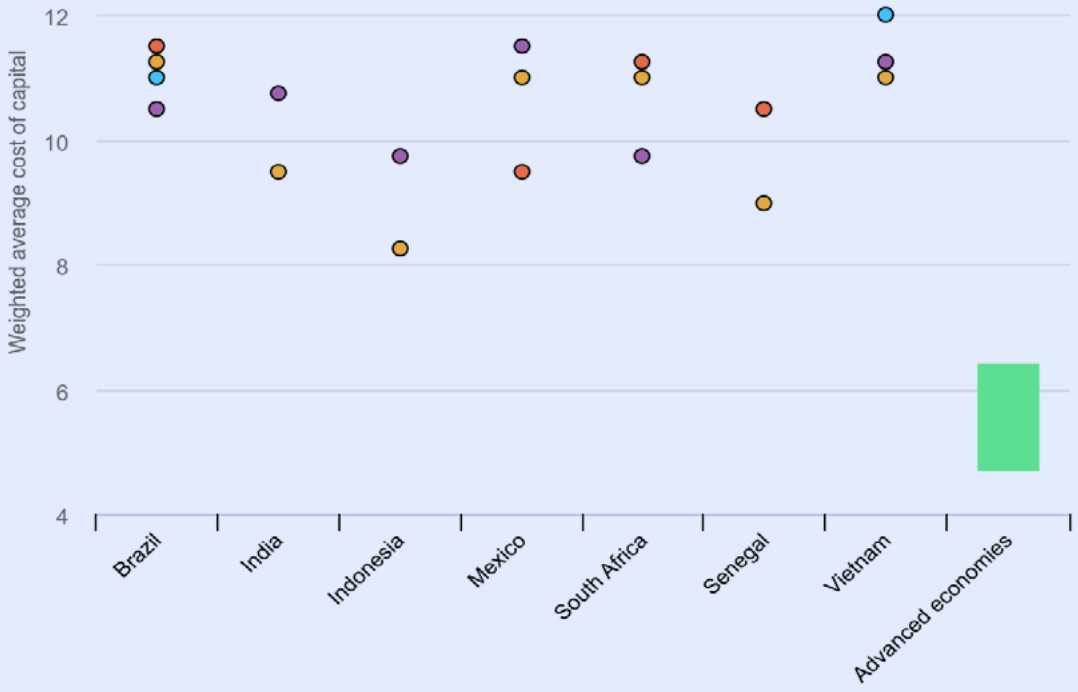

Figure 3: Weighted average cost of capital by project type in selected countries, 2022
Source: IEA (2023)[37]

EMDEs rely on external financing to meet their clean energy targets, given their inadequate domestic savings and limited fundraising capabilities. The external debt stock in these countries has outpaced their economic growth over the past decade.[38] High debt levels in EMDEs can be explained by three main factors: 1) EMDEs require substantial financial flows to meet their sustainable development goals and their limited domestic savings force them to borrow externally, 2) when EMDEs borrow in foreign currencies, depreciation of their domestic currency increases the local currency value of debt, making it more expensive to service, and 3) when economic shocks and external vulnerabilities, including post-pandemic macroeconomic conditions and political instabilities, impact EMDEs' priorities. Nonetheless, rather than the magnitude of the debt itself, it is the terms of borrowing for EMDEs that pose significant challenges.

Sovereign credit ratings play a crucial role in determining borrowing costs and conditions. Higher debt levels lead to increased perceived risks, reflected in worse sovereign ratings, and therefore higher interest rates. These ratings are determined through an initial assessment that incorporates three primary factors of equal significance: economic strength, governance criteria, and financial stability.[39] This assessment involves a blend of quantitative and qualitative metrics, with the "institutions" component exclusively relying on qualitative criteria. Additionally, the initial score may be subject to downward adjustments contingent upon a nation's vulnerability to event risks.[40]

While these are intended to be impartial assessments of default risk, they can be misleading or not accurately reflect a country's fiscal health or governance.[41] By prioritizing immediate policy measures and economic indicators, CRAs often overlook the sustainability and future growth prospects of national economies.[42] As such, sovereign credit ratings inadequately encapsulate the intricate risks and opportunities associated with national economies, particularly concerning long-term economic vulnerabilities and potential growth.[43] Unfortunately, the prevailing financial mechanisms fail to accommodate these complexities, often leading to inadequate support for managing the inherent uncertainties. Moreover, sovereign credit ratings are influenced by the political and policy preferences of the rating agencies. This influence results in systematic biases that affect countries differently based on their political orientation and policy choices.[44]

Misleading ratings and inaccuracies, resulting in poor sovereign ratings for EMDEs, increase the cost of borrowing, as investors demand higher returns for perceived higher risks.[45] Figure 4 shows that only less than 15% of the EMDEs with an assigned sovereign credit rating have an investment grade rating.[46] This dynamic imposes constraints on public debt and fiscal policies, pressuring governments to adopt austerity measures to avoid downgrades, which can lead to reduced public investment and social spending.

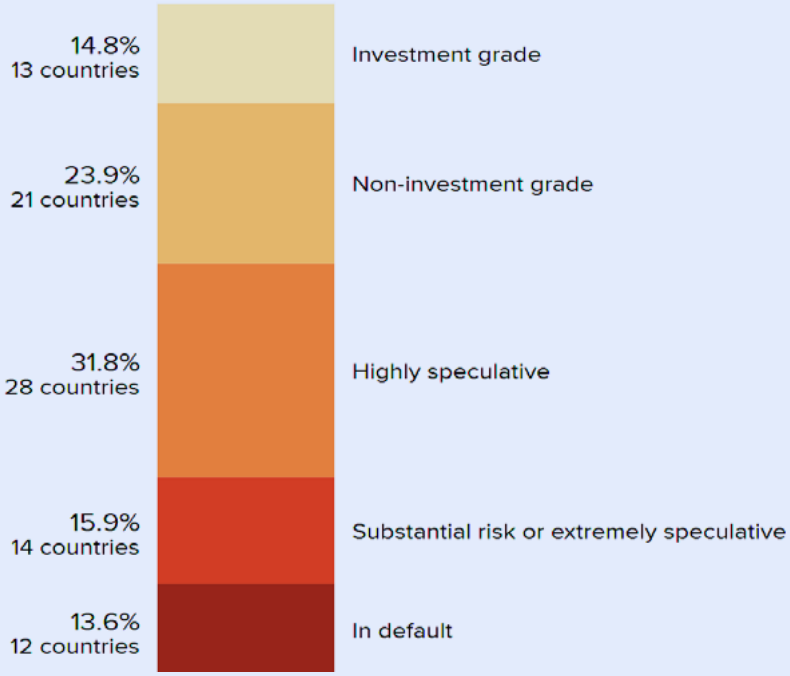

Figure 4: Distribution of Developing Countries on Rating Classes

Source: Credit ratings based on S&P and Moody's (as of 23 May 2024)
Note: Numerical rating is obtained using the ratings scale in Jensen (2022) and as a simple average across ratings.

EMDEs with weaker sovereign credit ratings have encountered slower economic expansion and faced more unfavorable financial circumstances, such as depreciation in exchange rates and an increase in sovereign spreads. Approximately one-third of these nations are anticipated to have per capita income levels in 2024 that remain beneath those of 2019, with growth throughout 2020–2024 expected to constitute the weakest non-consecutive five-year average since the mid-1990s.[47]

This creates difficulties in securing affordable financing for large-scale renewable energy projects that require substantial upfront investments. This scenario perpetuates a cycle where high borrowing costs and structural economic weaknesses constrain sustainable development efforts and hinder progress towards energy transition goals. Similarly, debt and sovereign risk ratings often create incentives for countries to exploit natural resources as a means of revenue generation without sufficient regard for the environmental and social costs.[48] Although it is challenging to price risk accurately in advance or reward sound management practices, the current system exacerbates the problem through both pricing and inflexible terms.

EMDEs end up borrowing short-term loans with very high costs, incompatible with the prolonged maturity of clean energy investments. For instance, if the debt were structured over a 40-year period, with project financing linked to a repayment plan, the issue of liquidity would not arise. Even if the debt were to reach over 200% (in fact Japan reached 226% in 2022) provided it is utilized to fund high-return investments that yield returns over three or four decades, and with an interest rate of 2% for 30 or 40 years, countries would only be paying around 5% of GDP in interest payments.[49]

Alarmingly, a significant portion of the funding provided by developed nations to EMDEs to finance climate-related and renewable energy projects is absorbed in excessive costs tied to the loans. This occurs, for example, when loan conditions require recipient countries to hire or purchase materials from companies based in the lending nations. Conditional loans and grants can increase costs for recipient nations by up to 30%, as they are often unable to consider cheaper alternatives.[50] Between 2015 and 2020, developed countries loaned at least USD 18 billion at market-rate conditions and another USD 11 billion in conditional loans.[51] Consequently, even as global attention turns to sustainability, EMDEs find themselves hindered by a financial architecture that does not acknowledge the unique challenges and timescales of their developmental and environmental agendas.

The debt conditions and high financing costs result in EMDEs having low liquidity and being particularly susceptible to liquidity crises. Several factors contribute to the propensity for liquidity crises in EMDEs. First, in times of global financial uncertainty, foreign investment can quickly exit these markets, leading to sudden and severe liquidity shortages. Second, since most EMDEs rely on foreign-denominated debt, a sharp depreciation in the local currency can dramatically increase the burden of foreign debt, leading to a liquidity crunch. The foreign currency risk is exacerbated by long project timelines typical of energy infrastructure, where sustained currency depreciation can lead to cost overruns, reducing investor confidence and deterring further investment. Third, countries that heavily rely on a limited number of commodity exports, or even a single one—such as Zambia's reliance on copper or Iraq's on oil—experience heightened vulnerability.[52] EMDEs that are heavily dependent on commodity exports (95% of the 20 countries most vulnerable to climate change are commodity-dependent EMDEs) are vulnerable to fluctuations in global commodity prices.[53] A sudden drop in prices can lead to reduced export revenues, straining public finances and reducing liquidity. Consequently, this tendency drives the economy further towards a reliance on commodities. Finally, banking systems in EMDEs can be less robust, with higher levels of non-performing loans and lower levels of capital adequacy.[54]

As the troubling pattern persists, cost of capital continues to be higher for EMDEs than for developed economies, complicating access to financing for the energy transition. This situation not only impedes economic development but also exacerbates the disparity between advanced and developing nations, thereby intensifying the difficulties associated with achieving sustainable growth and resilience in these critical global sectors. Overall, the combination of high borrowing costs, misleading credit ratings, and structural economic weaknesses traps EMDEs in a difficult position. This "rat's trap" scenario makes it exceedingly hard for these nations to break the cycle of unsustainable debt and underinvestment in the energy transition.

Fiscal Constraints

Competing demands on public budgets for various essential services and infrastructure limit the ability of governments to allocate sufficient funds for the energy transition and sustainability. Public budgets are often stretched thin by the need to address a wide range of critical issues, such as healthcare, education, public safety, and transportation infrastructure. The COVID-19 pandemic's legacy

has left fiscal constraints at a scale far larger than what would have been on track prior to the global emergency.[55]

Although the debt-to-GDP ratio is higher in AEs than it is in EMDEs, EMDEs have encountered significantly harsher conditions for accessing both long-term and emergency financing, including interest rates and sovereign bonds spreads.[56] Around 38% of EMDEs have net interest payments higher than 10% of their total public revenue.[57] These conditions limit EMDEs' capacity to manage their debt burden. Many EMDEs have short-term, high-interest debt that needs to be paid off within five years, which is often before they see any financial return from these renewable projects.[58] The discrepancy between the short-term duration of available financing options and the long-term investment horizon needed for energy projects creates a detrimental financing gap.

In such a way, the surge in short-term debt issuance has led to a deterioration of the repayment outlook for sovereigns in EMDEs, necessitating the repayment of large debt volumes within the forthcoming three years.[59] Such a quick repayment period increases the risk of default, damages credit ratings, and limits future borrowing opportunities. Low-income countries are particularly exposed to the greatest rollover risk, with 45% of their total outstanding debt requiring repayment or refinancing within a three-year timeframe.[60]

These detrimental debt terms can lead to a multitude of economic problems including reduced fiscal space for public investment, higher interest rates on borrowing, and an increased risk of financial crises. These challenges directly impact the ability of these countries to invest in critical areas for development, provided that financial resources are diverted from development projects to debt servicing. It is estimated that low-income countries, such as Rwanda or Nicaragua, allocate 2.3x more funds to servicing net interest payments than to social assistance, 1.4x more than to domestic health expenditures, and around 60% of their education spending.[61]

The International Monetary Fund and the World Bank (WB) assess debt sustainability of developing countries through their Debt Sustainability Analysis (DSA). The DSA aims to prevent debt crises by identifying potential risks and providing a framework for sustainable borrowing. However, the imposition of debt ceilings based on these analyses can be a double-edged sword. While intended to maintain debt at manageable levels, these ceilings can also limit the availability of funds needed for critical investments in energy transition.

The DSA errs on the side of caution, excessively focusing on the levels of borrowing to the detriment of facilitating necessary investments in critical areas. Borrowing should be examined relative to the returns on the investments and the feasibility of long-term debt servicing, not according to arbitrary limits on the debt-GDP ratio as now used in the DSA. Such an approach can unjustly restrict access to essential financing, particularly for long-term projects crucial for sustainable development. Recent DSAs indicate that 51% of developing economies are either already experiencing debt distress or are at high risk of encountering it.[62] By prioritizing the avoidance of immediate debt over the potential for long-term economic returns, DSAs may inadvertently hinder a state's ability to undertake investments that could ensure its future economic solvency. Moreover, DSAs frequently conflate liquidity issues—short-term abilities to meet debt obligations—with solvency issues—long-term economic viability—thereby enforcing unnecessarily stringent borrowing conditions.[63]

Regulatory Barriers

Inconsistent regulatory frameworks and policies across countries globally pose significant challenges to the smooth implementation of renewable energy projects. The success of the energy transition and SDGs will not be possible without the proper and enabling regulatory frameworks and policies.[64]

One of the significant challenges is the presence of outdated policies and complex permitting processes. Many regulatory frameworks governing energy production and distribution were developed decades ago, before the emergence of modern renewable energy technologies.[65] These outdated policies often fail to account for the unique characteristics and benefits of renewable energy, creating barriers to market entry and stifling innovation. The outdated policies also lack the consideration of new services required for the operation of intermittent renewable sources. For instance, most traditional energy markets offer only one or two products, such as energy and, in some cases, capacity. While wind and solar energy contribute to energy production and some capacity, they necessitate additional services like flexibility and frequency regulation. However, markets for these services are not yet fully established. Therefore, it is not merely that markets did not account for wind and solar energy; rather, they were not designed to accommodate variable energy sources.[66]

Similarly, securing the necessary permits for renewable energy projects and the transmission lines associated with them, especially in major jurisdictions, can take up to ten years, not including financing, construction, or ramp-up.[67] Bureaucratic red tape, inconsistent enforcement of regulations, and a lack of streamlined procedures can result in significant delays and increased costs. These permitting delays not only hinder the timely implementation of renewable energy projects but also discourage potential investors who are looking for more predictable and efficient environments to allocate their capital.[68]

Another significant issue, especially in the context of streamlining a regional energy transition, is the fragmentation of policies and regulations. Renewable energy projects often span multiple governmental levels and political cycles including at the local, state/provincial, and national levels. Inconsistencies and conflicts between regulations in these jurisdictions create uncertainty and ambiguity for project developers, complicating compliance efforts and increasing legal risks. This patchwork of policies can also lead to uncertainties and risks that deter foreign investment and innovation, essential for the advancement of renewable energy.[69]

Land-use reforms and the availability of suitable sites for renewable energy projects present additional challenges.[70] In many regions, especially in the EMDEs context, the allocation of land for renewable energy development competes with other land uses such as agriculture, urban development, and conservation. The process of securing land rights can be fraught with legal and regulatory hurdles, disputes over land ownership, and community opposition.

Unique Opportunities

Notwithstanding the above-mentioned transversal challenges to advance towards the energy transition from a regional perspective, each region possesses distinct opportunities influenced by their unique contexts, natural resources, and policy frameworks. Effectively harnessing these opportunities can serve to alleviate common challenges and expedite the energy transition process.

Africa

Africa stands at a critical juncture in the energy transition, characterized by its vast renewable energy potential juxtaposed with significant energy poverty. Of the regions analyzed through this work, Africa is the region with highest levels of energy poverty. Over 75% of the global population lacking access to electricity resides in Africa.[71] This stark energy deficit profoundly impacts economic growth, healthcare, education, and overall quality of life. Similarly, energy access in Africa is highly uneven. A significant portion of the population without access to energy is concentrated in five African countries: Nigeria, the Democratic Republic of Congo, Ethiopia, Tanzania, and Uganda.[72] North African countries like Egypt and Algeria have nearly universal access to electricity, while sub-Saharan Africa (SSA) lags significantly. In countries like Chad and Burundi, electricity access rates are below 20%.[73] This disparity underscores the urgent need for the Africa region to prioritize the achievement of Sustainable Development Goal 7 (SDG7), which aims to ensure "affordable, reliable, sustainable, and modern energy for all" by 2030.[74] Achieving universal access to electricity and clean cooking by 2030 in Africa requires substantial investments and coordinated policy actions.[75]

In parallel, Africa's current energy mix is dominated by traditional biomass and fossil fuels.[76] Biomass, including wood and charcoal, accounts for more than 45% of the primary source of energy for cooking and heating, particularly in rural areas.[77] Without proper investments in clean cooking technologies, millions of African households will continue to rely on traditional, polluting methods such as burning wood, charcoal, or dung. These methods are not only inefficient but also pose severe health risks, particularly respiratory illnesses, due to indoor air pollution. The failure to address this issue will have profound implications for public health, environmental sustainability, and economic development, especially in low-income and rural areas. Oil, gas, and coal also play a significant role in the energy supply, particularly in countries with substantial fossil fuel reserves like Nigeria and South Africa.[78]

Despite this, the region holds great potential for renewable energy, with abundant solar, wind, hydro, and geothermal resources. Hydropower has long been a cornerstone of Africa's renewable energy landscape, serving as the continent's largest renewable energy source. Major projects such as the Grand Ethiopian Renaissance Dam (GERD) highlight its continued relevance and expanding role.[79] In recent years, there has been a renewed interest in hydropower, not only for electricity generation but also for emerging applications such as green hydrogen production. One notable example is the revitalized focus on the Inga Dam in the Democratic Republic of Congo, which holds the potential to become a significant hub for green hydrogen.[80] Solar and wind energy are also gaining traction, driven by falling technology costs and increasing investment. Notable

examples include the 510 MW Noor Ouarzazate Solar Complex in Morocco, one of the world's largest concentrated solar power plants, and the 310 MW Lake Turkana Wind Power project in Kenya, which is the largest wind farm in Africa.[81] These projects highlight the potential for large-scale renewable energy deployment in Africa.

Box 1: Lake Turkana Wind Power Project

The Lake Turkana Wind Power Project (LTWP) is a flagship renewable energy project in Kenya, recognized as the largest wind farm in Africa. Located in the Loiyangalani District, Marsabit County, approximately 600 km north of Nairobi, it harnesses the region's strong and consistent wind resources to significantly enhance Kenya's electricity generation capacity. The wind farm has an installed capacity of 310 MW, comprising 365 wind turbines, each with a capacity of 850 kW. The project development started in the mid-2000s, with construction beginning in 2014 and full commercial operation achieved in 2017.

The success of this project includes robust risk mitigation through political risk insurance from the Multilateral Investment Guarantee Agency (MIGA), partial risk guarantees from multiple Development Finance Institutions (DFIs), and a 20-year Power Purchasing Agreement (PPA) ensuring a stable revenue stream. Similarly, a Special Purpose Vehicle (SPV) named Lake Turkana Wind Power Limited was established for the development, construction and operation of the project. The SPV also allowed for risk isolation and mobilized more investment.

While the direct benefits are concentrated in Kenya, given that the country is a member of the East African Community, countries like Uganda, Tanzania, Rwanda, Burundi, and South Sudan can have positive spillover effects on regional power trade.

Total investment: EUR 623 million

Funding structure: A combination of equity and debt from a diverse group of investors and financiers. These include the AfDB, EIB, Standard Bank of South Africa, Norfund, Finnfund, EADB, Proparco, and FMO.

Source: Lake Turkana Wind Power[82]

Some African countries are at the vanguard of implementing innovative and comprehensive policies and frameworks aimed at promoting the clean energy transition. For instance, South Africa's Integrated Resource Plan outlines a roadmap for energy development, prioritizing the expansion of renewable energy capacity.[83] Similarly, Kenya's Energy Act provides a framework for the promotion of renewable energy and energy efficiency.[84] Countries like Rwanda and South Africa have also launched their national green taxonomies, providing a unified framework to guide green investments across sectors.[85] In countries like Côte d'Ivoire, Ghana, Kenya, Mozambique, and Rwanda, some public utilities and regulators provide subsidies to assist households in connecting to the primary grid. This support is often facilitated through government assistance and/or regulatory mechanisms that allow for the gradual recovery of costs over an extended period within their tariffs.[86]

In a complimentary way, the AfCFTA has significant potential to impact the energy transition in Africa. By reducing tariffs and trade barriers, AfCFTA facilitates smoother trade in energy technologies and resources across African countries. This market integration aims to attract more investment in renewable energy projects.[87] Additionally, AfCFTA promotes regional infrastructure projects, including energy grids, which can enhance energy access and reliability. The AU also plays a crucial role in the energy transition with its Digital Transformation Strategy, which includes implementing smart grids and Internet of Things (IoT) technologies to optimize energy distribution and consumption. Enhanced data management and analytics under this strategy can significantly improve energy efficiency and the integration of renewable energy sources.[88]

The ongoing development of an Africa Energy Transition Strategy with its accompanying National Deep Decarbonisation Pathways will provide important direction on the implementation of energy transition in Africa as it will give a clear signal to investors on where to direct finance for energy transition in Africa. It will complement important AU initiatives including the AfSEM, the CMP, and the Africa Energy Efficiency Strategy (AfEES). These initiatives set the stage for a conducive investment environment through a predictable energy landscape. AfSEM and CMP establish a least-cost plan with a pipeline of priority generation and transmission interconnection projects for an integrated continental market. AfEES includes six roadmaps for energy efficiency in transport, agriculture, industry, power, appliances, and buildings. These will also help investors in identifying investment opportunities.[89]

While these initiatives are ambitious and innovative, the implementation of existing government policies remains inadequate to achieve SDG7—or net-zero by mid-century—in Africa.[90] The current landscape remains fragmented, with varying regulations and standards across different countries. This lack of uniformity complicates cross-border energy projects and trade. Under the current regulatory framework, an estimated 565 million people will remain without access to electricity, and approximately one billion individuals will continue to lack access to clean cooking by 2030.[91]

There is a significant disconnect between the available capital and the financial requirements of Africa's burgeoning clean energy sector. Despite accounting for approximately 20% of the global population, Africa receives less than 2% of the world's clean energy funding.[92] In fact, SSA's investment per capita has seen a significant decline: between 2000 and 2020 it received less than 1.5% of the global investment in renewable energy.[93] Africa needs a robust investment of USD 4.22 trillion by 2050 (in 2019 dollars) to successfully meet the Agenda 2063 and reach

SDG7 by 2030.[94] In parallel, the implementation of African Nationally Determined Contributions (NDCs) is calculated at nearly USD 3 trillion by 2030.[95] Historically, African governments have pledged to invest around 10% of what is needed annually to advance the energy transition in the region.[96] Assuming this, there is an estimated annual energy finance gap of up to USD 45 billion that cannot be covered by national governments.[97] This means that most African nations are forced to heavily rely on external funding, including loans from private and public creditors and grants or concessional financing from international financial institutions and foreign governments. This funding gap is particularly pronounced in the realm of early-stage and equity financing, which are critical for fostering innovation and scaling up renewable energy projects.[98] START

As with access to energy, access to financing continues to be deeply unequal within African countries. Out of 54 African countries, only ten absorbed over 77% of all energy finance across a 10-year period (e.g. Egypt, Mozambique, Nigeria, South Africa, Angola, Morocco, Ghana, Uganda, Kenya, and Ethiopia).[99] Between 2012 and 2021, 82% of the total energy finance provided to African countries was driven by only ten investors.[100] These are China, the World Bank Group, France, Italy, United States, Russia, United Kingdom, Japan, India, and the African Development Bank.

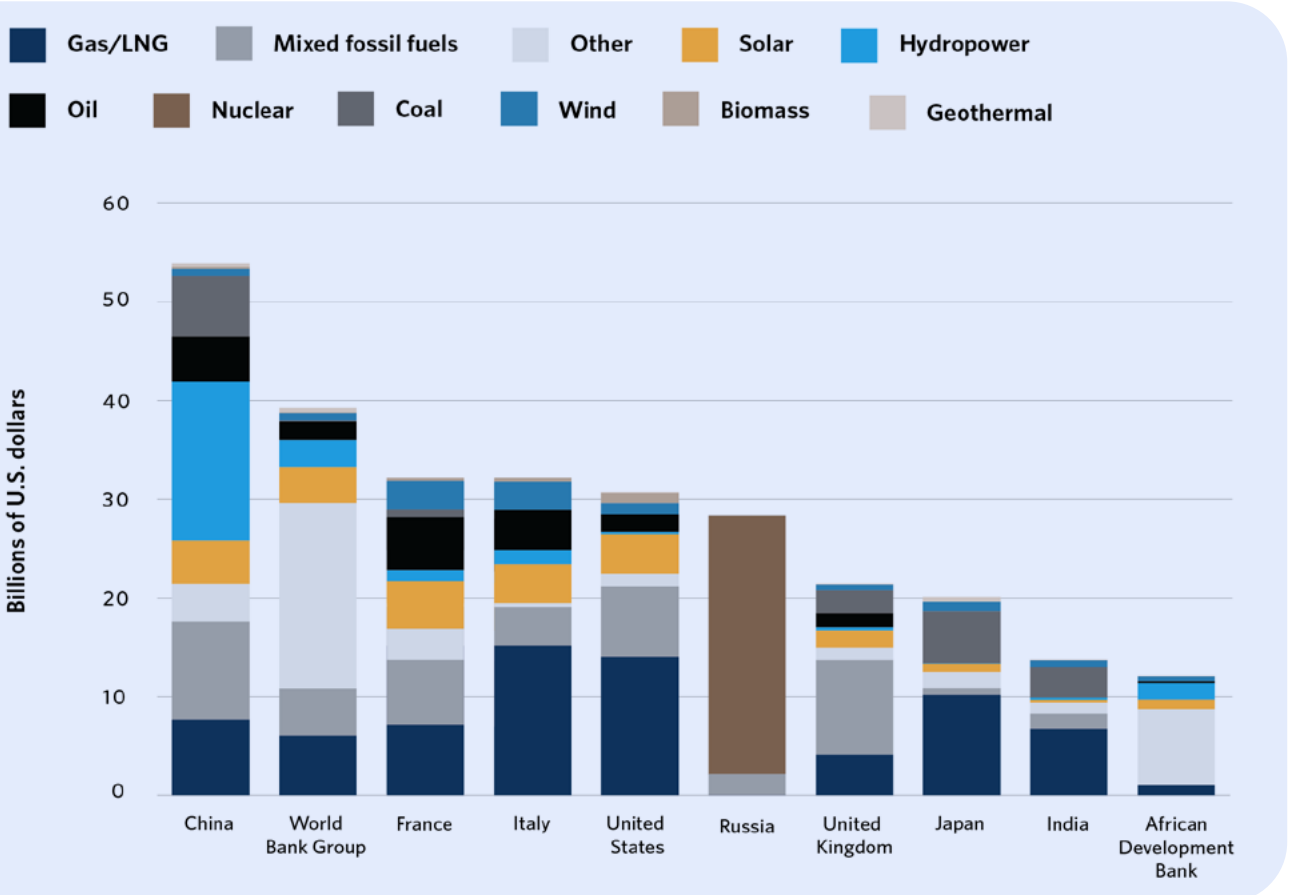

Figure 5: Top ten providers of energy finance to Africa, by energy source[101] (data for 2012-2021 period)

Source: Oyintarelado Moses, Who Finances Energy Projects in Africa?

The cost of Africa's limited financing is exorbitant.[102] Effective de-risking instruments are essential to reduce the elevated cost of capital for clean energy projects in the region, especially in volatile markets with abundant renewable

resources. For example, a 14-percentage point decrease in the cost of capital can cut the cost of solar electricity in Ghana by over 50%.[103] Even after controlling for risk ratings, SSA countries pay significantly higher coupons at issuance in foreign currency compared to their peers from other regions. On average, between 2004 and 2021, SSA countries paid around 2.1 percentage points higher coupon rates compared to countries from other regions.[104] Similarly, from 2014 to 2021, the average coupon rate for SSA issuances was persistently higher by 1.3 percentage points per year than the average coupon rate of EMDEs.[105] The situation is even worse in the secondary market.

Moreover, as described above in the second section of this paper, the high debt contributes to worse credit ratings, further undermining investor confidence, limiting financing flows and increasing the cost of capital. Of the 23 African countries that received a sovereign credit rating by the three international credit rating agencies (e.g. Fitch Ratings, Moody's Analytics, and Standard & Poor's) in the second half of 2023, 17 received a negative assessment, involving downgrades and negative outlook changes.[106] Additionally, 22 African nations lack credit ratings from international agencies.[107] The establishment of an Africa Credit Rating Agency (CRA) has the potential to fill this gap and represents a crucial move towards enhancing intra-continental integration.[108] This agency would facilitate African governments in accessing capital and linking the continent to global financial markets. In addition to credit ratings, the agency would offer evaluations on environmental, social, and governance (ESG) factors, as well as foreign direct investment (FDI) ratings. These services are urgently required in Africa to complement government initiatives aimed at fostering the growth of domestic financial markets.

The figure below highlights the wide range of interest rates within each creditor type in Africa, indicating the diversity of borrowing terms within each category. As indicated, African nations can only access private capital at extraordinary cost.[109]

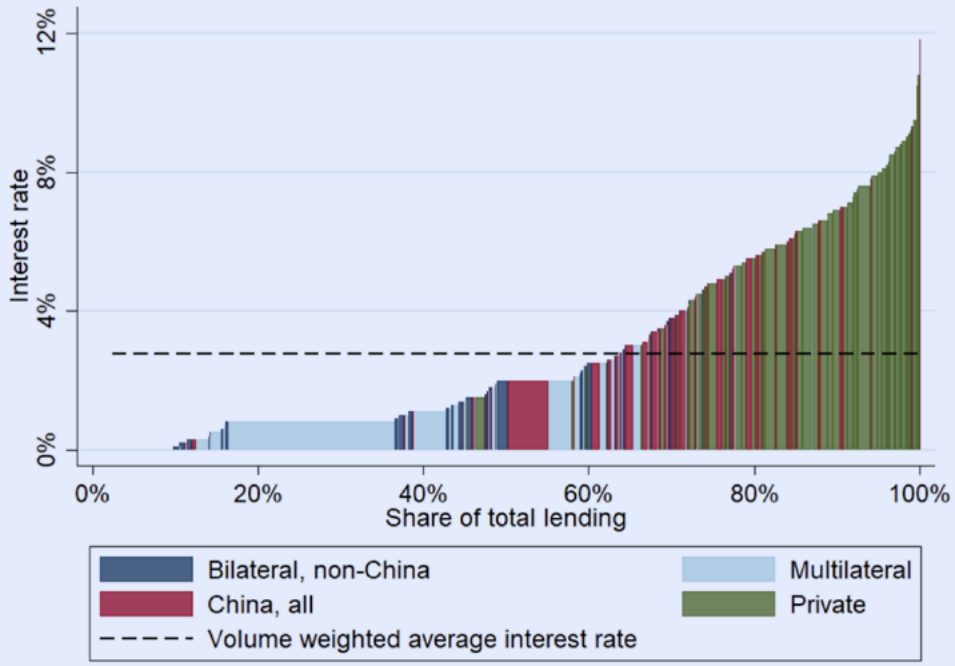

Figure 6: Anatomy of Africa sovereign debt interests - distribution across creditor type

Source: Mihalyi and Trebesch, Who Lends to Africa and How? Introducing the Africa Debt Database.[110]

Notably, a substantial portion of private energy investment in Africa goes to fossil fuel ventures (e.g. mixed fossil fuels, gas/LNG, oil, and coal), while only a smaller fraction is directed toward clean energy projects such as solar and wind power.[111] Just 23% of private energy investment in Africa has been allocated to solar and wind projects.[112]

The majority of public energy finance predominantly consists of loans, accounting for 77% of the public funding. The cumulative investment of approximately USD 197.17 billion from public bilateral institutions of G20 countries and MDBs for energy projects in Africa from 2012 to 2021 still falls short of what is needed.[113] Of that amount, public bilateral institutions provided 63%, and MDBs financed the remaining 37%.[114] The fact that most financing is provided by bilateral rather than MDBs is worrisome given the terms of those loans. On average, bilateral loans have a maturity of 22 years and an interest rate of 2% on top of LIBOR plus rates, whereas loans from MDBs to Africa have a maturity of 30 years and an interest rate of 0.8%.[115] Guarantees and insurance make up 19% of the finance, while grants constitute a mere 3%, equity 2%, and other forms of finance only 0.1%.[116]

Some African countries have shown leadership in fostering innovative financing mechanisms to advance towards their net-zero commitments by 2050. For instance, Rwanda's Development Bank issued its first Sustainability-Linked Bond (SLB) amounting to approximately USD 25 million in 2023.[117] The issuance also represented the first SLB in East Africa, marking the first time a national development bank, globally, issued this type of bond in the international capital market.[118] Besides the step-down coupon structure (the coupon payments decrease on a sliding scale between 0-40 basis points), the bond also has an innovative credit enhancement mechanism (facilitated by the WB).[119] The oversubscription of Rwanda's SLB signifies high demand and confidence in this type of financing. Additionally, the diverse participation from over 120 investors indicates that the bond appeals to a broad range of investment strategies and risk appetites.[120]

Asia and the Pacific

With a rapidly expanding population of over 4.5 billion, the APAC region represents more than half of global energy consumption. Over 97% of the population residing in the APAC region has access to energy.[121] Within APAC, the Association of Southeast Asian Nations (ASEAN) has become a focal point for the global energy transition. ASEAN stands as the world's fourth-largest energy consumer, driven by a rapidly growing population approaching 700 million.[122] The region is experiencing one of the fastest economic growth rates in the world.[123] Such growth is accompanied by a corresponding increase in energy consumption of over 3% annually, a trend expected to persist throughout this decade.[124] Currently, around 85% of such consumption relies on fossil fuels, particularly coal.[125] This underscores the significance of the region in shaping the future of global energy and sustainability. In addition to the strong mitigation efforts needed, the APAC region urgently needs investments in adaptation and resilience.

Even for economies that are increasing their renewable share in the respective energy generation matrix, coal and natural gas continue to be pivotal for the APAC region.[126] While renewable energy is set to play an increasingly significant role in the APAC region's power generation mix, the share of renewables is projected to rise to only 30% by 2040 from the current 24% under current policy scenarios,

unless stronger policy frameworks are implemented and more investment is provided.[127] Despite the growing consensus on the need to transition to cleaner energy sources, most of APAC and ASEAN renewable energy potential remains untapped. In Southeast Asia alone, renewable energy resources, based on their technical potential, are 40-50x current energy demand.[128] But to achieve net-zero in the region, renewable energy deployment must increase five-fold by 2030.[129] Countries like Indonesia and the Philippines have immense geothermal potential due to their location along the Pacific Ring of Fire, while coastal nations such as Vietnam and the Philippines are ideal for wind energy development.[130] Similarly, abundant solar resources make countries like India, China, and Thailand prime candidates for large-scale solar power projects. Hydropower also offers a reliable and sustainable energy source, particularly in countries with significant water resources like Laos and Myanmar.[131]

Infrastructure and technological challenges further complicate the energy transition in the APAC region. Existing grid infrastructure is inadequate to handle the variable nature of renewable energy, necessitating significant investments in grid capacity and smart grid technologies. The adoption of advanced technologies requires substantial investment in R&D to ensure technological readiness. Ensuring the reliable operation and maintenance of renewable energy projects, especially in remote areas, also requires capacity building and training.

The regulatory frameworks and policies in the APAC region related to energy transition exhibit a stark contrast between ambitious goals and practical implementation. While countries like China, Japan, Singapore, and South Korea have announced robust plans to achieve carbon neutrality by mid-century, the regulatory measures often lack the necessary enforcement mechanisms and consistency.[132] For instance, while China has rapidly developed green energy, it has also continued to rely on coal, hampering the speed of the energy transition.[133]

In many ASEAN nations, subsidies for fossil fuels remain a significant barrier to the adoption of cleaner energy sources.[134] The highest fossil fuel subsidies in Asia are in Indonesia at USD 25 per capita, followed by China and India at USD 18 and USD 17, respectively.[135] In Southeast Asia, fossil fuel subsidies amounted to a total of USD 32 billion over the past decade.[136] These subsidies undermine the financial viability of renewable energy projects.

While the region's policy landscape has been plagued by a lack of harmonization and coordination among neighboring countries, leading to fragmented and sometimes conflicting approaches, there have been efforts to foster coordinated regional frameworks. For instance, the Asia-Pacific Economic Cooperation (APEC) developed the APEC Renewable Energy Roadmap, aiming to double the share of renewable energy in the region's energy mix by 2030.[137] Similarly, the APEC 2016-2025 framework aims to enhance energy security in the ASEAN region. Nonetheless, while the APAC region's energy transition policies are commendable on paper, their execution remains fraught with significant challenges that must be addressed to meet global climate goals effectively. Enhanced cooperation within ASEAN, such as through the ASEAN Power Grid (APG) and Trans-ASEAN Gas Pipeline (TAGP), is crucial for improving energy security, accessibility, and sustainability. [138]

In terms of investment, the current levels are far from what the region needs. EMDEs in the APAC region require an investment of at least USD 1.1 trillion annually to achieve net zero.[139] This represents an investment gap of about USD 800 billion annually just for EMDEs in APAC.[140] This gap is aggravated by the

fact that of total energy investments in APAC, fossil fuels continue to receive the highest amount of capital by far. To illustrate, about 79% of total energy investments in 2022 were allocated to support fossil fuel projects.[141] Similarly, between 2016 and 2020, average annual clean energy investment in Southeast Asia was a mere USD 28 billion,[142] compared to the estimated USD 150 billion annually needed for ASEAN to be on track with the PA.[143]

It has also been estimated that to meet the energy sector requirements outlined in their NDCs, Asian nations would necessitate a total investment of USD 4.8 trillion from 2016 to 2030.[144] This staggering figure highlights the immense financial challenge ahead. Despite the decreasing costs of renewable technologies, many projects remain stalled or underfunded due to the inability of domestic sources to provide sufficient capital.[145]

On average, public finance in APAC provides ⅓ of the investment in renewable energy projects.[146] Governments in APAC are increasingly investing in renewable energy projects. China leads the energy transition in Asia with substantial investments aimed at decarbonizing its energy and transport sectors. Between 2017 and 2022, China's annual investments in electrified transport soared by 330%, reaching USD 234.1 billion. Similarly, annual investments in renewable energy increased by 93%, totaling USD 274.4 billion.[147] Just in 2022, China added approximately the same amount of solar photovoltaic production capability as the rest of the world put together.[148] India also recently announced an investment of USD 2.3 billion to boost its green hydrogen capabilities.[149]

Recent public initiatives are also increasingly designed to explicitly encourage private sector participation. For instance, the Just Energy Transition Partnerships (JET-Ps) aim to mobilize USD 20 billion from a consortium of AEs, co-led by Japan and the United States, to phase out coal-fired power plants in Indonesia.[150] However, while this initiative intends to foster a collaborative approach where public funding is used as a catalyst to attract substantial private investment, the implementation has not been exemplary. To date, the primary effect of these partnerships has been to stimulate internal negotiations within recipient countries, rather than achieving significant progress in the energy transition. This highlights a fundamental issue: the scale of anticipated financial support through JET-Ps is grossly insufficient compared to the needs of the recipient countries.[151]

The financial support and leadership of MDBs has also proven to be paramount in APAC's energy transition. Particularly, the Asian Development Bank (ADB) and the WB have been instrumental in supporting the region's transition. For instance, the first wind power project in Laos required an investment of over USD 692 million by ADB. [152] Debt finance accounts for over 73% of renewable energy funding provided by the MDBs. [153]

The APAC region is increasingly participating in the global sustainable debt market, primarily led by China. However, funding from green bonds represents around 2% of the total renewable energy financing in APAC.[154] In 2023, the region raised over USD 190 billion through sustainable debt issuance, with China leading globally in green bond issuance.[155] The ASEAN economies and India have also significantly increased their sustainable debt issuance, indicating a growing commitment to financing the energy transition through more innovative and sustainable financial instruments.[156] Additionally, APAC countries are advancing in the development of tools to strengthen their participation in international capital markets. Under the Green Growth Action Plan, Vietnam aims to enhance the capacity of financial

institutions to engage effectively in the green bond market.[157] However, unlike other regions, APAC sovereign issuances do not seem to have benefited from a significant greenium.[158] This suggests that the green bond market still remains highly underdeveloped and unattractive to investors, with no significant decrease in interest costs when compared to traditional instruments.

Private finance must also continue to scale up the energy transition efforts across APAC. The financing landscape for renewable energy projects in South and Southeast Asian economies predominantly relies on traditional banking channels due to premature bond markets and a limited fiscal capacity.[159] In 2019, roughly 95% of the private sector financing for renewable energy projects in APAC came from bank loans, yet between 2016 and 2022, Asian banks allocated only 14% of their investments to renewable energy projects.[160] This heavy reliance on conventional banking methods poses significant challenges, as these markets are often less flexible and slower to adapt to the rapidly evolving needs of the renewable energy sector. Equity, as with most of EMDEs, still plays a miniscule role in financing the energy transition in APAC. In 2019, equity financing from green securities and green funds accounted for only 3% of green finance.[161]

Latin America and the Caribbean

Latin America and the Caribbean is one of the most biodiverse regions in the world,[162] but it is also one of the most vulnerable regions to climate change.[163] Over the past 50 years, the frequency of climate-related natural disasters has tripled in LAC.[164] This has resulted in severe implications on health, ecosystems, and economies throughout the region. On average, these disasters can decrease GDP by up to 0.9% in lower-income countries and up to 3.6% in the Caribbean.[165] The average country in the region is also expected to incur an additional 3% of annual debt as a percentage of GDP due to climate disasters.[166] Additionally, climate change is projected to force the migration of 17 million people across LAC by 2050.[167]

The LAC region accounts for about 5% of the global cumulative energy-related GHG emissions.[168] Around 16.2 million people (representing over 2% of the Latin American population) still lack access to electricity.[169] Of the 33 countries in the region, approximately half of them have committed to achieving net zero by 2050 (or sooner). These countries make up 65% of LAC's GDP and 60% of its energy-related CO_2 emissions.[170] The region has abundant natural resources, such as solar, wind, and hydroelectric power, making it an attractive destination for these investments. While the region has evidenced progress towards the energy transition by increasing its renewable energy capacity by 51% between 2015 and 2022, LAC would need to adopt substantial changes in energy matrices and expansion plans to meet its 2050 targets.[171]

The regional energy matrix is widely heterogenous, with some countries fully based on hydropower, while others are initiating the transition.[172] In terms of the electricity generation matrix, Latin America is one of the cleanest worldwide.[173] However, this is mostly driven by a significant reliance on hydropower, which constitutes approximately 45% of electricity generation, bringing both benefits and challenges.[174] While hydropower provides a source of cheap electricity, it also heightens the region's vulnerability to climate change impacts. Industries in the region that are based on natural resources have the potential to become key economic drivers, particularly in clean fuels and bio-economy sectors. The abundance in the region of minerals that are critical for green technologies, such

as nickel, graphite, and lithium, presents significant opportunities. Moreover, the region has the potential to export green hydrogen to fulfill Europe's future needs.[175]

Countries like Brazil are rapidly diversifying their energy generation sources, reducing reliance on hydropower and increasing the share of other renewables.[176] However, this transition is not without challenges. To achieve the energy transition, Latin American countries need to not only transition the generation sources but also develop the adequate infrastructure. The region's current energy infrastructure primarily supports oil and gas production and consumption, with hydropower being also prominent across LAC countries.[177] In tandem, there is often a mismatch between generation and transmission, exacerbated by lengthy and inconclusive local community consultations and comprehensive planning issues. Developing transmission corridors and integrating transmission planning with generation projects are essential steps to address these challenges.

One of the key opportunities for Latin America is to enhance interconnections and create stronger regional energy markets. Although expanding the grid may introduce complexities to its operation, a larger grid offers increased flexibility and a wider range of options to efficiently meet power demand under optimal economic and technical conditions.[178] Grid interconnection enables a greater variety of transmission options to transport excess energy from one region to another. This helps in circumventing or delaying the need for new investments in additional generation capacity, energy storage technologies, auxiliary services, and baseload generation.[179] By integrating 80% renewable energies into the regional network, it is possible to save USD 23 billion and reduce carbon dioxide emissions by 0.7 Gigatons by 2030.[180]

Strengthening these interconnections not only boosts the integration of renewable energy sources but also fosters regional collaboration, ultimately leading to reduced generation costs. A good example of this is the Central American Electrical Interconnection System (SIEPAC) project, consisting of a 1,790-km electrical system connecting six countries (Panama, Costa Rica, Honduras, Nicaragua, El Salvador, and Guatemala).[181] The USD 505 million investment was co-financed by the Inter-American Development Bank (IDB), the Central American Bank for Economic Integration (CABEI), the Development Bank of Latin America (CAF), and other private banks.[182] In the Southern Cone, there is not a synchronous super grid yet. However, strong interconnections are being further discussed with the establishment of regulatory frameworks to facilitate power exchanges. Projects like the Arco Norte, a 3,000-megawatt power interconnection involving Guyana, French Guiana, Suriname, and Brazil, exemplify the potential of regional cooperation. The proposed interconnection would involve an investment of USD 800 million in different projects.[183]

The implementation of renewable energy projects and technology in LAC faces significant challenges due to regulatory barriers across the region.[184] Currently, there is no regional regulatory framework that provides a long-term vision for the energy transition. More generally, the region experiences an absence of precise definition of clean energy needs, insufficient pricing and tariff structures, and the lack of developed markets to enable the energy transition.[185]

As LAC countries commit to reducing carbon emissions and increasing the share of renewable energy in their energy mix, substantial public and private investments are required. The region must invest up to USD 150 billion or USD 1.3 trillion by 2030 to deliver on the PA goals.[186] By contrast, LAC governments have

penciled in approximately USD 20 billion annual financing to meet climate and energy transition goals in their NDCs.[187] Since 2020, Latin American governments have invested approximately USD 14 billion in the clean energy transition.[188] With the essential support of international development finance institutions, countries like Colombia, Brazil, Peru, and Chile have also attracted private sector investment in transmission grids using a business model comparable to the Independent Power Producer model for generation.[189]

However, the LAC region continues to face challenges in clean energy supply and infrastructure development due to limited fiscal space, macroeconomic issues such as high inflation, governance problems, and incomplete investment frameworks.[190] These factors have led to low investment levels and sluggish growth in the energy sector. It is also worth noting that most of the Latin American countries lack effective and efficient market development, resulting in weak capital markets and a poor financial system overall.[191] Most of the LAC countries continue to experience fiscal distress primarily driven by high levels of unsustainable debt.[192] Debt sustainability is a major concern for the region, especially given the high levels of public debt in many LAC countries. While it is also true that the risk perception has improved in recent years, many countries in the region still have low (or very low) investment grades, making it difficult to secure funding for large-scale projects due to very high financing costs.[193]

As a general rule, most of the bond yields of Latin American countries are typically higher than those in other developing countries. Brazil's ten-year government bond yield of Brazil in reais was just above 12% in 2023, compared to 6.5-7.5% in both Indonesia and India in domestic denominated currencies in the same year. Needless to say, this discrepancy tends to be even higher when compared to developed economies such as the U.S. (below 3%) and Europe (right above 2%).[194]

Box 2: Role of National Development Banks

BNDES - Leveraging Public Funds for Private Investment in Brazil's Energy Transition

BNDES (Banco Nacional de Desenvolvimento Econômico e Social) is Brazil's national development bank, with a long history of financing projects that support the country's economic and social development. Over the years, BNDES has become a critical player in Brazil's energy sector, particularly in supporting the transition to renewable energy sources.

One of the unique aspects of BNDES's operations is its ability to provide loans in the local currency, the Brazilian Real (BRL). This approach offers several advantages including mitigation of currency risk, enhanced project viability, and alignment with domestic policies. BNDES's model involves the strategic use of public funds to subsidize loans, making financing more affordable for projects that align with national development goals. This subsidy of public funds is a key element of BNDES's approach, as it serves to lower borrowing costs, catalyze private funding, and promote public-private partnerships (PPPs).

While BNDES has made substantial contributions to Brazil's energy transition, ongoing challenges include maintaining the balance between public and private investment, adapting to shifts in the global energy market, and continuing to innovate in financial mechanisms that attract private capital.

Source: BNDES (2024)[195]

Dealing with high inflation has also been a significant barrier to further developments in the clean energy transition across Latin American countries.[196] First, long-term high levels of inflation pressure governments to demonstrate their ability to control public spending and prices, driving some countries to utilize off-balance sheet infrastructure financing methods.[197] Second, high inflation can also tighten the conditions of the public debt. The average debt maturity in the LAC region has decreased from 12 years pre-pandemic to 5 years in 2023.[198] This exacerbates investors' reluctance to invest in long-term investments with fixed returns.

Only 2% of total global private energy transition investments are in LAC.[199] Due to low market penetration and size, the PE and VC markets show promising potential for expansion. To date, most private investments have been highly concentrated in larger businesses.[200] Latin American countries have, however, drawn considerable FDI.[201] Between 2005 and 2020, China invested over USD 136 billion of sovereign financing.[202]

Development banks have also been important finance providers in the region. Between 2016 and 2020, the IDB approved over USD 4.6 billion in loans and grants for renewable energy projects. Among these significant undertakings are the Cauchari Solar Park in Argentina and various wind farms in Mexico and Chile.[203] The funding sources include the Ordinary Capital (ORC) and the Strategic Climate Fund (SCF). As of June 2024, 48 out of 281 projects have yet to disburse funds.[204]

The CAF has allocated USD 2.74 billion in loans to support renewable energy projects and infrastructure development across nine countries in the region.[205] This funding is part of CAF's broader strategy to enhance ecological resilience and promote sustainable development in Latin America and the Caribbean. In addition to these loans, CAF has recently committed to mobilize USD 25 billion over the next five years for green operations aimed at increasing climate resilience, promoting the energy transition, and reducing greenhouse gas emissions across its member countries.[206]

Latin America and the Caribbean has also advanced in raising financing through the issuance of sustainable debt. By the end of 2022, the LAC sustainable debt market reached USD 154 billion.[207] Chile, Mexico, and Brazil lead the market. Countries like Colombia are boosting their energy transition through the issuance of catalytic green bonds.[208] Addressing issues related to investment and financing requirements and increasing investment must be key in facilitating the region's development of infrastructure projects and overall growth.

Europe

Europe's energy landscape is undergoing a significant transformation, moving away from a high reliance on fossil fuels to a more sustainable and renewable energy-based system. The European Commission recently announced an updated target aimed at cutting GHG emissions by 90% by 2040, compared with the 1990 levels.[209] This target is underpinned by the European Union's strategic financial and policy initiatives, notably through the EGD, the Next Generation EU (NGEU), the Fit for 55 package, the REPowerEU Plan, the EU Taxonomy and the EU Just Transition Fund.

Over the last decade, solar capacity across the region increased at an average rate of 12% annually, while wind capacity grew at an average rate of 8%. Estimates show that for this decade, annual installations in the region should

grow at 16% and 11%, respectively.[210] To meet its 2030 targets, EU member states must work collectively towards a regional energy transition, leveraging their respective advantages to reduce costs. While it cannot address the global energy transition single-handedly, the EU has the potential to position itself as a global leader. By striving to meet its commitments, it can set an example for other countries and regions to follow.

The European region has been a pioneer in implementing essential policies and measures to foster sustainability. These initiatives, usually financed through the EU's Multiannual Financial Framework (MFF), are rooted in the long-term political priorities that shape the EU's development trajectory and are converted into specific short-term targets by the European Commission. The MFF is negotiated every seven years, setting the maximum level of capital allocation for each category.[211] The EGD sets forth a comprehensive blueprint for the EU's quest to reduce greenhouse gas emissions by 55% by 2030 compared to 1990 levels. The Deal outlines the need for a deep economic transformation, which includes ramping up renewable energy sources and decreasing dependency on fossil fuels. This policy framework not only guides direct investment in green technologies but also shapes regulatory and financial landscapes to support such investments. In a complimentary manner, the NGEU serves as a pivotal element in Europe's economic recovery, with a clear focus on sustainability. These funds are intended to catalyze various sectors towards achieving the EU's ambitious climate and energy goals, providing a financial backbone for green projects across the continent.[212]

The EU Taxonomy and various sustainable finance regulations set rigorous standards for what constitutes sustainable investment. These measures are intended to guide and standardize investment in green projects.[213] In FY2022, the average taxonomy-aligned capital expenditure (CAPEX) of around 14% exceeded the average aligned turnover, reflecting an increase in green investment.[214] Nonetheless, the EU taxonomy has encountered significant challenges, with critics pointing out issues like the confusion generated by certain criteria, the demand for highly detailed data, its lack of comprehensiveness, and the binary, backward-looking nature of the taxonomy, which could potentially mislead investors.[215] Furthermore, the EU taxonomy continues to evolve, shaped by the work of its technical expert group, the issuance of "delegated acts" or implementing regulations, and ongoing consultations with various economic stakeholders.

The European Union has also advanced its regulatory framework for sustainable finance by incorporating key legislative measures such as the Sustainable Finance Disclosure Regulation (SFDR), the Corporate Sustainability Reporting Directive (CSRD), the European Sustainability Reporting Standards (ESRS), and the European Green Bond Standard Regulation (EGBSR). The European region has also advanced in the standardization of carbon markets as a means to mobilize further climate funding. Reformed in May 2023, the Emission Trading System (ETS) and Carbon Border Adjustment Mechanism (CBAM) are some of the components of the EU's market mechanisms to reduce carbon emissions. These systems aim to adjust market dynamics to favor low-carbon alternatives, effectively pricing carbon emissions, and adjusting import conditions to ensure fair competition and high environmental standards.[216]

Moreover, the main regulatory challenge in the European context lies in the effective policy implementation and the ongoing need for precise and integrated

impact measurement and monitoring. This nuanced approach is essential for the real and effective implementation of sustainable finance and clean energy regulations. The above-mentioned policies are not achievable if the available resources are not efficiently allocated for climate and SDG purposes.[217] Although sufficient funds exist, there is a qualitative mismatch. Decarbonizing the region's energy system presents a USD 5.3 trillion investment opportunity.[218] The challenge remains in terms of capital allocation and matching investment demand and supply. Currently, large-scale institutional investments are available, but there is a shortage of small-scale equity for RD&D and early-stage technologies.[219] Moreover, the current economic climate has constrained member states' ability to deliver the necessary investments for implementing the transition pathways.[220]

Over the next few decades, the monetary landscape in Europe and major economies is expected to be significantly tighter compared to the period from 2009 to 2022. Both nominal and real interest rates may rise by to two percentage points.[221] These conditions are specifically relevant for renewable energy financing given that the impact of higher interest rates grows as the CAPEX share of total expenditure also increases. Conversely, as the oil and gas sector is less reliant on upfront capital cost, it is much less vulnerable to the cost of debt and increased interest rates. Moreover, fiscal sustainability poses significant challenges for European governments due to the pressure to judiciously allocate limited public budgets across several critical areas: the digital transition, military expenditures, and social infrastructure.[222] Coupled with the financial implications of an aging population, these factors could limit the political will to prioritize investments in the green transition.[223]

To meet the PA and EGD agenda by 2030, annual investments should increase by approximately EUR 620 billion across the region.[224] The European Commission has announced that 30% of the 2021-2027 budget and 37% of the EU Green Deal are allocated for climate action initiatives.[225] The remaining funding is expected to be primarily mobilized by private entities, leveraging public funds and incentives to attract private investment.

Underscoring the importance of regional interconnectivity, the Connecting Europe Facility (CEF) has been a major source of funding for interconnected infrastructure projects across the region, prioritizing transport, energy and digital infrastructure. In addition to grants, the CEF also provides guarantees and project bonds.[226] Between 2021-2027, the Facility funded EUR 5.84 billion in energy projects. This type of initiative is expected to leverage both private and public capital, especially in the development of Projects of Common Interest (PCIs), key cross-border infrastructure projects that link multiple energy systems within the EU countries.[227] The region has also innovated through Projects of Mutual Interest (PMIs), between EU and non-EU countries aiming at improving convergence (e.g. electricity transmission, offshore hybrid interconnectors, hydrogen transmission, and CO_2 networks).[228]

Public and private finance in the European region involves a number of stakeholders that should continue to play a crucial role in unlocking climate finance. Institutions like the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD) are essential to mobilize capital flows. The EIB has supported the regional energy transition by providing around USD 108 billion in the past decade, excluding additional finance for clean energy projects in other countries and regions.[229] Projects like the interconnection between Tunisia and Sicily exemplify how the EIB supports essential infrastructure

that complements the EU's energy objectives, facilitating better integration and renewable energy generation across borders. The EIB's financial instruments are designed to address the diverse needs of the energy sector. Investment loans and Multilateral Development Bank Intermediated Loans (MDBILs) cater to large-scale and multi-beneficiary projects, respectively, while equity and quasi-equity options provide necessary capital for higher-risk ventures. Guarantees help mitigate investor risks, encouraging further investment in the energy transition.

Similarly, the EBRD launched the Green Transition Approach for 2021-2025. This aims to be a strategic initiative fostering green, low-carbon, and resilient economies in the regions where the EBRD operates. The EBRD utilizes a comprehensive range of financial instruments and collaborates with various donors like the Climate Investment Funds, the European Union, and the Green Climate Fund, among others, to mobilize climate finance and support green investments through dedicated programs. Since 2006, the EBRD has committed EUR 49 billion to over 2,600 green projects that are expected to cut annual carbon emissions by 124 million tones.[230]

In the region, financing mechanisms focused on sustainability have seen a robust increase in the last couple of years in the primary market. As of November 2023, sustainability-related labeled bonds represented up to 6% of the total bond market in the region. Sustainable loan financing, on the other hand, almost tripled that amount of bond financing in 2022.[231]

The Way Forward

Financing the energy transition requires a comprehensive strategy that leverages regional strengths and addresses global and regional roadblocks and challenges. Below are some key recommendations to accelerate the energy transition from a regional perspective.

1. Develop a Robust Regional Clean Energy Strategy

The initial step involves the development of a robust clean energy plan for each region. This foundational framework is essential to guide subsequent actions and policies, including the decommissioning of existing fossil fuel plants and the reorientation of finance from new fossil fuel projects to clean energy investments. Countries can only commit to halting the development of new fossil fuel plants and projects when there is a clear, actionable, and financed plan for expanding renewable energy sources.

Establishing and developing interconnected regional energy grids will facilitate energy trade and balance supply and demand across each region. Initiatives like GEIDCO's transnational energy interconnection plan highlight the potential for collaborative efforts to enhance energy security and efficiency across multiple countries.[232] These efforts will change how the regions generate, distribute, and use energy. They take advantage of economies of scale, support large energy projects, and make energy cheaper. One crucial aspect of creating a regional-level systemic development plan is having a clear value proposition of the benefits of a multinational approach as well as the various financing opportunities available to the member states.

In many regions, countries can leverage the anchor demand from large mining and industrial projects to finance bankable energy projects. Financial institutions and investors are more likely to fund energy projects with guaranteed off-take agreements from established industries, ensuring a steady return on investment.[233] By strategically leveraging anchor demand from existing mining and industrial projects, countries can create a sustainable and self-reinforcing cycle of energy and industrial development.

Developing a robust regional clean energy strategy necessitates the involvement of a wide array of stakeholders to ensure its effectiveness. National, regional, and local government bodies are all essential for policy formulation, regulatory frameworks, and budget allocations. Regional development banks play crucial roles in providing direct funding and indirect guarantees, supporting member states with regional expertise and technical assistance, and facilitating international cooperation. National energy and environmental agencies are pivotal for enforcing energy policies and promoting sustainable practices, while private sector entities, including energy companies and financial institutions, provide the necessary capital and technological innovations. Similarly, national development banks (NDBs) are instrumental in driving long-term development by addressing market failures, supporting critical sectors, providing patient capital, and mobilizing private investment.

To effectively implement this strategy, it is crucial to map stakeholders, develop a structured engagement framework, ensure public participation through

consultations and forums, establish platforms for ongoing dialogue, and regularly monitor and evaluate policies and strategies.[234] Such an approach can significantly benefit from leveraging the extensive expertise and resources offered by a wide range of academic and non-profit organizations. These organizations are at the forefront of developing sophisticated models and analytical frameworks that can inform and enhance the planning and implementation of transformation strategies. By integrating the insights and findings from these models, governments and policymakers can ensure that their pathways are grounded in the latest research, are more robust, and are better equipped to address complex, multifaceted challenges.

2. Advance Structural and Regulatory Reforms

Policymakers must address specific regulatory barriers that hinder clean energy investments.[235] These barriers include modifying liquidity requirements for institutional investors, establishing benchmarks and key performance indicators, and adjusting asset risk classifications to account for climate risks for asset managers and banks. Furthermore, the prudential regulatory framework should be revised to value long-term investments and lending within the banking sector. These changes, though politically challenging, are essential. The existing rules and regulations are primarily designed to ensure financial stability, not to address the climate crisis or facilitate the energy transition.[236] Thus, revising these frameworks to enable investor participation while safeguarding public interests is a complex task.

Implementing reforms to enhance the quality of public institutions, improve transparency in budget processes, and create an enabling environment for the private sector can be transformative. Developing and deepening the liquidity of domestic financial markets can mobilize local capital and reduce dependency on external financing. Strengthening public institutions and improving governance can enhance credibility and trust in the financial system, making it more attractive to investors. To level the playing field for renewables, phasing out fossil fuel investments should be coupled with eliminating fossil-fuel subsidies.[237]

Harmonizing and streamlining regulatory frameworks are essential to support the energy transition. Developing and enforcing consistent standards for renewable energy production, distribution, and consumption can ensure quality and reliability across the region.[238] Streamlining approval processes for renewable energy projects can reduce administrative delays and costs, facilitating quicker implementation. Ensuring long-term policy stability is also crucial, providing confidence and predictability for investors and encouraging more investment in the renewable energy sector. The establishment of standardized contracts for interconnection projects can further streamline processes and reduce uncertainties for investors. Robust green bond markets supported by consistent regulatory frameworks and standards can further enhance investor confidence and participation, facilitating the flow of capital into clean energy projects. The success of the energy transition will heavily depend on aligning national regulations and optimizing energy resource use.[239]

Governments must start re-designing policy and regulatory systems and prioritize a long-term regional energy transition. This strategy should be based on five key pillars. First, universalizing access to electricity is crucial. Ensuring that all citizens have access to reliable and affordable electricity can be achieved

through investments in grid expansion, off-grid solutions, and targeted programs to bring electricity to underserved and remote areas. Second, increasing the share of renewable sources in the energy matrix is essential. This can include subsidies for renewable energy projects, tax incentives, and support for research and development in renewable technologies. Third, increasing energy efficiency across all economic sectors can reduce overall energy demand and lower emissions. Policies could include setting energy efficiency standards for appliances and buildings, encouraging the use of energy-efficient technologies, and supporting industrial processes that reduce energy consumption. Fourth, strengthening regional energy integration and interconnection can lead to more efficient and resilient energy systems. This includes investing in cross-border infrastructure, harmonizing regulations, and facilitating the trade of electricity between countries. Fifth, increasing resilience is essential for developing an energy system that can withstand and recover from disruptions. This involves diversifying energy sources, investing in grid modernization, and implementing strategies to protect infrastructure from climate impacts and other risks.

3. Address the Debt Conundrum

International financial institutions, developed countries, credit rating agencies, and other private sector actors must collaborate to tackle the debt trap that most EMDEs continue to face. Many EMDEs are trapped in a low-growth, high-debt cycle due to short-term, high interest, foreign currency debts. The main priority to finance the transition has to be a coordinated mechanism to increase the affordability and maturity of loans for the transition. Creating a global lender of last resort, such as the IMF, could further reduce credit risk by preventing self-fulfilling rollover crises. If the IMF is unable to play this role, EMDEs should establish their own regional monetary funds or clubs, such as the BRICS or ASEAN initiatives, to provide liquidity and support regional stability and strengthen the current work led by regional MDBs. Similarly, credit enhancement should be provided to countries that are not in debt distress but lack the financial room to reduce capital costs. Additionally, other types of assistance, such as temporary suspension of debt service, should be offered to maintain liquidity and expand fiscal space for investments in a green and inclusive recovery.[240]

Initiatives such as the HIPC Initiative, the Multilateral Debt Relief Initiative (MDRI) and the Bridgetown Initiative have shown that debt relief can significantly improve a country's fiscal space.[241] Expanding this type of initiatives to include middle-income countries heavily investing in energy transition could provide much-needed relief and investment capacity. Similarly, the Debt Relief for a Green and Inclusive Recovery (DRGR) offers a comprehensive alternative to provide sustainable debt relief, while committing to green development.[242]

Improving the accuracy and fairness of credit ratings, along with updated approaches to assessing debt ceilings and borrowing limits, could alleviate some of the financial pressures on developing countries. CRAs' methodologies should be reformed to truly provide fair, transparent, and accurate assessments of creditworthiness that can help lower the cost of capital for EMDEs. Credit ratings should be based on long-term (30-40 year) growth trajectories rather than short-term projections. Countries should not be penalized for low GDP per capita, as this often indicates higher growth potential. Assessing debt-to-

GDP ratios over a 30–40-year period, considering the uses of sovereign debt for capital asset creation, proactive investments in mitigation, resilience and broader development objectives, and accounting for the maturity structure of the debt can provide a more accurate risk assessment. Additionally, the adequacy of credit risk management systems and regional monetary arrangements should be factored into ratings. What is needed is a more flexible structure that both rewards good risk management practices (for instance through interest rebates) and also provides adequate opportunities for correcting poor risk management (e.g. penalties with reasonable cure periods for defaults).

More generally, exploring alternative ways to measure and manage risk is strongly encouraged. For instance, the Global Sustainable Competitiveness Index (GSCI) is an annual ranking designed to assess countries' ability to achieve long-term economic growth that is both socially inclusive and environmentally sustainable. By focusing on sustainability, the GSCI aims to measure not only current economic performance but also the potential for future growth in a way that benefits both society and the environment. In contrast to traditional sovereign credit ratings, one of the key strengths of the GSCI is its long-term perspective by considering factors that go beyond financial metrics, thereby offering a more complete picture of economic sustainability and competitiveness.[243]

Similarly, the IMF-WB Debt Sustainability Framework (DSF) should be reformed to incorporate these long-term growth considerations, the maturity structure of debt, and measures to improve secondary-market liquidity of sovereign debt. It is crucial for DSAs to evolve, distinguishing clearly between liquidity and solvency, to provide states with the means to secure low-cost, long-term financing. This change would not only support immediate economic stability but also bolster long-term developmental prospects by enabling investments in infrastructure and other pivotal sectors.

Finally, debt-for-climate swaps can be particularly relevant for EMDEs that have climate externalities, borrowing constraints, and lack of fiscal space.[244] For instance, in 2023 Ecuador engaged in a significant debt-for-climate swap specifically aimed at conserving the Galápagos Islands. Through this swap, Ecuador's foreign debt will be reduced by up to USD 1.1 billion of debt repayments over the next 17 years. In return for the debt forgiveness, Ecuador committed to investing USD 450 million in conservation and sustainable development.[245] In parallel, Belize's 2021 debt-for-nature swap restructured Belize's debt while committing USD 107 million to marine conservation. The swap restructured Belize's foreign currency bond, known as the "Superbond," into a new "Blue Bond" with a U.S. International Development Finance Corporation (DFC) credit enhancement, converting junk bond status to investment grade.[246] These structures should be replicated in clean energy to both to address debt issues and also to guide investments. Critics argue that these swaps are too small in scale compared to the massive sovereign debts of biodiversity-rich developing countries. Over three decades, these countries paid over USD 7.6 trillion in debt servicing, while only about USD 8.4 billion was addressed through debt swaps.[247] High transaction costs and real-world issues like currency instability further undermine the effectiveness of conservation commitments associated with these swaps.

4. Strengthen Innovative Financing Mechanisms

Alternative financing mechanisms and innovative approaches are necessary to effectively address climate-related challenges and support sustainable development initiatives in EMDEs and globally. Instruments like tax incentives, grants, and revenue guarantees can make projects more attractive for investors.[248] However, it is important to not only increase spending on these instruments, but also focus on their strategic design and implementation. Simply allocating more funds is insufficient; the incentives must be carefully crafted to align with specific objectives and produce the desired results.

Leveraging clean energy and green assets involves exploring innovative financial products such as green asset securitization, green asset-backed bonds, green income-backed securities, corporate power purchase agreements, energy performance contracts, risk guarantees, and green collected debt products. Regions should promote and facilitate the issuance of innovative thematic financial instruments, including green and SLBs with low interest rates and long maturities.

Many of the key technologies needed for the energy transition, such as solar- or wind-powered irrigation systems for agriculture or retrofitting buildings and industrial facilities, do not fit well with the traditional debt-financing model used for public projects. Traditional debt financing is typically geared toward predictable, large-scale infrastructure projects, while these emerging technologies tend to be more experimental, carry higher risks, and may not provide immediate returns. To address this gap, it is essential to support innovation in early-stage technologies through catalytic public funding and VC. By increasing public grants, contracts, and other forms of support for research, development, and demonstration (RD&D) of innovative clean energy technologies, we can encourage the development and deployment of these critical advancements.

Similarly, SPVs play a crucial role in increasing the financing of cross-border renewable energy projects by serving as dedicated entities established specifically to undertake and manage the project. The advantages of using SPVs include risk isolation, enhanced creditworthiness, and potential regulatory benefits.[249] This risk isolation strategy can be attractive to investors, as their liability is generally limited to the investments they make in the SPV. In addition to risk isolation, SPVs can effectively ring-fence the assets and liabilities of the renewable energy project, ensuring that they are distinct from those of other projects or entities. This separation provides clarity and transparency to investors regarding the project's scope and associated risks. Furthermore, SPVs offer flexibility in structuring financing arrangements tailored to the specific requirements of the renewable energy project. They can facilitate the pooling of funds from various sources, including equity investors, lenders, and other stakeholders, enabling a diversified and robust financial structure.

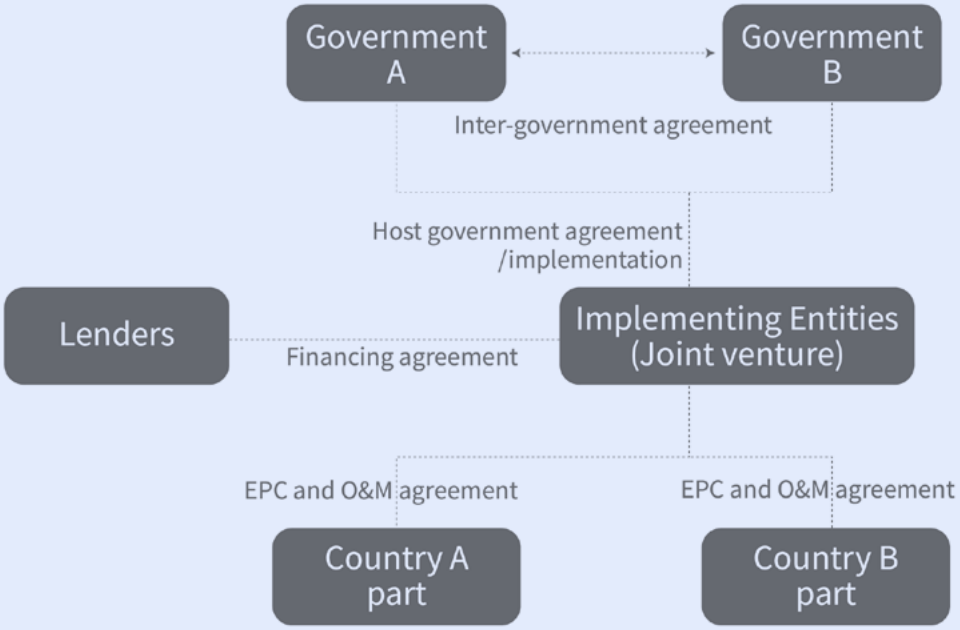

Figure 7: Special Purpose Vehicle Structure

Source: UNESCAP [250]

In addition to SPVs, joint ventures also present a viable and effective mechanism to increase the financing of cross-border renewable energy projects. One key advantage of joint ventures in cross-border renewable energy projects is the ability to combine the strengths and resources of multiple partners. By partnering with local companies, international firms can benefit from their knowledge of the local market, regulatory environment, and community relations, which can support the successful implementation of the project. Moreover, joint ventures can help mitigate political and regulatory risks associated with cross-border projects.[251]

5. Rethink Public Financing and MDBs

Concessional financing needs to be leveraged to de-risk investments, particularly for small-scale projects that are critical for expanding energy access to underserved communities. Enhancing the availability and affordability of hedging instruments could mitigate currency risk and draw more foreign capital into the energy sector. Guarantees have proven to be the most effective tool to lower the cost of capital in renewable energy projects. On average, revenue guarantees and grants can reduce the cost of capital of clean energy projects by up to three percentage points.[252] Furthermore, MDBs can optimize blended finance instruments to reduce green energy costs by up to 35% and enable large-scale refinancing, which could save up to USD 10 trillion through 2050.[253]

Box 3: The World Bank Guarantee Platform

The World Bank Guarantee Platform

Through the provision of guarantees, the World Bank Group Guarantee Platform helps mitigate risks that might otherwise deter private investors, thereby enabling critical infrastructure investments, especially in sectors like energy, transportation, and water. The platform, located within the Multilateral Investment Guarantee Agency (MIGA), integrates the expertise and resources of the World Bank, International Finance Corporation (IFC), and MIGA to provide streamlined and efficient guarantee solutions. It aims to elevate the World Bank Group's (WBG) annual guarantee issuance to USD 20 billion by 2030.

The platform will feature three types of coverage: credit guarantees for loans to both public and private sectors; trade finance guarantees for trade finance initiatives involving public entities; and political risk insurance to protect against non-commercial risks in private sector projects and public-private partnerships.

Key Features:

Risk Mitigation: The World Bank provides partial risk guarantees (PRGs) and partial credit guarantees (PCGs) to cover risks such as political instability, currency inconvertibility, and breach of contract. These guarantees reduce the perceived risk for private investors, making it easier for projects to attract financing.

Catalyzing Private Investment: By lowering the risk profile of projects, the platform helps crowd in private capital, often leveraging significant amounts of investment with relatively modest amounts of guarantee coverage. This multiplier effect is crucial for addressing the vast infrastructure financing gap in developing countries.

Flexibility and Adaptability: The World Bank Guarantee Platform offers a range of guarantee products tailored to the specific needs of projects and investors. This flexibility allows the platform to support a wide variety of projects, from large-scale renewable energy installations to smaller, community-based infrastructure initiatives.

Focus on Development Outcomes: Beyond financial considerations, the platform is designed to ensure that projects contribute to broader development goals, such as poverty reduction, job creation, and environmental sustainability. The guarantees are often linked to performance benchmarks that align with the World Bank's broader mission of sustainable development.

Source: World Bank (2024) [254]

Critically, MDBs must increase the availability of low-interest loans and grants for renewable energy projects in developing countries, including potentially through a special funding window for energy transition initiatives. MDBs are essential to successfully lowering borrowing costs for their members by maintaining excellent loan portfolios and achieving preferred creditor status. Enhancing the structural and operational flexibility of MDBs is pivotal. MDBs, by revising their traditional lending policies to account for the complexities of cross-border energy projects, could develop tailored financial products that accommodate the varying economic and regulatory landscapes of the countries involved. For instance, multi-currency lending options or flexible loan terms that reflect the different stages of project development and risk profiles could be beneficial. [255]

To mitigate the risks associated with currency mismatching, borrowers and lenders can employ various strategies such as hedging mechanisms, lending and borrowing in their domestic currencies, or diversifying revenue streams. For instance, the issuance of green bonds in local currencies can serve as a way to address currency risk in financing the energy transition. By doing so and attracting local investors, the dependence on foreign capital can be overcome.[256] For low-income economies with smaller projects, a regional bond could be created. An intermediary would combine projects from different countries into one bond, making it easier to raise funds without requiring direct cooperation between the governments. This allows smaller projects to access larger pools of capital.[257] Overall, addressing the issue of currency mismatching is crucial for ensuring the stability and sustainability of cross-border lending and minimizing the potential disruptions and bankruptcies that can arise from this mismatch.[258]

The need for greater coordination among MDBs is also paramount to enhancing the efficiency and impact of financing for the energy transition. Currently, varying appraisal standards across MDBs lead to fragmented efforts and inefficiencies. Harmonizing these standards can significantly streamline project approvals, reduce duplication of efforts, and ensure a consistent level of quality and transparency in project evaluations. By adopting universally high appraisal standards, MDBs can facilitate easier comparison and coordination across projects, ultimately accelerating the implementation of critical development initiatives.

Strengthening reliance agreements between MDBs, which involve one MDB trusting the due diligence and project assessments of another, can build greater trust and cooperation among these institutions. This collaborative approach allows MDBs to leverage each other's expertise and resources, enhancing overall project oversight and risk management. Stronger reliance agreements can lead to more efficient resource utilization and better project outcomes, as responsibilities and oversight are shared.

Finally, recipient countries must advance towards more effective and progressive tax systems, improve public spending efficiency and debt management, and establish stronger and more sustainable fiscal frameworks.[259] This involves strengthening tax administration, broadening the tax base, and combating tax evasion. EMDEs can also implement fiscal consolidation programs by adopting rules-based fiscal frameworks to help sustain the benefits of fiscal adjustment over time and reduce the perceived sovereign risks.[260]

6. Catalyze Private Investment

Even with increased public financing, both from governments and MDBs, the influx of private investment must significantly increase and speed up to reach the trillions of dollars needed over the next few decades.[261] Mobilizing private finance serves as a critical way of funding clean energy investments without burdening public budgets. Additionally, private investment has the potential to introduce favorable characteristics that may not be easily accessible within the public sector. It has been asserted that the private sector must raise its share of climate finance in EMDEs by 50% by 2030.[262] By the early 2030s, the private sector must have mobilized USD 0.9-1.1 trillion annually.[263]

Effective planning and a clearer regulatory framework are paramount to attracting more private sector investment in clean energy projects. A strong regulatory framework acts as a catalyst for unlocking private capital, guiding it

toward projects that are not only financially viable but also aligned with broader economic and environmental objectives.

Concessional finance should be scaled up to mitigate regional and project risks and attract further private investment through financing mechanisms such as blended finance. Private financial institutions are encouraged to engage more directly with MDBs to demonstrate their commitment to providing finance through blended finance initiatives, contingent upon the fulfillment of suitable conditions. Such mobilization of private finance can take various forms, including direct investment, intermediation through funds or credit lines, or indirect mobilization enabling outputs. By leveraging catalytic capital to enhance the risk-return profile of investments, blended finance has the potential to make climate-focused projects commercially viable. For instance, loan guarantees can offer protection against political risks, while concessional loans may incentivize investors to support new technologies lacking proven track records. Project aggregation platforms and securitization vehicles can bundle small EMDE clean energy projects into investment-grade portfolios to attract large institutional investors, whose mandates or regulatory restrictions may limit their direct exposure to these markets.[264]

Private investors must redirect their financing towards low-carbon solutions, significantly increasing investments in these areas while ending support for fossil fuel exploration and expansion. By pro-actively and methodically allocating capital to solar, wind, and other renewable energy projects, private investors can drive the development and deployment of sustainable energy solutions. Private investors can also engage in impact investing, where they prioritize investments that generate positive environmental outcomes alongside financial returns. Asset owners play a key role in that matter: clarifying the investment mandate to untie the hands of the asset managers is critical to enable transition and green investment. In parallel, private investors should stop lobbying against climate-friendly regulations, both directly and through their financed entities, to support a policy environment that facilitates the transition. Similarly, financial institutions should leverage their influence over the companies they finance to encourage the adoption of sustainable practices that align with global climate goals.[265]

Ultimately, private investors can promote transparency and accountability by both reporting on the impact of their investments and encouraging their portfolio companies and issuers to rigorously engage and report on their decarbonization trajectory, thus setting benchmarks and encouraging other investors to follow suit in supporting the global energy transition.

7. Accelerate Technology Advancements

Technological advancements are the driving force behind the transformation of the energy landscape, complementing financial and regulatory innovations in remarkable ways. These advancements are essential in achieving the energy transition, especially when viewed from a regional perspective. Organizations like the CEET play a crucial role in facilitating this transition by bringing together leading engineers and energy experts who play a critical role in accelerating the shift towards sustainable energy systems. With a diverse membership representing different regions, this type of organizations ensures that its guidance is globally relevant and responsive to regional challenges.

Financing advanced technologies is essential for enhancing the efficiency and reliability of energy systems. Investments in smart grids, for instance, are crucial as they use digital communication to adapt to real-time changes in energy usage and generation, improving stability and adaptability.[266] Funding is needed not only for the implementation of these grids but also for integrating data-driven planning and AI-driven control systems that streamline maintenance and optimize operations. Additionally, substantial financial support is required to drive innovations in energy storage, grid modernization, and renewable energy integration. High-capacity batteries, which address intermittency issues, and the modernization of grids to incorporate diverse energy sources, are vital for ensuring a steady energy supply and enhancing energy security.[267] Moreover, financing is necessary for developing advanced platforms for power system modeling and flexible DC transmission technology, which are key to transmitting renewable energy from remote sources to urban centers, thereby strengthening grid resilience and efficiency.

Supporting international collaborative R&D programs is vital to maximize the benefits of these technological advancements. CEET and similar organizations are at the forefront of these efforts, bringing together experts from around the world to work on enhancing renewable energy technologies and reducing their costs. These collaborative R&D programs drive innovation by sharing best practices, technological breakthroughs, and innovative solutions, accelerating the global transition to sustainable energy systems.

Regional cooperation in R&D not only fosters technological innovation but also ensures that advancements are accessible and beneficial to all participating countries. By pooling resources and expertise, regions can overcome individual limitations and achieve collective progress. This collaborative approach is essential for advancing renewable energy technologies and achieving global energy sustainability goals.

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