Pontifícia Universidade Católica do Rio de Janeiro

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No. de Matrícula: 2010458

Scaling up financing for the energy transition in emerging and developing economies

Monografia de Final de Curso

Orientador: Sérgio Besserman Vianna

Rio de Janeiro, Novembro, 2024

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Rio de Janeiro, Novembro, 2024

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Abstract

This study investigates why emerging markets and developing economies have struggled to scale up investments to support their transition to a low-carbon energy system. This work focuses on framing the argument for scaling up resources from both environmental and socioeconomic perspectives. It also examines the current clean energy landscape in emerging and developing economies and identifies its challenges. The findings reveal that investments in clean energy have failed to reach scale in emerging and developing economies due to significantly higher risks, which translate to a high cost of capital. This study emphasizes that to lower the cost of capital, improvements to the macroeconomic environment must work in tandem with policies and de-risking tools to bridge the financing gap. The findings provide a roadmap for emerging and developing economies to seize the investment opportunities associated with the energy transition to ensure a more sustainable and equitable future.

Keywords

Energy transition, climate finance, emerging and developing economies.

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1 Introduction

Climate change is one of the most important challenges of the 21st century, and limiting global warming to 1.5°C above pre-industrial levels is crucial to minimize its natural and socioeconomic impacts (IPCC, 2023). To achieve this, global greenhouse gas (GHG) emissions must peak immediately, fall 45% by 2030 (from 2010 levels), and reach net-zero by 2050 (IPCC, 2023). This implies significant changes to energy systems, as currently 68% of global GHG emissions are energy-related (UNEP, 2024b), while fossil fuels account for around 80% of global energy demand (Energy Institute, 2024). This means that, if the world is to avoid larger impacts from climate change, it must undergo an energy transition, in which fossil fuels are substituted by low-carbon alternatives.

Against this backdrop, renewable energy costs has fallen drastically, making solar and wind generation cheaper than fossil fuel alternatives in most countries (IRENA, 2024b). This has led to unprecedented clean energy deployment and has driven clean energy investment to increase significantly in recent years, reaching close to US$ 2 tn in 2024, compared to US$ 1 tn invested in fossil fuels (IEA, 2024f). However, emerging and developing economies (from now on referred to as EMDE, does not include China) accounted for only 8% of the increase in clean energy investment from 2019 to 2023 (IEA, 2024f). At the same time, these countries represent over one-third of global GDP and two-thirds of the world's population (IEA, 2024c), holding 70% of global solar and wind resources and 50% of critical minerals (BHATTACHARYA et al., 2024). Moreover, EMDE will be the main driver of energy demand growth to 2050, rising 16% from 2030 to 2050, which is enough to offset a 9% decline in advanced economies in the same period (IEA, 2023d). Crucially, these countries are expected to contribute over 50% of global emissions by 2030, driven by growing populations, urbanization, and industrialization (BHATTACHARYA et al., 2024).

Therefore, it is imperative that these countries are integrated in the energy transition system if the world is to meet its climate goals, which has not been the case so far. This research aims to address this by presenting the argument for scaling up financing for the energy transition in EMDE, coupled with a diagnosis of the current challenges, and a roadmap of potential solutions.

In chapter 2, the thesis analyzes the urgency of scaling climate action from both an environmental and economic perspective, by delving into scientific and economic consequences of climate change, emphasizing the critical need for immediate action to limit global warming to 1.5°C above pre-industrial levels. It highlights the accelerating physical risks posed by climate change and the severe economic implications of inaction, as well as the disproportionate burden that EMDE are expected to bear due to their vulnerability. This serves as a foundation to reinforce the argument for increasing investments in clean energy in EMDE. In chapter 3, this work provides an analysis of the current clean energy investment landscape in EMDE, with a focus on identifying the barriers hindering capital flows. It identifies the higher cost of capital and its associated risks as the main challenge to scale up investments. In chapter 4, in response to these challenges, the thesis proposes actionable solutions to bridge the current financing gap, including policy levers and de-risking mechanisms, highlighting the need of coordinated efforts between relevant stakeholders. This comprehensive approach aims to lay the groundwork for a sustainable and equitable energy transition, positioning EMDE as active participants in achieving global climate goals.

2 Climate crisis

2.1 Climate emergency

Human activity has, through GHG emissions, led to an increase of 1.2°C in global average temperatures (2014-2023) since the industrial revolution, making the last 10 years the hottest decade on record (WMO, 2024b). This trajectory is worsening. 2023 was the warmest year ever registered, reaching an average temperature of 1.45°C above pre-industrial levels, while in 2024 the world is expected to surpass the threshold of 1.5°C of warming for the first time (WMO, 2024b) (Figure 1).

Despite this, GHG emissions are still on the rise (Figure 2). Since 1990, they have grown by 51%, reaching 57.1 $GtCO_2e$ in 2023, with about 68% related to energy (UNEP, 2024b). Of this, the production of fossil fuels (coal, oil and natural gas) represents 10%, while their consumption in sectors such as power (26%), transport (15%), industry (11%), and buildings (6%) accounts for the rest (UNEP, 2024b). Moreover, the atmospheric concentration of CO_2 reached an average of 420 parts per million in 2023, a level 51% higher than pre-industrial levels, while methane levels were 265% larger. The last time the earth saw a comparable concentration of CO_2 in the atmosphere was 3 to 5 million years ago, when global average temperatures were 2°C to 3°C warmer than today and sea levels were significantly higher (WMO,

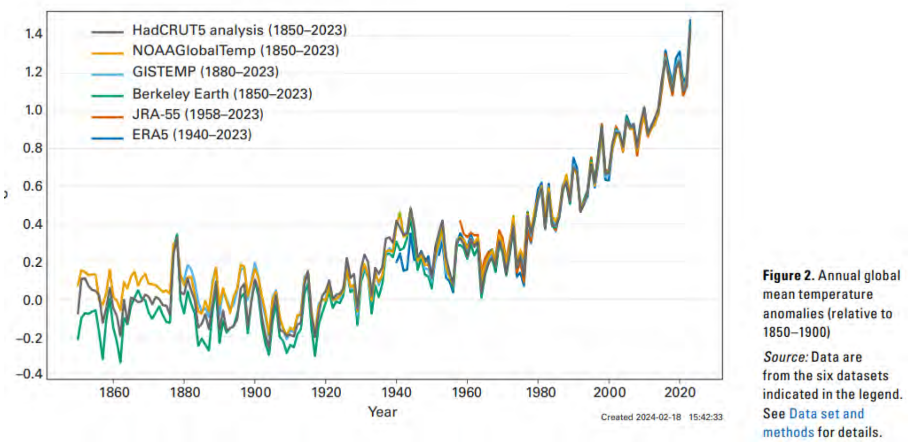

Figure 1 – Source: WMO, State of the Global Climate 2023, 2024

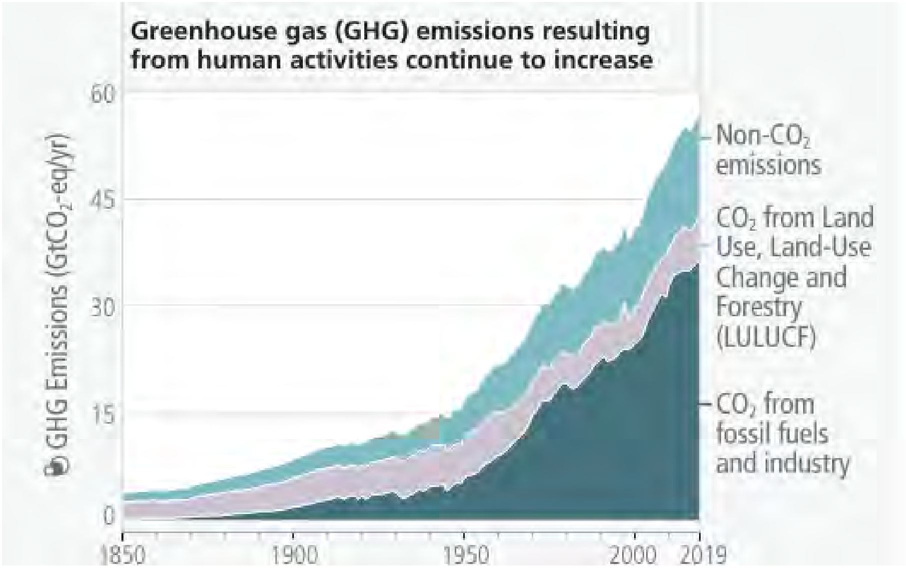

Figure 2 – Source: IPCC, AR6 Longer Report, 2023

2024a).

This unprecedented change in the earth's climate and stability poses significant risks to natural systems, leading to potentially disastrous consequences to food and water security, ecosystems and biodiversity (IPCC, 2023). According to (CAESAR et al., 2024), the earth's stability, resilience and life-support capacity can be analyzed through nine planetary boundaries. So far, human activity has led six out of the nine boundaries to breach safe levels. Crossing these boundaries can create a feedback loop, leading to a non-linear acceleration of global warming beyond human control. In fact, even the 1.2°C of warming already observed is pushing ecosystems toward potentially catastrophic thresholds, such as coral reef die-offs (IPCC, 2023).

Impacts from human activity are not limited to the climate, and its effects across multiple systems have already led to significant consequences to human health. (ROMANELLO; AL., 2024) states that from 2019 to 2023, climate change was responsible for exposing individuals to 46 additional days of health-threatening heat, while in 2023 alone, this number reached 50, and over 30 countries saw at least 100 days of health-threatening heat . Meanwhile, heat-related deaths in people over age 65 increased by 167% globally in 2023 compared to 1990s levels — nearly three times more than what would have been expected with stable temperatures.

So far, given its global nature, climate change has been addressed via multilateral

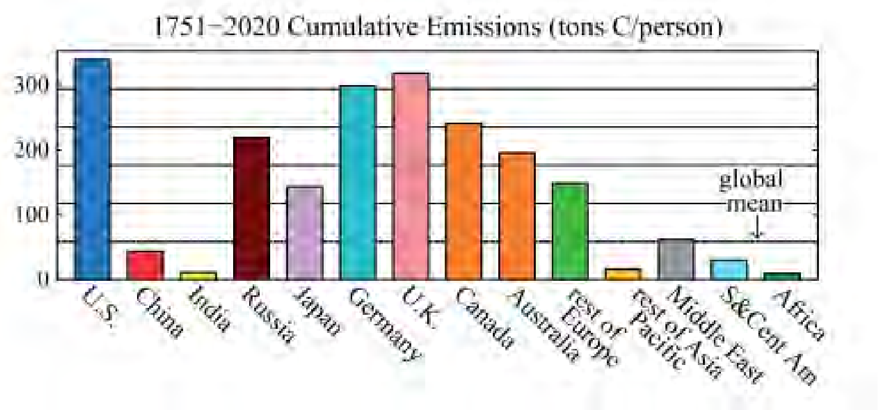

Figure 3 – Source: Hansen et al., 2023, Global warming in the pipeline

engagements. The most important one so far was the Paris Agreement reached in 2015, in which countries agreed to limit global warming to well-below 2°C above pre-industrial levels, while pursuing efforts to restrict the temperature increase to 1.5°C (UNFCCC, 2015). This target is crucial to significantly reduce the risks and impacts of climate change. Exceeding this limit would lead to irreversible changes and widespread disruption of natural and human systems (IPCC, 2023).

However, under the current approach to mitigate emissions, global warming will exceed 1.5°C in the 2020s and 2°C before 2050 (HANSEN et al., 2023). Meanwhile, aligning with a 1.5°C pathway would require an effort of unprecedented scale, speed and cooperation. Additionally, delays in reducing emissions will make it increasingly difficult and costly to adapt to and mitigate climate change, as the implications of the 1.2°C rise in global average temperatures are already felt across natural systems (IPCC, 2023). Extreme weather events, such as, heavy rain, floods, hurricanes, droughts, heat waves, wildfires, landslides, and others have become more frequent, intense or both (IPCC, 2023).

According to (IEA, 2024g), to limit the increase in global average temperatures to 1.5°C (with at least 50% probability) and with limited overshoot, the global energy sector must achieve net zero emissions by 2050. This is represented by the International Energy Agency (IEA)'s net zero emissions scenario, which outlines the necessary transformations required in the energy sector to achieve this. On the other hand, the IEA's business-as-usual pathway, referred to as the stated policies scenario, which considers the energy, climate, and industrial policies that are in place or that have been announced, would lead to at least 2.4 °C of warming by 2100, which would cause severe and irreversible damage to the climate (IEA, 2024g).

Under this urgent scenario, international cooperation has seen recent progress. At COP28 (2023), nearly 200 countries acknowledged the need for "deep, rapid and sustained reductions in GHG emissions reductions in line with 1.5°C pathways" (UNFCCC, 2024b). This agreement included several energy targets, including tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030, accelerating efforts towards the phase-down of unabated coal power and transitioning away from fossil fuels in energy systems, in a just, orderly and equitable manner, accelerating action in this critical decade, so as to achieve net zero by 2050 in keeping with the science (UNFCCC, 2024b). At COP29 (2024), developed countries committed to lead the provision of at least US$ 300 billion per year in climate finance targets for EMDE, which includes public, private, bilateral and multilateral sources (UNFCCC, 2024a). However, the previous target of US$ 100 billion per year to developing countries in climate finance provided and mobilized by developed countries by 2020, was only met in 2022 (OECD, 2024).

Climate finance flow targets from advanced economies to EMDE stem from the principle of Common but Differentiated Responsibilities (CBDR), which acknowledges that while all countries share responsibility for addressing climate change, they do not bear equal blame nor equal capacity to respond (UNFCCC, 1992). This means that, advanced economies, which industrialized earlier and contributed the most to cumulative GHG emissions, must take the lead in emission reductions and provide financial and technological support to EMDE, which, on the other hand, are encouraged to pursue low-carbon growth but are granted flexibility given their laggard socioeconomic development (UNFCCC, 2024b).

According to (HANSEN et al., 2023) and (IPCC, 2023), developed economies in North America (led by the United States) and Europe (led by the United Kingdom and Germany) have been responsible for most historical GHG emissions, especially on a per capita basis (Figure 3). For example, the United States is responsible for about 17% of the contribution to global warming from 1850 to 2021, China

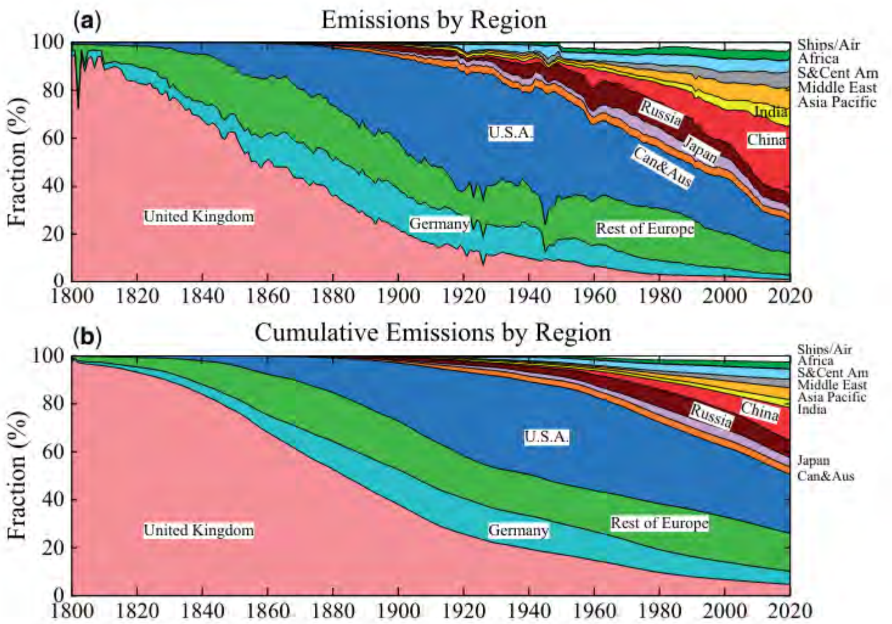

Figure 4 – Source: Hansen et al., 2023, Global warming in the pipeline

accounts for 12%, and the European Union responds for close to 10%, while the group of least developed countries contributed to approximately 4% of historical CO_2 emissions and only 6% to global warming (Figure 4). This is because, to generate economic growth and raise standards of living, western countries turned to fossil fuels to generate increasing amounts of energy, boosting industrial output and wealth (SMIL, 2004). However, advanced economies are already experiencing a structural decline in GHG emissions. Since 1990, they have decreased by 32.5% in the European Union (European Commission, 2024) and 3% in the United States (from a peak of 15.2% above 1990 levels in 2007)(EPA, 2024), with China nearing its emissions peak (Carbon Brief, 2024).

Therefore, the large quantities of GHG emissions generated by advanced economies and China are responsible for externalities that disproportionately affect EMDE, which are more vulnerable to the impacts of climate change due to financial, institutional, and infrastructure limitations (IPCC, 2023) (Figure 5).

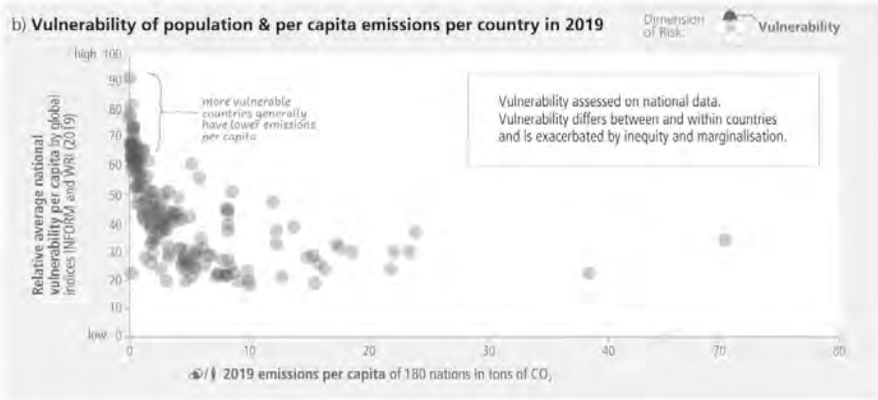

Figure 5 – Source: IPCC, AR6 Longer Report, 2023

2.2 Economic implications

Climate change's impacts go beyond the natural environment. As temperatures rise and the climate crisis worsens, extreme weather events are becoming increasingly frequent, intense and costly (IPCC, 2023). From 2010 to 2019, weather-related natural disasters caused around US$ 1,4 tn in economic losses, an eightfold increase compared to the decade from 1970 to 1979 (WMO, 2021). Moreover, in 2023 alone, losses reached over US$ 280 bn, of which 60% were uninsured (AON, 2024). Evidence shows that broader economic implications stem from both acute and chronic climate change-related events.

Physical damages from extreme weather events can affect supply, demand, and financial systems (NFGS, 2024). Empirical evidence shows that extreme weather events have both short- and long-term negative impacts on GDP (NGFS, 2024), with EMDE being particularly vulnerable (NOY, 2009). On the supply side, destruction of output, productive capital, real estate and infrastructure tend to be the main disruptions. On the demand side, household income, wealth, as well as consumer and business confidence can also be affected by extreme weather events. Furthermore, the financial sector can propagate these shocks through falling asset prices and deteriorating credit conditions (NFGS, 2024).

Inflationary pressures can also arise, especially when disruptions hit key supply chains, such as the impacts of heatwaves on agricultural output and food prices

(NFGS, 2024). (MEINERDING et al., 2022) demonstrate that perceptions of climate change affect inflation expectations, while (NFGS, 2024) finds that climate change may amplify inflation volatility, posing new challenges to central banks. At the same time, climate change is increasingly responsible for disruptions to labor and productivity. In 2024, around 2.4 billion workers, the equivalent of 70% of the world's workforce, were exposed to a high risk of extreme heat (ILO, 2024). Meanwhile, by 2030, 2.2% of total working hours globally could be lost due to higher temperatures, the equivalent of approximately 80 million full-time jobs (ILO, 2019).

Looking ahead, expected damages to the global economy are large. (CPI, 2023b) estimates that climate inaction could result in cumulative global losses of US$ 2,328 trillion from 2025 to 2100. In contrast, aligning with a 1.5°C pathway would still entail losses of US$ 1,062 trillion, but US$ 1,266 trillion (54%) of damages could potentially be avoided.

The expected impact of climate change in the economy can also be looked at terms of GDP loss. (BILAL; KäNZIG, 2024) argue that a 1°C increase in global temperatures is equivalent to a 12% drop in GDP, which would lead warming compatible with business-as-usual pathways to result in a 31% reduction in global output, six times greater than previous estimates.

(KOTZ et al., 2024) incorporates five new variables - beyond the mean temperature - including average annual temperature, daily temperature variability, total annual precipitation, number of wet days and extreme daily rainfall to estimate the economic impact of climate change. As a result, the study finds that the global economy is already committed to a 19% income loss by 2049, despite additional mitigation efforts. Still, beyond 2050, mitigation could have a significant impact in future damages. The study also captures the lagged effects of climate shocks on income, which persist for up to 10 years.

By incorporating (KOTZ et al., 2024)'s damage function into its estimates, (NGFS, 2024) found losses from chronic physical climate change risks to be as much as 15% of global GDP by 2050 under current policies, compared to 5% in previous estimates. In a net zero by 2050 scenario, these losses would still be equivalent to

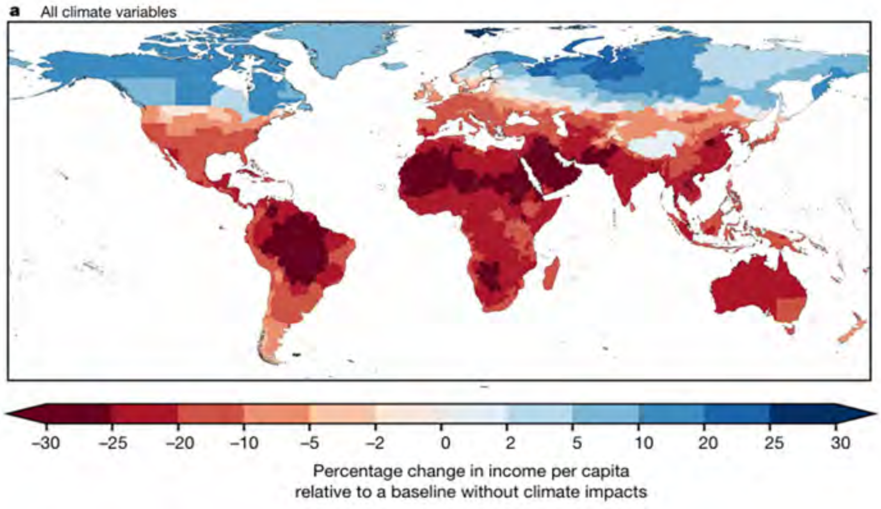

Figure 6 – Source: Kotz et. al, 2024

7% of global GDP. Meanwhile, losses from acute climate risks - led by droughts and heatwaves - would, by 2050, represent 8% of global GDP under current policies and less than 5% in a net zero scenario. Total loss projections by 2050 increased from 5% to 15% under current policies and from 2% to 7% in a net zero scenario.

Against this backdrop, EMDE are found to be more vulnerable to the expected economic impacts of climate change. (MOORE; DIAZ, 2015) find that welfare losses are disproportionately concentrated in poorer areas. Meanwhile, (KOTZ et al., 2024) estimate that, despite having contributed minimally to global emissions historically, EMDE, which are concentrated in lower latitude tropical regions, are projected to experience the largest income losses under current climate pathways, bearing a disproportionate share of climate-related damages (Figure 6).

Therefore, climate change mitigation offers significant benefits to these countries EMDE, as emphasized by (DROUET et al., 2022) and (BURKE et al., 2018), given their high vulnerability to climate shocks, making it the optimal economic pathway for the 21st century. According to (GLANEMANN et al., 2020), limiting global warming to below 2°C offers greater long-term economic benefits compared to business-as-usual scenarios. In tandem, (DROUET et al., 2022) find that the net benefits of limiting warming to 1.5°C-2°C exceed the associated costs, particularly in EMDE, while (BURKE et al., 2018) show that economic damages are expected to be substantially lower under a 1.5°C scenario compared to 2°C. Additionally, advanced economies would reap economic benefits from directing resources to accelerate the energy transition in EMDE, particularly the phase out of unabated coal power generation (BOLTON et al., 2024).

The inequality between EMDE and advanced economies is also evident in the context of the energy transition. (ROMANELLO; AL., 2024) find that countries with a low human development index (HDI) are much less prepared to transition to a net zero economy than high HDI nations. In fact, all countries with low HDI levels had energy transition preparedness scores below the global average, while 93% of high HDI countries showed higher than average capability to reach net zero.

(IEA, 2023b) highlights this by looking at EMDE that are highly dependent on fossil fuel revenues, which are significantly exposed to the risk of stranded assets. Stranded assets consist of fossil fuel volumes left unexplored, non-recovered investments in infrastructure and lower future revenues from projects. Stranded assets can be caused by physical impacts from climate change or increased climate action and policies - such as carbon pricing - that lead to lower fossil fuel demand and prices, are expected to pose significant economic risks to fossil fuel exporting countries with low economic diversification. Large oil and gas producers with less diversified economies would be significantly vulnerable (in economic terms) to increased climate action, leading to a steep drop in income compared to a business as usual scenario (IEA, 2024b).

On the other hand, the energy transition poses an opportunity, as clean energy has significant co-benefits beyond climate change mitigation, such as improvements to air quality and lower water consumption. In 2021 alone, air pollution from fossil fuel combustion cost US$ 4.95 trillion in healthcare expenses (ROMANELLO; AL., 2024). Still, the phase-down of coal-fired power generation in advanced economies, has led to a 6.9% drop in deaths from fossil-fuel derived air pollution (ROMANELLO; AL., 2024). In EMDE, which account for most of the premature deaths caused by outdoor air pollution, those could fall 40% by 2030 in a net zero emissions scenario (IEA, 2024g). Similarly, replacing fossil fuel generation with renewables in a pace equivalent with a net zero scenario would lead to lower energy-related water usage and higher energy sector jobs (IEA, 2024g).

These findings underline how climate change will increasingly shape economic outcomes, posing significant implications for monetary and fiscal policy, economic development, welfare and inequality. They also show the importance of ensuring EMDE are not left behind in the energy transition, highlighting the need increase investment. Therefore, much greater efforts are required to drive resources to clean energy in these countries, not only from an environmental perspective, but also from a socioeconomic one.

3 Clean energy investment in emerging markets and developing economies

3.1 Current energy landscape and low-carbon technologies

Looking at the current global energy system, as well as multiple aspects of the global economy - such as trade, investment and fiscal revenues -, it is evident that it has been built around and is largely depend on fossil fuels (IEA, 2024g). This means that, despite international consensus on the need to tackle climate change, decarbonizing energy systems implies complex implications, which have led to insufficient progress so far (IEA, 2024g).

According to (Energy Institute, 2024), from 2013 to 2023, energy demand grew 15%. However, only 40% of this growth was met by clean energy, which resulted in the share of fossil fuels in the global energy mix decreasing from 82% to just 80%. Moreover, energy consumption is still on the rise, having increased by 2% in 2023 compared to 2022 and surpassing pre-pandemic levels by over 5%.

However, there is a significant difference in the energy consumption patterns of advanced economies and EMDE. While the former have seen their energy demand decline by an average of 0.5% since 2013, the latter have seen the same metric increase by an average of 2.6% per year in the same period (IEA, 2024g). Additionally, advanced economies benefit from much higher energy consumption levels than EMDE, reflecting their higher living standards and economic outputs. In EMDE, average energy use by households is equivalent to one-third of that in advanced economies, while the richest 10% of households in EMDEs consume the same amount of energy as the poorest 10% in advanced economies (IEA, 2024e). Still, despite consuming relatively more energy than EMDE, advanced economies use it much more efficiently than their lower-income counterparts (Figure 7).

Therefore, EMDE face the challenge of decarbonizing current energy needs while meeting growing demand with low-carbon sources and improving energy efficiency.

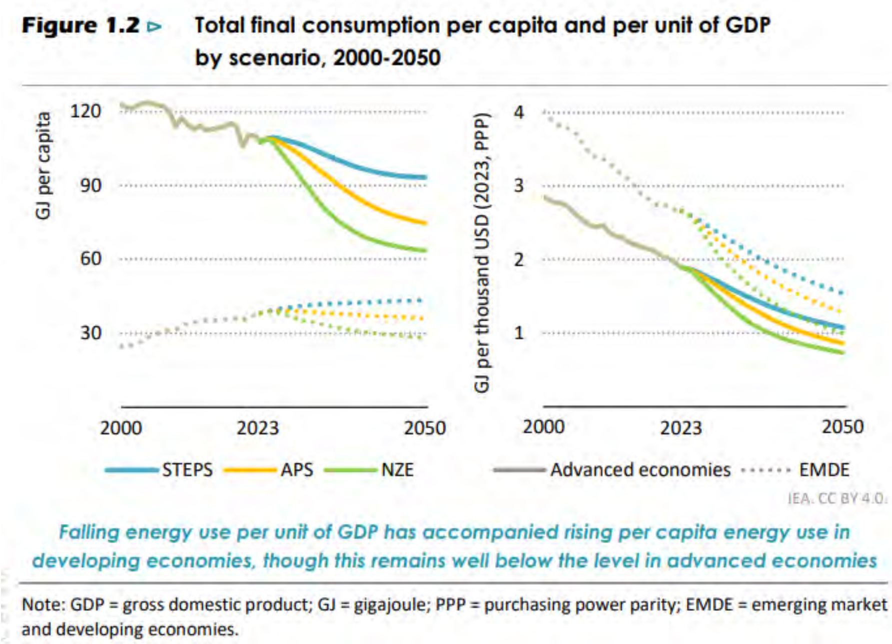

Figure 7 – Source: IEA, World Energy Outlook, 2024

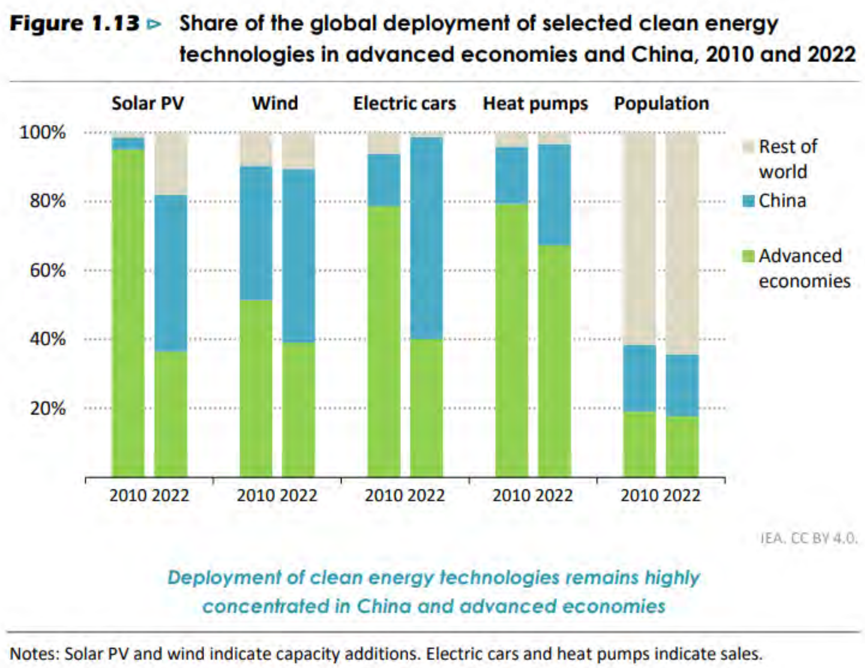

Figure 8 – Source: IEA, Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach, 2023

To achieve this, clean energy technologies must be deployed at scale. However, while the world has seen a significant this scale up of clean energy in recent years, it has been concentrated in advanced economies and China, with little to no improvement since 2010 (IEA, 2023a) (Figure 8).

There are multiple low-carbon alternatives to substitute fossil fuels in a decarbonized energy system, but maturity levels still vary widely. Key technologies such as solar panels, wind turbines and batteries have seen significant cost declines, thanks to growing manufacturing capacity (IEA, 2024a). (IRENA, 2024b) finds that, despite fossil fuel prices returning to historical ranges after a peak in 2022, renewables are increasingly competitive and have become the main source of low-cost power generation globally. In fact, the global weighed average levelized cost of energy (LCOE) for solar power was 56% cheaper than fossil-based alternatives in 2023, a significant cost reduction compared to 2010, when it was 414% more expensive. The same can be said for wind power, which saw 67% lower LCOE levels compared to fossil fuel generation in 2023. Due to this, renewables have become become the default source of least-cost new power generation.

On the other hand, technologies such as low-emissions hydrogen, hydrogen-based fuels and carbon capture and storage (CCUS) still carry a large premium over their traditional unabated fossil-based counterparts. These are crucial to decarbonize hard-to-abate sectors, such as steel, cement, aluminum, shipping, and aviation, but still require significant regulatory and fiscal support, limiting their viability in EMDE (IEA, 2024a).

Despite this, (IEA, 2024c) states that over three-quarters of clean energy investment required in EMDE to 2035 is in mature technologies with viable business models and large global expertise, while only 5% of the cumulative investment needed is in nascent technologies (Figure 9). On a sector basis, power accounts for half of the clean energy investment needed in a net zero scenario, followed by electrification and efficiency, which represent around a third of the total. Solar and wind power are the main focus of investment in the power sector, followed by transmission and distribution grids, hydropower, and battery storage. Regarding electrification and efficiency, the key drivers are energy efficiency in buildings and electric mobility.

These sectors and technologies are already seeing significant transformation and being deployed at scale in major markets, proving their viability. For example, in China, hybrid and battery-electric vehicles surpassed 50% of total sales in July 2024 (Bloomberg, 2024), while in the European Union, solar and wind overtook fossil fuels for the first time and generated 30% of the bloc's electricity in the first half of

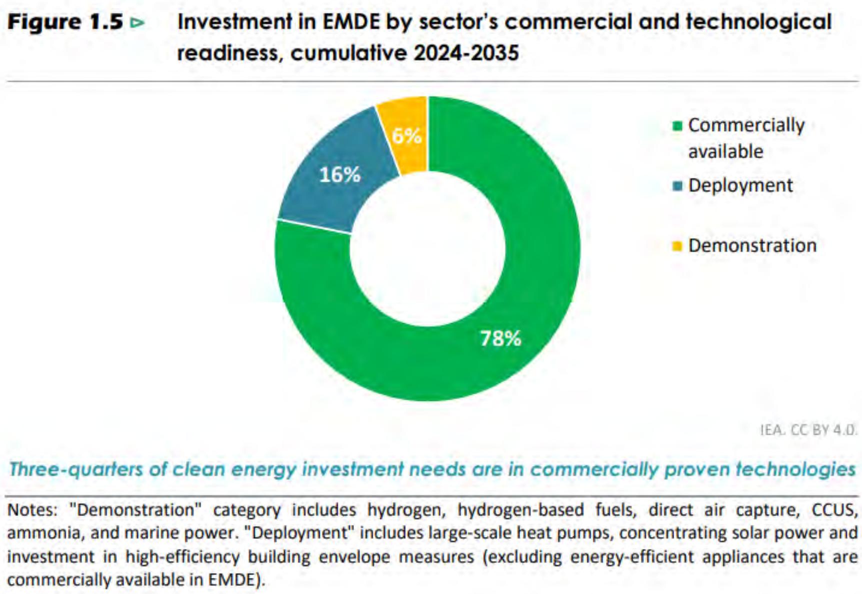

Figure 9 – Source: IEA, Reducing the Cost of Capital, 2024

2024 (Ember, 2024). In fact, solar power has reached much larger deployment levels in regions with less potential than EMDE. Northern European countries have a low to average solar power potential but some of the highest installed solar capacity per unit land area in the world. At the same time, Sub Saharan African countries with abundant solar potential have minimal installations, while even more stable Middle Eastern and North African nations still see modest solar deployment levels (CPI, 2023a).

Therefore, based on a climate, economic and technological perspective, capital flows to clean energy EMDE should be larger. However, there are significant challenges to investment hindering the scale up financing for the energy transition in EMDE, which will be analyzed in the following chapters.

3.2 Challenges for clean energy investment

According to (IEA, 2024f), the world will invest over US$ 2 trillion in clean energy in 2024, around 2x the amount invested in fossil fuels over the same period. But EMDE account for just 15% of the total amount invested in clean energy. At the same time, while clean energy investment is over 2x larger than fossil fuels investment in China and more than 6x larger in Europe, capital flows to fossil fuels still outweigh clean

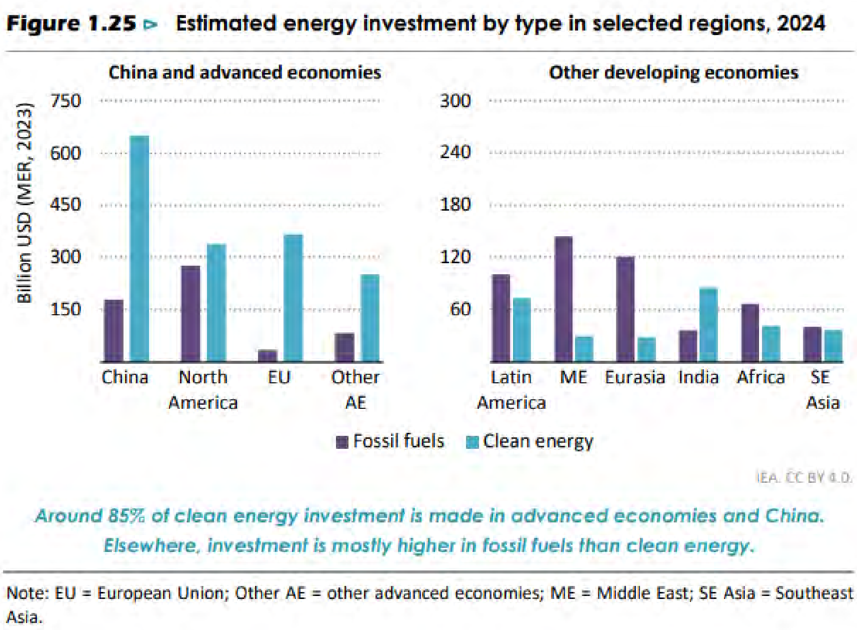

Figure 10 – Source: IEA, World Energy Outlook, 2024

energy in EMDE of all regions, except for India (Figure 10).

Therefore, it is essential to understand what is hindering capital from flowing to EMDE and close the large gap in clean energy investment if the world is to meet its climate goals. Especially as, in a net zero scenario, clean energy investment would need to grow more than six times, from around US$ 280 billion in 2023 to US$ 1.8 trillion, in EMDE (IEA, 2024g), increasing their share of global clean energy investment to 40% from the current 15% (Figure 11), compared to doubling in advanced economies and China by 2035.

In this context, the main barrier to scale clean energy investments in EMDE is the higher cost of capital in these countries. The cost of capital is the cost associated with raising funds for investment and represents the expected financial return, or the minimum required rate of return, to justify an investment in a project (IEA, 2024c).

Currently, the cost of capital for a utility-scale solar PV project in selected EMDE ranges from 9% to 12%, while in advanced economies it is no higher than 6% (Figure 12). Meanhwhile, (CPI, 2023a) also finds significantly higher required return for a solar projects in EMDE compared to advanced economies, including 7% Germany, 22% in Brazil, and 38% in Zambia, for example (Figure 13). This hinders

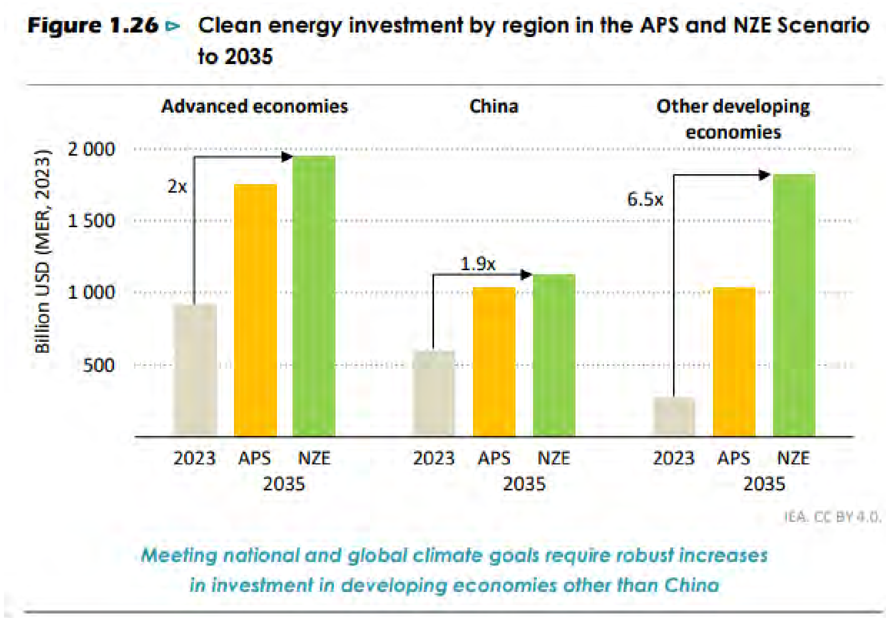

Figure 11 – Source: IEA, World Energy Outlook, 2024

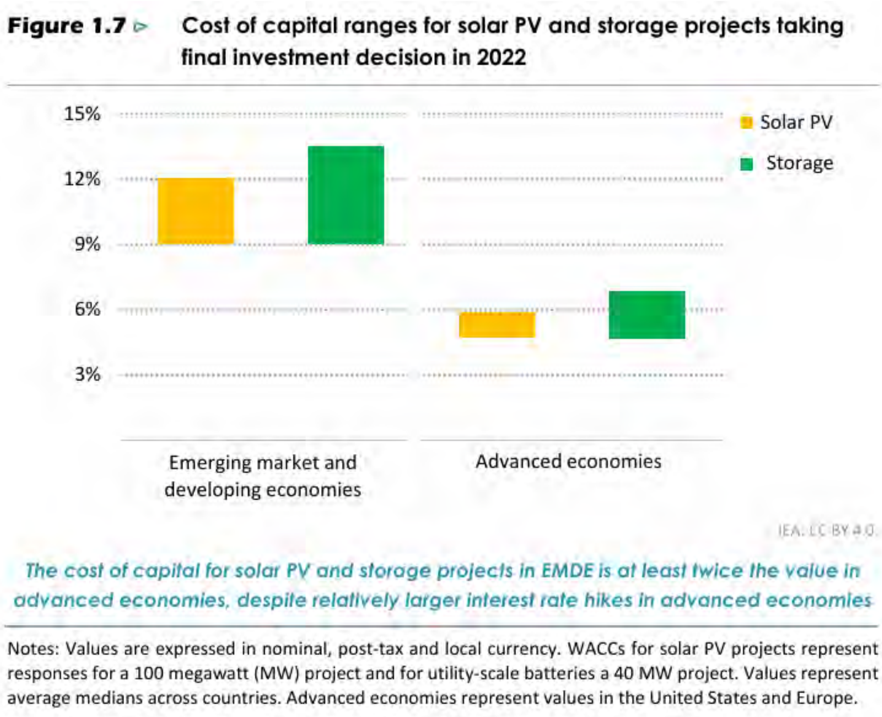

Figure 12 – Source: IEA, Reducing the Cost of Capital, 2024

financing flows to EMDE because the cost of capital is a key determinant of the viability and attractiveness of clean energy projects as they require large upfront investment, compared to lower operating expenses (SONGWE et al., 2022)).

The cost of capital critical also weighs on the affordability of the energy transition for EMDE.Financing costs represent 50% or more of the levelized cost of electricity (LCOE) of clean power projects in EMDE, compared to around 30% in Europe and 40% in the United States (IEA, 2024c). In fact, lowering the average cost of capital in EMDE would lead to a reduction of US$ 150 billion per year in financing costs in the net zero scenario from 2024 to 2050 (IEA, 2024c).

The cost of capital reflects the real and perceived risks associated with projects. Consequently, this means that there is a higher risk associated with clean energy projects in these countries, requiring higher returns to justify investment (IEA, 2024c).

In general, the risks associated with the cost of capital can be divided into two main sets. The first comprises of macroeconomic and other country-related risks (from now on referred to as macro risk), which apply to any investment in a jurisdiction and is related to the overall investment conditions in a country. Second, are risks specific to the energy sector or clean energy project involved (from now on referred to as micro risk) (IEA, 2024c).

Macro risk

The macro risk is responsible for most of the higher cost of capital in EMDE and consists of country-related barriers that hinder investments (PERSAUD, 2023). According to (IEA, 2024c), macro risk includes political risks - asset expropriation, destruction of assets or interruption of operations due to conflicts, and breach of contract - and currency risks - long- and short-term foreign exchange fluctuations, domestic inflation, and currency convertibility. Meanwhile, weak institutions and governance, which lead to political instability, as well as issues with the rule of law and the sanctity of contracts, also add significantly to a country's investment risk.

EMDE are also more vulnerable to external risks, which are out of their control,

Table 7.2. Return expectation from solar projects in EMDCs

Country	S&P Rating	Required return from solar project (%)
Germany	AAA	7%
USA	AA+	9%
UAE	AA	10%
Saudi Arabia	A-	12%
Chile	A	12%
Morocco	BBB-	15%
India	BBB-	17%
Algeria	B	18%
Oman	BB-	18%
Peru	BBB	20%
Costa Rica	B	21%
Namibia	BB-	21%
Ghana	B-	22%
Brazil	BB-	22%
Nigeria	B+	22%
Bolivia	B+	24%
Tanzania	B	24%
Egypt	B	28%
Zambia	CCC-	38 %
Argentina	CCC+	52%

Figure 13 – Source: Songwe et. al, Finance for climate action, 2022

such as international monetary tightening (BNEF, 2023). In recent years, as advanced economies increased their borrowing rates, many EMDE had to follow suit, worsening investment conditions (IEA, 2024c). Additionally, EMDE face significant exposure to commodity prices, international supply chain disruptions, natural disasters, and climate risks (BNEF, 2023). For example, the pandemic left over 50 countries among EMDE - specially low-income ones, which are the most vulnerable to climate change - with a highly-challenging fiscal scenario, unable to raise funds for the energy transition (JAIN, 2023).

Higher country-related risks in EMDE also limits their access to international capital markets. In fact, 74% of low-to-medium income countries have a sovereign risk rating of B+ or lower, also referred to as highly speculative, from credit agencies (WEF, 2024). (JAIN, 2023) finds that this is particularly evident in the green bonds market - thematic bonds with proceeds destined exclusively for projects with environmental benefits -, in which EMDE account for less than 6% of the total green bonds issued so far, and 1% when accounting for bonds denominated in local EMDE currencies. Although there are other obstacles to access the green bond market, such as taxonomy complexities and high costs, exchange rate risks are the main factor behind the lack of participation of EMDE in this market, especially those issued in local EMDE currencies.

(IEA, 2023c) finds that restrictions on foreign direct investment (FDI) and high local content requirements can also drive up the cost of capital, as EMDE impose some of the most restrictive conditions on FDI globally. Not only is FDI a crucial source of investment, but also an opportunity for technology transfers. Therefore, poorly designed local content requirements and excessively restrictive FDI rules can be counter productive, increasing costs and reducing investments.

Furthermore, access to competitive lending in local EMDE currency can be limited due to currency risks, which includes restrictions on currency repatriation and exchange rate volatility (IEA, 2024c). This leads investors to reduce their exposure to currency volatility by adopting hedging mechanisms, which drive up financing costs. At the same time, domestic EMDE financial markets can face strength and stability limitations, such as information gaps, lack of scale, and credit risk, which lead to high local currency financing rates (IEA, 2024c).

Micro risk

Meanwhile, micro risk accounts for the sector- and project-specific risks of clean energy projects. These include a wide variety of factors related to government effectiveness, how well energy-sector regulations are designed and implemented, as well as the administration of state-owned enterprises (BNEF, 2023).

The lack of strategies coupled with clear pathways and targets in the energy sector leads to weak project pipelines. This lowers the chance of global private investors entering clean energy markets in EMDE, and implies that investable projects available might lack scale, due to the high risk of the country's project pipeline not materializing (SONGWE et al., 2022). This can be further amplified by weak energy sector institutions, which leads to regulatory uncertainties and a lack of long-term energy and grid planning (BNEF, 2023). Potential disruptions also arise when accounting for the effectiveness of EMDE institutions which can affect key steps of clean energy projects, such as land acquisition, environmental impact assessment and establishing interconnections. Lengthy and unreliable licensing and permitting processes drives up the cost of capital of clean energy projects as they can lead to significant delays (BNEF, 2023).

Payment-related risks are also common in EMDE, due to operational inefficiencies in the energy sector, the revenue nature of clean energy projects, as well as debt sustainability issues in state-owned utilities, which are commonly the offtakers of clean energy projects in these countries ((IEA, 2024c). The lack of transmission capacity and adequate planning can also lead to curtailment - a deliberate reduction in output below what could have been produced to balance energy supply and demand or due to transmission constraints -, leaving renewable energy plants unable to sell generated power (IEA, 2023c). Additionally, clean energy projects are often financed in developed country currencies - such as the United States Dollar - while revenues are in local EMDE currencies, which leads to a currency mismatch that is exacerbated by the high macro risks discussed previously (SONGWE et al., 2022).

Given the high payment-related risks in EMDE clean energy projects, investors might require mechanisms, such as sovereign or multilateral guarantees for project offtakes, to hedge against them (IEA, 2023c). However, an absence of simple, easy to access and fit-for-purpose mitigation instruments hinders investments (SONGWE et al., 2022). In addition, the usage of public resources to fund these mechanisms can increase the exposure of EMDE to international financial risks and balance of payment vulnerabilities (PRASAD et al., 2022). At the same time, incentive structures from multilateral development banks (MDBs) can crowd out private capital instead of mobilizing it (SONGWE et al., 2022).

Moreover, investors' perceived investment risks in EMDE is often higher than the realized risk of projects (BHATTACHARYA et al., 2024). This is mainly due to issues related to data availability, as many EMDE are not well integrated to international financial markets. The absence of information about previous projects, such as project performance and credit information, often means investors often cannot accurately estimate project risk, which can lead to overestimation and an overall higher perceived risk for clean energy projects in EMDE (SONGWE et al., 2022).

Overall, higher macro and micro risks amplify financing costs for clean energy projects in EMDE, which significantly affects their attractiveness, slowing the pace of the energy transition in these countries. This leads investments to flow increasingly towards advanced economies and risks locking in fossil fuel technologies, which would lead to higher global emissions and potentially stranded assets as advanced economies and China continue to decarbonize (IEA, 2024d). Therfore, given the reasons discussed in the previous chapters, policies, de-risking mechanisms and innovative financing mechanisms must be put in place for these projects to become viable and, ultimately, to scale financing for the energy transition and ensure the sustainable development of EMDE.

4 Scaling up financing

As previously discussed, the cost of capital in EMDE is affected by higher real and perceived risks, which has concentrated clean energy investment in advanced economies. Therefore, reducing the cost of capital in these countries is key to scale financing, which requires a combination of policies and innovative measures at the international and country levels (BHATTACHARYA et al., 2024). Significant improvements in the domestic macroeconomic environment, coupled with de-risking and financing mechanisms are crucial to better the attractiveness of projects and unlock a larger share of private investment for the energy transition in EMDE (IEA, 2024c). These initiatives can be divided into two main pillars: policy measures and de-risking tools (WEF, 2024).

Policy measures

The public sector plays a key role in creating an enabling investment environment and funding clean energy (BHATTACHARYA et al., 2024). This can be achieved through clear policies and robust regulatory frameworks that promote a stable business environment on the long term, in which investor confidence is secured, as well as efforts to boost public resources.

Overall, policies to scale financing for the energy transition can be divided into three groups: fiscal policy and national strategy, monetary and exchange rate policy, and sectoral policies (BNEF, 2023).

1. Fiscal policy and national strategy

   National development strategies should be closely aligned with climate and energy transition goals, providing a clear direction for investments (BHATTACHARYA et al., 2024). Additionally, long-term climate strategies, such as Nationally Determined Contributions (NDCs) are a crucial baseline to drive clean energy investments. They provide investors with long-term, credible national goals, such as GHG reduction targets, as well as renewable energy deployment and energy efficiency targets (BNEF, 2023). These strategies and goals must be clearly translated into investment plans and project pipelines, supported by strong policies (BHATTACHARYA et al., 2024).

Country platforms have been gaining momentum as a way to mobilize resources for and implement national energy transition strategies (BHATTACHARYA et al., 2024). These country-led coordinated initiatives pool strategic transition projects into a single investment platform to more easily match them with financing sources, ranging from domestic and international private capital to development finance institutions (DFIs) (BHATTACHARYA et al., 2024). In October 2024, Brazil launched the Brazil Climate and Ecological Transformation Investment Platform (BIP), with seven initial projects covering sectors such as energy, industry and nature-based solutions, totaling US$ 10.8 billion in potential investments. To be selected, projects must be aligned with several country decarbonization and development goals, which provides investors looking to invest in the country's energy transition with reliable options (GFANZ, 2024).

When it comes to fiscal policy, disciplined government spending and public sector debt sustainability are crucial, as many EMDE are already highly indebted (BNEF, 2023). Additionally, the energy transition offers EMDE governments an opportunity to raise resources for clean energy by phasing-out inefficient fossil fuel subsidies and introducing carbon pricing mechanisms (BHATTACHARYA et al., 2022). Coupling fiscal and carbon budgeting by aligning long-term climate strategies with fiscal frameworks can be a critical source of confidence for clean energy investments (BNEF, 2023). However, progress has been limited so far.

At COP28 nearly 200 countries committed to "phasing-out inefficient fossil fuel subsidies that do not address energy poverty or just transitions, as soon as possible" (UNFCCC, 2024b). Broadly, this means optimizing fossil fuel taxation to maximize economic growth with the least GHG emissions by reducing subsidies for fossil fuel consumption where more competitively priced alternatives exist (BNEF, 2023), but no progress has been made on a global consensus of what "inefficient subsidies" entails or a framework to phase them out. Additionally, the adoption of carbon pricing mechanisms - emissions trading schemes (ETS) or a carbon tax - has remained stagnated in the past two years, covering around 24% of global emissions (World Bank, 2024), while fiscal support for fossil fuels via subsidies averaged around US$ 630 billion per year from 2010-2019 and reached over US$ 1.5 trillion in 2022 driven by the energy crisis (Fossil Fuel Subsidy Tracker, 2024).

2. Monetary and exchange rate policies

   According to (BNEF, 2023), improving the overall macroeconomic environment in EMDE, by managing domestic inflation, interest rates and currency fluctuations is an important factor to mobilize private investment for clean energy in EMDE. First, stable and credible monetary policy via an independent Central Bank is key. Against this backdrop, establishing a different cost of capital for priority sectors could be a possible lever to boost investments. In practice, this is can be done by DFIs via concessional loans. In Brazil, the national development bank (BNDES) has played a key role in providing below market rate financing to kickstart the country's clean energy sector (IRENA, 2024a). Still, Central Banks could also directly provide lower cost debt for clean energy projects (BNEF, 2023). This is being considered by the Reserve Bank of India as part of a wider set of measures to boost clean energy growth in the country (BNEF, 2023). Meanwhile, the Bank of Japan has auctioned zero-interest green loans to fund research and development for climate change mitigation solutions as part of the country's green transformation plan (CBI, 2024).

   Tackling currency risk is also crucial to lower the cost of capital in EMDE. The most commonly used currency hedging mechanisms in EMDE are portfolio diversification, currency swaps, and forward contracts, but the viability of these instruments varies between EMDE income brackets (IEA, 2024c). Hedging mechanisms are mostly limited to more developed EMDE, which tend to have more liquid currencies, enabling commercial providers of these instruments, as well as export credit agencies, to operate. For low-income countries expanding the Currency Exchange Fund (TCX) - a global currency hedging facility for emerging and frontier currencies - presents the most significant opportunity, despite limitations related to costs and familiarity outside DFIs (BNEF, 2023). Still, expanding currency hedging mechanisms is challenging and costly. Therefore, the most viable and long-term solution to reduce currency risk in EMDE is developing domestic financial markets and their capacity to finance clean energy assets in local currency, lowering dependence on foreign currencies (IEA, 2024c).

In general, there is a correlation between levels of private climate finance mobilized, financial system development and country income level (TASKIN et al., 2024). Therefore, along with the improvement of macroeconomic conditions, it is crucial to develop domestic financial and capital markets, as well as reducing barriers to transactions and international capital flows (BNEF, 2023). This requires support from institutions, such as the Central Bank and the finance ministry to facilitate overall economic activity. MDBs also play an important role - via credit lines and guarantees - by enabling domestic financial institutions to increase lending volumes, reduce lending costs and improve flexibility to provide loans that suit the revenue structure of clean energy projects (BNEF, 2023).

Finally, institutions are key to fostering a stable investment environment and sustainable economic development (ACEMOGLU et al., 2001). Therefore, sustained political and institutional reforms should address concerns over the rule of law, property rights and the sanctity of contracts by strengthening governance and transparency (IEA, 2024c).

3. Sectoral policies

Sectoral policies include measures that promote overall international private investment, such as the equal treatment of foreign and domestic companies by recalibrating and/or lifting restrictions in foreign direct investment (FDI), local content requirements and capital repatriation (BNEF, 2023). Additionally, ensuring regulatory certainty and efficiency by guaranteeing the sanctity of contracts, facilitating patenting of clean energy technologies, as well as streamlining property registration (IEA, 2024d).

Looking at the energy sector, the first step towards providing an enabling investment environment for clean energy is setting sectoral targets, including

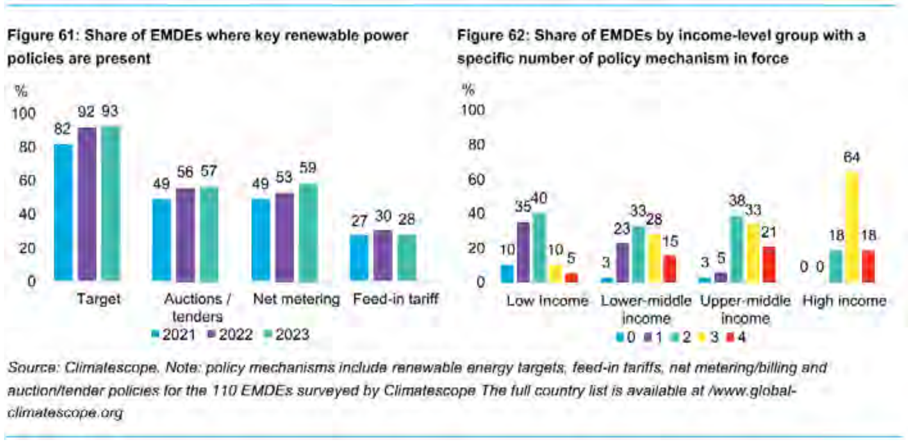

Figure 14 – Source: BNEF, Mobilizing Capital in and to EMDEs, 2024

capacity deployment targets and GHG emissions reduction goals (IEA, 2024d). Governments can also set up regulatory standards for existing polluting technologies, such as fossil-based power plants and internal combustion engines. Still, these must be coupled with specific policy levers to ensure concrete incentives are in place to accelerate investments in the energy transition (BNEF, 2023). Although clean energy policies have been increasing in EMDE, they are still concentrated in higher-income countries (Figure 14). Effective data collection and evaluation is also key for policymakers to monitor and evaluate clean energy policies, as well as to establish robust plans and strategies for the energy sector (IEA, 2024d).

According to (BNEF, 2023), when it comes to energy policy, auctions have been the most effective measure to create and maintain a strong clean energy project pipeline. At the same time, long-term power sector and power grid planning, coupled with grid access guarantees for renewable power projects, can enhance market predictability and ensure the consistent growth of clean energy. Streamlining licensing and permitting of renewable energy projects is also key to scale deployment, as the absence of these initiatives can lead to generation curtailments on existing plants, grid bottlenecks and queues for new projects to obtain grid access (IEA, 2023c).

The public sector can also set up incentives to level the playing field between fossil and clean energy projects, such as tariff premiums, contract-for-difference schemes, tax reliefs for renewables, net metering regulations and technology standards (WEF, 2024).

Still, implementing national strategies and policies as well as reforming fiscal, monetary and exchange rate policies can be politically challenging tasks, with medium- to long-term benefits (IEA, 2024c). Therefore, given the urgency of climate action, these measures should work in tandem with other short-term highly impactful mechanisms that can be adopted and scaled more quickly, while the overall investment environment of EMDE improves in tandem (IEA, 2024d). On the short term, there are a wide-variety of mechanisms that can be adopted to improve the attractiveness of clean energy projects and scale investments.

De-risking mechanisms

Given the higher investment risk in EMDE, de-risking measures are essential to boost investments. De-risking levers are needed when risks levels are too high to attract private financial resources, requiring innovative tools to mitigate, transfer or compensate risks, bring risk-adjusted returns to acceptable market-equivalent levels and, therefore, to mobilize private financing for the energy transition in EMDE (WEF, 2024).

One approach to de-risking is on the portfolio level. This can be done by bundling projects to dilute individual project risks and increase the potential to attract investment demand (WEF, 2024).

Additionally, blended finance mechanisms are designed to deploy catalytic capital from public or philanthropic sources to balance the risk-return profile of projects and boost private sector investments (IEA, 2024c). These interventions must be tailored and targeted to mobilize private-sector capital, instead of crowding out investment opportunities (IEA, 2024d). The most common blended finance frameworks are equity funds and debt funds, which pool public, philanthropic, and private capital and deploy it strategically to address specific risks and improve the financial viability of projects (WEF, 2024). These frameworks often use layered structures, with public or philanthropic capital absorbing higher risks to attract private investors by enhancing returns or reducing default probabilities (WEF, 2024).

Guarantees and insurances are also key enablers of private investment in EMDE. These tools improve the attractiveness or projects by providing investors with assurances related to technology, political instability, regulatory changes and currency fluctuations risks (IEA, 2023c). There are many existing mechanisms that de-risk clean energy investments via guarantees and insurances, while governments, MDBs, DFIs and export credit agencies (ECAs) play a key role in providing them (WEF, 2024). For example, national governments can provide sovereign guarantees, which are formal assurances to underwrite financial liabilities to mitigate political instability and defaults (WEF, 2024). Meanwhile, MDBs and ECAs can provide assurances against political risks - such as expropriation, currency convertibility issues, and conflicts - and general export transactions and activities (IEA, 2023c). Additionally, financial instruments such as liquidity facilities - which cover potential short-term cash flow shortfalls - and convertible instruments - protects investors from early-stage project risks by providing financial flexibility - are also potential levers (WEF, 2024).

To address currency risks, recent proposals have highlighted innovative financial mechanisms. Intermediary structures could issue hard currency bonds to attract international investors while providing local currency financing to clean energy projects in EMDE, taking on currency risk through hedging strategies supported by MDBs and DFIs (JAIN, 2023). Similarly, a foreign exchange guarantee agency could tackle excessive currency hedging costs, which are often driven by macro risk. This agency would operate counter-cyclically, providing partial guarantees to stabilize hedging costs (PERSAUD, 2023).

Furthermore, improving access to granular, reliable and comparable data is crucial for investors to assess the risk profile of clean energy projects more accurately (IEA, 2024d). This can be done by creating standardized datasets, that provide information on project performance and credit rates, which can be shared and accessed by financial institutions to better assess the risks associated with clean energy projects (SONGWE et al., 2022) (BHATTACHARYA et al., 2024).

Sources of capital

Currently, half of all energy investments in EMDE comes from governments or state-owned-enterprises, compared to 15% in advanced economies (IEA, 2024f). But, since the COVID-19 pandemic, public debt has increased sharply and fiscal deficits grown larger in EMDE (BHATTACHARYA et al., 2024). Around three quarters of all EMDE have debt-to-GDP ratios of at least 75%, which, added to the higher cost of financing government debt seen in these countries, leaves little room for domestic public finance to expand (IEA, 2024f). At the same time, against a backdrop of increasing extreme weather events, EMDE governments will need to strengthen climate resilience and adaptation, while dealing with growing losses and instability (UNEP, 2024a). This could place additional pressure on the already constrained financial resources in EMDE, potentially limiting their capacity to fund critical mitigation investments.

This means that EMDE are much less capable of disbursing public incentives to clean energy technologies, while advanced economies have launched schemes such as the Inflation Reduction Act in the United States - which destined around US$ 370 billion in federal subsidies to clean energy technologies, driving over US$ 500 billion in investment announcements so far (Rhodium, 2024). This has left EMDE unable to compete, further concentrating investment in rich countries. As previously discussed, raising public funds while ensuring public debt sustainability can be supported by the coordination of fiscal strategy with climate goals, establishing carbon pricing mechanisms and phasing out fossil fuel subsidies (BHATTACHARYA et al., 2024).

Still, looking ahead, to achieve the necessary increase in clean energy investment in EMDE, international and domestic private capital must play a major role (BHATTACHARYA et al., 2024). This means that, for private investments to reach the scale needed, public, philanthropic and development finance - requiring below-market returns - must absorb a significant amount of these risks to mobilize larger shares of private capital (Figure 15) (BHATTACHARYA et al., 2024). In a 1.5°C scenario, clean energy financing from DFIs in EMDE must grow seven times from current levels by 2035 while annual concessional funding for the energy sector in EMDE must triple to over US$ 115 billion by 2030 (IEA, 2024f).

Figure 3.2 ▷ Types of investors and return expectations

Entity type	Returns spectrum
• **Private companies** of all sizes • **Commercial banks** • **Institutional investors** such as pension funds, sovereign wealth funds, other asset managers	**Market-rate returns**
• **Bilateral, multilateral and national development banks** (private sector arms) • **Impact investors** (seeking impacts and returns)	**Quasi or blended returns**
• **Philanthropies and NGOs** • **Bilateral, multilateral and national development banks** (public sector arms) • **Impact investors** (not seeking market returns) • **Governments**	**Below market-rate returns by design**

The higher return expectations of private investors can be offset by lower public sector return requirements

Figure 15 – Source: IEA, Scaling up Private Finance for Clean Energy in EMDEs, 2023

A successful mobilization of private capital also requires significant collaboration between governments, DFIs, and the private sector (BHATTACHARYA et al., 2024). This means that DFIs must play a more proactive role in scaling clean energy investments by providing policy support, capacity building and concessional capital to de-risk clean energy projects, reduce the cost of capital and mobilize domestic and international private capital (IEA, 2024d).

(IRENA, 2024a) shows how the alignment of financial mechanisms and energy planning from the Energy Planning Office (EPE), the Ministry of Mines and Energy (MME) and BNDES has been crucial for the development of the energy sector and the successful integration of renewables in Brazil. In fact, BNDES is the world's largest lender to renewable projects with over US$ 36 billion since 2004, the equivalent of 81.6 GW of additional power capacity (65% of total power capacity expansion in the same period). The development bank also provides below-market financing and first-loss mechanisms which drive down the cost of capital of clean

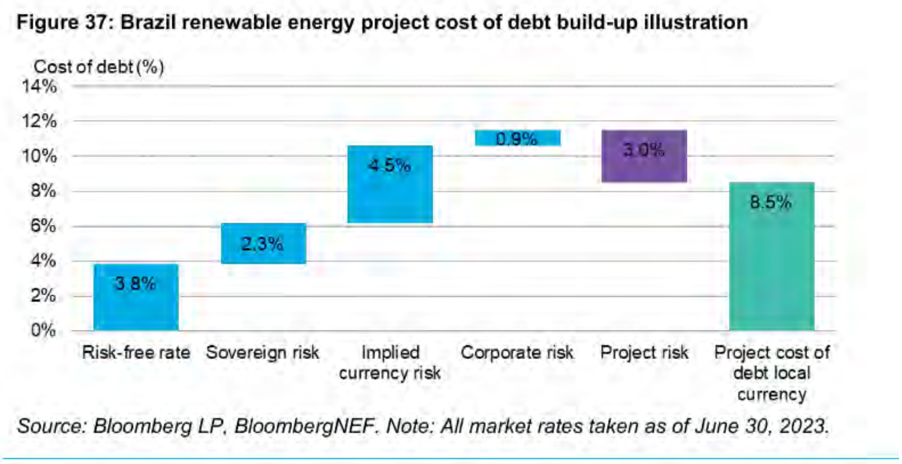

Figure 16 – Source: BNEF, Mobilizing Capital in and to Emerging Markets, 2024

energy projects in the country by around 3 percentage points (BNEF, 2023) (Figure 16). Additionally, EPE publishes detailed long-term energy plans, providing crucial information on anticipated load growth, current energy projects, potential expansion plans and transmission line developments - which in turn offer a transparent and predictable environment for investors. This shows that countries can create an enabling environment by coupling financial mechanisms, long-term energy planning and climate goals.

Meanwhile, MDBs play a central role in scaling up financing for the energy in EMDE, as they are a stable source of low-cost and long-term finance with ample capacity to mitigate risks (SONGWE et al., 2022). But, despite recent progress, their contribution remains insufficient. In 2022, MDBs mobilized just US$ 17 billion in private finance from US$ 80.6 billion in their own climate finance lending in EMDE, reflecting a lack of cooperation with the private sector to tackling investment barriers - especially in low income -, as their portfolio remains skewed towards public sector financing (BHATTACHARYA et al., 2023). Therefore, increasing the involvement of MDBs in the private sector through policy reforms, scaling and improving capital deployment, expanding risk-sharing mechanisms, mobilizing larger shares of private finance, and engaging more closely and efficiently with countries to support market development initiatives is key (SONGWE et al., 2022) (WEF, 2024).

At the same time, more than half of the US$ 1.6 trillion in annual financing for the energy transition in EMDE needed in a 1.5°C scenario must be sourced domestically.

This creates a dilemma for EMDE, given the urgency of investing climate mitigation and adaptation, while managing public debt and fiscal budgets is crucial to preserve creditworthiness, and therefore attract investment (BHATTACHARYA et al., 2024).

Developing a pipeline of clean energy projects with stable financial returns could tackle this by improving creditworthiness even if indebtedness increases (BHATTACHARYA et al., 2024). To achieve this, improving EMDE access to low-cost and long-term financing, as well as international cooperation for capacity building, technical assistance and long-term energy planning is key (BHATTACHARYA et al., 2024). There is approximately US$ 17 trillion of domestic financial capital, made up of household savings, pension capital, and corporate and local bank finance available in EMDE, making it a crucial opportunity to leverage the stable nature of renewable energy projects' financial returns (IEA, 2024c).

Destination of resources

To ensure a successful scale up in financing for the energy transition in EMDE, policies and mechanisms must be deployed effectively. It is crucial to understand the risk profile of each country and clean energy project in order to identify an optimal solution and ensure initiatives are clearly targeted and fit for purpose. The IEA, in partnership with Brazil's G20 presidency, developed the following framework to assess the level of support a project requires defined by both technology and country risk (IEA, 2024d)(Figure 17).

1. Privately led

   Privately led investments account for 40% of annual clean energy investments in EMDE in the IEA's net zero scenario by 2035, the equivalent of US$ 720 billion. These consist of low risk, mature technologies in established markets, which means that only limited interventions to attract new sources of capital are needed, especially from institutional investors and domestic retail investors.

   Attracting retail investors provides an opportunity for diversification for both households (source of investment) and developers (source of finance), and can be done by providing fiscal incentives to debt associated with clean energy projects. Meanwhile, tapping into institutional investors, such as sovereign

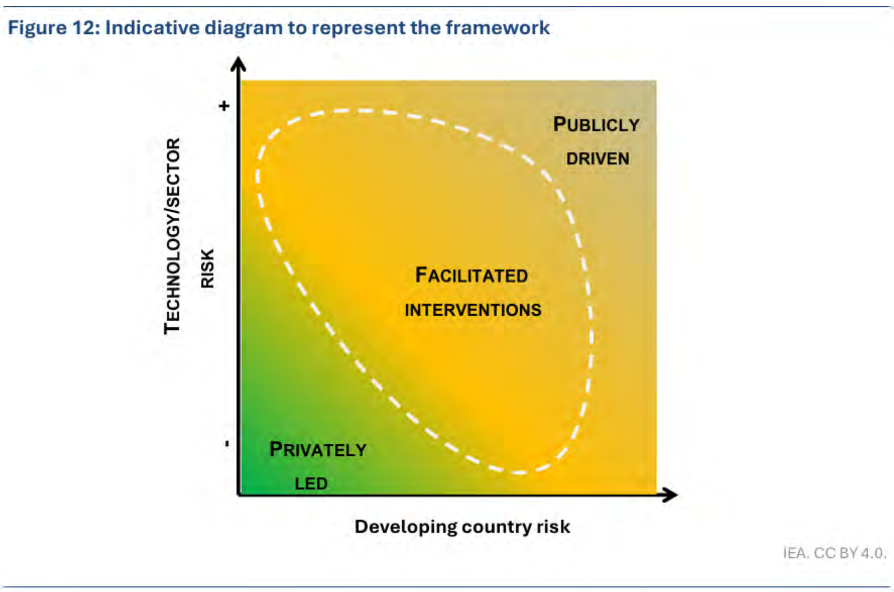

Figure 17 – Source: IEA, Roadmap to Increase Investment in Clean Energy in Developing Countries, 2024

wealth funds and pension funds, can increase market liquidity and domestic currency financing, though it requires significant support from DFIs to establish more attractive structures.

2. Facilitated interventions

Investments that require facilitated interventions imply some level of risk mitigation, accounting for around 50% of annual clean energy investments in EMDE in the IEA's net zero scenario by 2035, or US$ 900 billion. They consist of mature technologies entering new EMDE markets - which requires de-risking, especially for the first projects - or EMDE with low creditworthiness, as well as emerging technologies in low-risk EMDE.

In both cases, collaboration between the public and private sectors is key. When it comes to the former, increasing the role of DFIs in providing concessional finance, improving business models, increasing the availability of risk mitigation mechanisms, and expanding finance sources are all potential measures to scale financing. For the latter, governments, DFIs and philanthropies must provide concessional finance (below market rate or longer return periods), as privately-financed emerging clean technology projects carry significant risk due to limited track records and longer lead times.

3. Publicly driven

   Publicly driven investments represent 6% of annual clean energy investments in EMDE in the IEA's net zero scenario by 2035, the equivalent of US$ 100 billion. These include include projects in least developed low-income countries, often emerging from or involved in conflicts, as well as nascent technologies. In this case, bridging the finance gap consists of providing low-cost debt for initial clean energy projects, especially off-grid projects aimed at increasing access to clean electricity in high-risk EMDE. On the other hand, supporting first-of-a-kind projects involving nascent technologies in EMDE requires coordination between governments and DFIs to provide first loss guarantees or grants to reduce risk.

5 Conclusion

The urgency of climate change poses a clear incentive to scale financing for the energy transition in EMDE. From both an environmental and economic perspective, it is clear that a successful mitigation of climate change is adjacent to a more sustainable and equitable pathway for economic development in EMDE - which implies accelerating the energy transition towards low-carbon sources in these countries.

Renewable power is now cheaper than fossil fuel alternatives in most countries, and technological advancements are bringing many low-carbon solutions in hard-to-abate sectors closer to commercial viability. However, EMDE have captured a disproportionate share of clean energy investments so far, and risk being locked in to high emissions fossil fuel technologies as the energy transition moves forward in advanced economies. To solve this, the risks driving up the cost of capital and hindering investments in EMDE must be identified and tackled.

It is important to acknowledge that investment conditions in EMDE are not favorable and must improve, which depends to a large extent on EMDE-led efforts regarding macroeconomic stability, policy certainty and effectiveness, data reliability, as well strong institutional capacity and governance. Making improvements in these areas is important to ensure a stable and transparent business environment, for both domestic and foreign companies, on the long term.

This must work in tandem with ambitious and innovative de-risking solutions in the short term. These mechanisms have already been successfully deployed to mobilize private capital in clean energy in many EMDE. Still, a much stronger effort is needed to scale and replicate these solutions across countries in order to achieve climate goals, which requires enhanced international cooperation and coordination governments, MDBs, DFIs, and the private sector.

In conclusion, scaling up financing for the energy transition EMDE is a global effort in the economic interest of all countries, given the disastrous consequences if humanity does not succeed in reducing GHG emissions to a 1.5°C pathway. Although it is a monumental task and current efforts are falling short, the combination of technological advancements, improved investment conditions in EMDE and a focused large scale deployment of de-risking mechanisms provide an optimistic pathway to increase investment in the energy transition in EMDE and ensure a more sustainable future for all.

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