Mobilizing Capital in and to Emerging Markets

Commissioned by

GFANZ
Glasgow Financial Alliance for Net Zero

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Foreword from the Co-Leads of the GFANZ Workstream on Mobilizing Capital to Emerging Markets & Developing Economies

The GFANZ Workstream on Mobilizing Capital to Emerging Markets and Developing Economies (EMDEs) works to identify practical actions to accelerate capital allocation in support of the net-zero transition in these critical countries. This includes supporting country platforms; strengthening ties between public agencies, international financial institutions, and private finance to support partnerships and capital mobilization efforts; aiding the development of high-integrity carbon markets; and advancing global capacity building efforts for EMDE financial institutions. You can read more about our work in the GFANZ 2023 Progress Report.

GFANZ commissioned this BloombergNEF report – an update to the inaugural 2022 report Mobilizing Capital into Emerging Markets and Developing Economies – to advance understanding of the key trends and issues driving clean energy and fossil fuel investment and capital market activity, as EMDEs look to transition their energy sources to low-carbon. This report sets those out in detail and highlights micro and macro enabling environment factors that can accelerate the pace of progress, including through analysis of six country case studies. The insights from this report highlight the complexity of the challenge as well as the opportunity and impact associated with successfully creating an enabling environment for climate investment.

Positively, in the past year, three quarters of new power generation added in EMDE countries was low-carbon, delivering an all-time high level of investment. Despite such examples of success, however, we remain significantly off-track in delivering the investment needed to support EMDEs in their transition to net zero, with investment levels needing to increase five-fold between now and 2026 - 2030.

We extend our gratitude to BloombergNEF for their analysis and hope this report will prove useful to a wide range of audiences to advance the necessary dialogue, ambition and action to scale climate finance for the transition of EMDEs.

And we are deeply thankful to the 35 financial institutions and civil society organizations across 16 countries that are dedicated to supporting GFANZ's work on EMDE Capital Mobilization.

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Section 1. Executive summary

In 2022, some 75% of new power generation capacity added in emerging markets and developing economies (EMDEs), excluding China[1], was low-carbon. Energy transition investment in these markets reached a new record of $85 billion, up 10% from 2021. However, low-carbon investment in and to EMDEs continues to fall significantly short of what is required to meet net-zero emissions goals by 2050. Investments in fossil fuel energy supply[2] still eclipse those in clean energy and the International Energy Agency (IEA) estimates that annual investment in low-carbon energy supply must grow more than five-fold from 2022 to 2030. The disparity in clean energy investment between emerging economies and richer nations persists, with EMDEs comprising less than 15% of global investment.

However, there are positive developments, primarily in markets with robust enabling environments. Brazil stands out this year and for most of the last decade. With an effective and stable clean energy policy framework and strong, supportive and independent public institutions, the country represented over one-third of EMDE renewable energy investment in 2022, contributing significantly to the EMDEs' total new record. India and South Africa follow Brazil as the top three main investment destinations in 2022. Most other economies, however, continue to attract insufficient low-carbon energy investment.

The lessons learned from countries across all income groups that have been trailblazing the energy transition highlight that meaningful, stable progress requires strong collaboration between key stakeholders. Governments, national public finance institutions, the private sector, and Multilateral Development Banks (MDBs) need to work together to create favorable investment environments, mitigate risks, enhance liquidity and deploy catalytic investment effectively. Domestic EMDE financial institutions have been notably effective at supporting the transition in the last five years, and their investment has proven relatively resilient to external shocks like Covid-19 and rising interest rates. There is a clear need and opportunity to develop and harness local capital markets. That said, to reach the scale of finance required for transition, which will require many EMDEs to more than triple their renewable capacity to reach the global 11 terawatts of global capacity needed by 2030, international private

[1] Throughout the report, emerging markets and developing economies (EMDEs) refers to EMDEs excluding China.

[2] Fossil fuel energy supply capital investment includes the upstream, midstream and downstream value chains of oil, natural gas and coal production and processing, as well as unabated fossil-based electricity supply.

capital must also be mobilized at much greater rates. Development finance institutions, bilateral donors and MDBs must all accelerate efforts to mobilize international private finance, particularly through rapidly scaling the availability and accessibility of catalytic instruments like guarantees.

This report provides an overview of the current state of the energy transition and its financing in EMDEs and discusses how to execute and accelerate it. Six country case studies – Argentina, Brazil, Egypt, India, South Africa and Vietnam – are used to explore how different stakeholders can influence macro and microeconomic factors that affect investment in EMDEs. Finally, it discusses four transformative initiatives or developments that could significantly accelerate the transition in EMDEs: the emergence of country platforms as a coordinating mechanism, ongoing efforts to strengthen and evolve MDBs, the scaling of high-integrity voluntary carbon markets, and the development of coal phase-out strategies.

The report's key findings:

- **Low-carbon energy supply investment in EMDEs remains insufficient to reach 1.5C scenarios.** The IEA's Net Zero Emissions by 2050 scenario (NZE) estimates that a nearly fivefold increase in low-carbon investment is needed by 2030, compared to 2022 levels, while investment in fossil fuel needs to halve.
- **Although low-carbon energy supply investment in EMDEs reached a record high in 2022, it still only represents 14% of the global total, the lowest share since 2016.** Investment rose by 11% from 2021, reaching $85 billion, with a third of it directed to small-scale solar. Investment remains concentrated in a few markets, primarily in upper-middle income countries. The top 10 markets by investment volume combined account for over 80% of total investment, and Brazil and India together represent more than half of the total.
- **Renewable energy represented three-quarters of the new power-generating capacity added in EMDEs in 2022, while fossil fuel's share fell to a new low.** EMDEs installed 94 gigawatts of new capacity, with renewables (including hydro) representing 74% of this. The share of fossil fuels in total capacity added dropped to 26%, down from 48% in 2021.
- **While renewables additions and investment remain concentrated in larger EMDEs, technologies like photovoltaics (PV) are rapidly expanding to more markets.** In 2022, PV was the primary technology installed in 46% of the EMDEs, up from just 8% in 2012. This is because PV modules cost less than a third of what they cost in 2012, and a sixteenth of what they cost in 2008.

Figure 1: Low-carbon energy supply investments, by country group

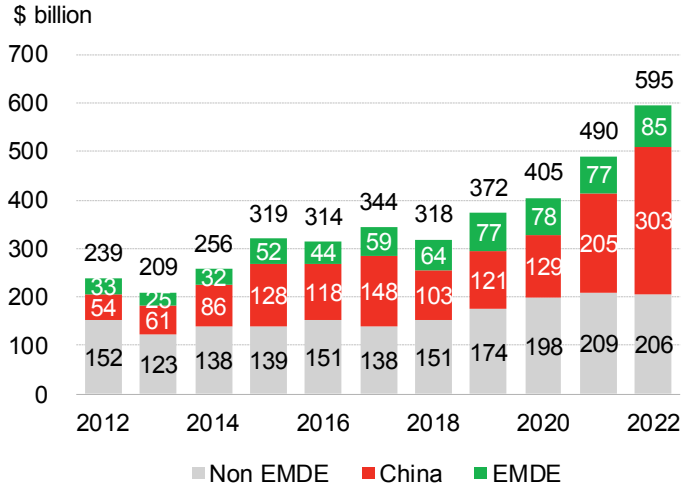
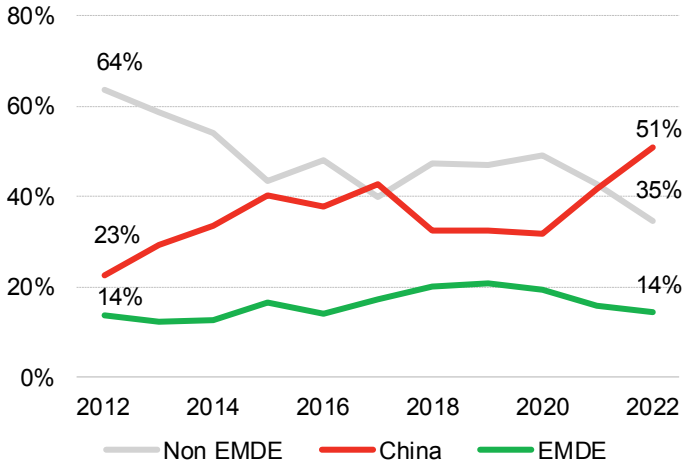


Figure 2: Share of low-carbon energy supply investments, by country group



Source: BloombergNEF. Note: Low-carbon energy supply includes renewable energy, nuclear, energy storage, hydrogen and CCS. Excludes transmission and distribution (T&D) and large hydro. Total volumes exclude small-scale solar investment buffers.

- **The results of measures taken in the countries studied in this report highlight the need for unprecedented collaboration among domestic and international stakeholders to achieve net-zero goals within the time frame envisioned by the Paris Agreement,** with an emphasis on both strengthening the enabling environment and ensuring public capital is used catalytically to leverage private investment.
- **Argentina's experience demonstrates how a mix of well-designed policy frameworks and financial risk mitigation mechanisms can spur renewable energy development in a challenging macroeconomic context.** A combination of auctions and guarantees managed to create bankable projects despite a volatile economic environment. This required an innovative mechanism based on a collaborative approach between the market operator, the national government and the World Bank.
- **Brazil's success illustrates the resilience that a complete and stable policy framework, supported by strong independent public institutions, can bring to the transition of a country.** Brazil has one of the most inviting renewable energy enabling environments among EMDEs, which helped drive over $93 billion in investment in the country over 2012-2022. The Brazilian National Development Bank (BNDES) was pivotal to the development of the sector and ensuring low cost of debt for clean energy projects, while the country's independent Central Bank has been key to maintaining macroeconomic stability.
- **Egypt's story shows the impact of MDB technical and financial support on renewable energy investment flows**. One of the main drivers of investment in energy transition in the country was the collaboration of the Egyptian government with MDBs. The International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) helped the government design a set of power purchase agreements and other incentives offered to developers through a competitive mechanism. In parallel, the Multilateral Investment Guarantee Agency of the World Bank (MIGA) provided guarantees for projects under the program. This helped drive $3.3 billion in 2017, up from nearly nothing in 2015.
- **India's vibrant clean energy sector highlights how high ambition can be matched to a comprehensive set of policy tools designed to address challenges and mobilize**

domestic investors in support of the transition. The country has implemented a variety of mechanisms to boost confidence among local financial institutions, leading to a significant growth in local investment. Domestic investment in low-carbon energy was four times higher than foreign investment in 2022. The country has been a role model in holding renewable auctions with high volumes and a regular schedule, with an average of 15GW of renewables capacity auctioned in each of the last five fiscal years.

- **South Africa's challenges illustrate the importance of policy stability, the need for multi-stakeholder collaboration, and the role renewables can play in improving energy security.** Despite being a mature renewables market in terms of procurement experience and financing capacity, South Africa faces major energy transition stumbling blocks in its policy instability, regulatory tightness and political risk. When executed properly, its clean power incentives, such as auctions, have driven substantial investment and build, but retroactive changes and cancellations have damaged investor confidence. However, recent changes in regulation have unlocked the potential of distributed PV in addressing power shortages.
- **Vietnam's ambitious clean energy policies show how quickly a vibrant market for renewables can materialize under the right conditions, but also how quickly it can be saturated in the absence of a more holistic energy transition plan.** Generous feed-in tariffs triggered a solar and wind boom, driving $44 billion in investment in just four years. However, unsustainable tariff levels, lack of clarity and infrastructure bottlenecks led to a steep decline in investment flows, emphasizing the importance of sustained and clear policy direction.
- **The above case studies provide clear examples of how each stakeholder group across the public and private sector has a critical role in driving progress.** Crucially, each stakeholder's action is more effective when working in collaboration across the public and private sector to create vibrant renewables markets, scale up clean technologies or effectively manage the phase-out of fossil fuel assets.
  - Governments are responsible for translating their climate targets into a set of policies and regulations that, along with macroeconomic and political stability, create an enabling environment that is conducive to investment, providing stability to investors and carefully deploying limited budget resources where they are most needed.
  - MDBs must act as enablers, providing both technical and financial support to host countries, private-sector companies and financial institutions, and project developers. MDBs have a unique role in the interface between governments and the private sector, identifying opportunities where a country can spur investment most efficiently by mobilizing private finance, and where more enabling investment using public resources is needed.
  - Where the enabling conditions are in place, the private sector needs to play its role as a creator, financier and operator of the assets that are needed to decarbonize economies.
- **These lessons are particularly important as leaders build momentum to triple global installed renewable energy capacity by 2030, from a 2022 baseline.** This goal equates to 11 terawatts of renewables capacity by 2030, but contributions will differ around the world. While for earlier adopters of renewables, tripling is the right goal, other countries – especially EMDEs in south and southeast Asia, the Middle East and Africa – will need to set a steeper path away from fossil fuels while meeting growing electricity demand.
- **Some transformational initiatives also have the potential to accelerate the transition by ensuring appropriate multi-stakeholder collaboration, increasing and diversifying investment flows and creating new strategies for remaining challenges.** These include

evolution of the mandate of MDBs to focus on climate and private-sector mobilization, leveraging country platform approaches, developing managed coal phase-out solutions and enhancing voluntary carbon markets.

- An **evolution of MDBs** to increase their support for the energy transition and identify opportunities to mobilize the private sector as a developer of assets and investor is critical to driving capital to EMDEs and achieving global climate targets. This is fundamental, as MDBs are uniquely positioned to act as a key enabler to support governments on how to create the environment for private capital to flow at scale and tailor the activity based on country-specific challenges. The MDB community has begun to respond to this challenge in recent years, signaling their intentions to increase blended finance activity and collaborate with the private sector, as exemplified by the creation of the World Bank Private Sector Investment Lab.
- **Country platforms**, such as Just Energy Transition Partnerships (JETPs), are key instruments to ensure the level of cross-stakeholder coordination that is required to accelerate the transition. Country platforms are designed to bring stakeholders together around a comprehensive transition plan and mobilize financing against it, including from the private sector. They set ambitious climate objectives with their execution conditional to technical or financial support from global partners.
- Beyond boosting renewables, a **managed phase-out of coal-fired power plants** (CFPPs) is one of the most important steps to decarbonize the global economy. While the number of pledges to shut down coal plants has been rising, the process of effectively closing coal assets is complex and requires significant additional effort from policy makers, utilities and investors. This includes widespread adoption of emerging approaches to managed phase-out as a net-zero-aligned transition finance strategy. Around 190GW of CFPPs will need to be retired in EMDEs to reach net-zero emissions by 2030. This will also require a transformation of the corporations, utilities, and communities that have historically relied on the operation of these assets, and bold policy support to ensure a just transition.
- **Voluntary carbon markets can significantly aid the decarbonization of EMDEs if scaled effectively.** They offer financial incentives for reducing emissions across various sectors, including coal phase-out**.** While current global volumes are modest, EMDEs are the primary source of carbon offset issuance and accounted for around 68% of the total in 2022. Market uptake of voluntary standards to ensure credit quality and integrity on both the demand and supply sides are likely to support further scaling.

Technology and country definitions used in this report

This report focuses exclusively on energy supply technologies, including renewable energy, nuclear, energy storage, transmission and distribution, carbon capture and storage (CCS), and hydrogen. It does not encompass energy demand technologies, such as electrified transport and electrified heat.

In this report, EMDEs are defined as non-OECD, but include Chile, Colombia, Costa Rica and Mexico. This report separates China from the EMDE category because the country represents an entirely unique case in terms of the volumes of investment it attracts and where it sources its capital.

Section 2. State of energy transition investment

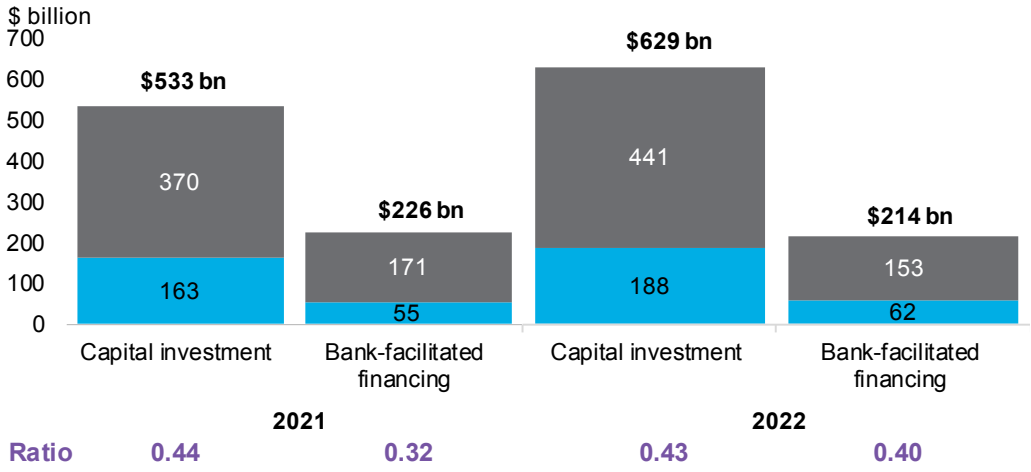
This report explores energy supply investment in EMDEs through two lenses: capital investment and bank-facilitated financing. There is a loose correlation between capital investment and bank financing activity. However, they are fundamentally different measures:

- **Capital investment** (also referred to as capital expenditure or capex) is the money invested in fixed assets, such as land, buildings and equipment – ie generation and storage projects and factories. We discuss this in section 2.1. Throughout the text we also refer to capital investment as simply investment.
- **Bank-facilitated financing** refers to the funds raised by corporations, governments, supranational entities and project special purpose vehicles (SPVs) from capital markets or from banks and other financial institutions via unlisted but openly disclosed debt and equity instruments. This is analysed in section 2.2. Throughout the text we also refer to bank-facilitated financing as simply financing.

Capital investment to build energy projects in EMDEs usually comes from corporate balance sheets. Energy supply capital investment in EMDEs was approximately $630 billion in 2022, while financing came in at just above $210 billion (Figure 3). Although these are quite different metrics, there is a loose relationship between them and the difference is broadly made up by balance sheet financing of capital investment – in other words, the use of firms' operating cashflow and/or non-geography-specific fundraising to invest, for example via a corporate bond issued by an overseas headquartered institution for general corporate purposes.

The amounts of such financing are significant and highlight the importance of including the operating cash flows and capital expenditures of companies involved in the energy sector. For further details, see BNEF's *Financing the Transition: Energy Supply Investment and Bank Financing Activity* (web).

Figure 3: EMDE energy supply capital investment and bank-facilitated financing



Source: IJ Global, International Energy Agency, BloombergNEF. Note: Capital investment has been aggregated by BNEF from the IEA's World Energy Investment 2023 dataset. Figures are nominal, capital investment back-adjusted for US consumer price index between 2021 and 2022. Labels may have rounding differences. Bank-facilitated financing numbers include project finance

lending, as well as corporate debt and equity underwriting For further details see BNEF's "Financing the Transition: Energy Supply Investment and Bank Financing Activity".

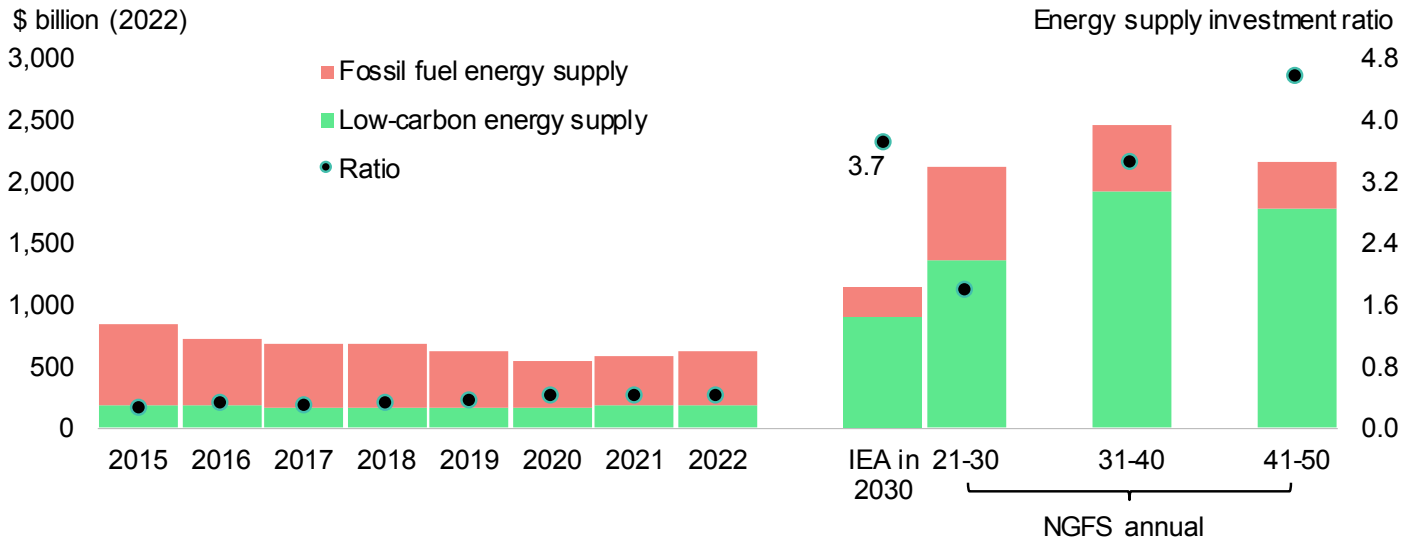
2.1. Energy supply capital investment

In 2022, some 75% of power generation added in emerging markets and developing economies (EMDEs) was low carbon, and low-carbon energy supply investment reached an all-time high of $85 billion, up 10% from 2021. However, the majority of energy supply investment in EMDEs still went to fossil fuels, with major oil producers in all income groups leading. EMDEs still account for less than 15% of global energy transition supply investment flows. The dominance of fossil fuels is equally prevalent in bank financing activities in EMDEs.

Low-carbon energy supply investment in EMDEs remains insufficient to reach 1.5C scenarios

In the International Energy Agency (IEA) Net Zero Emissions by 2050 scenario (NZE), low-carbon investment needs to grow almost five-fold to 2030 relative to 2022 levels, while capital for fossil fuel needs to halve. The Network for Greening the Financial System (NGFS) echoes the requirement to scale up low-carbon investment, with the next decade needing an annual average seven times higher than the investment in 2022. Fossil fuel investment – except coal (see Managed phaseout of coal section) – also needs to increase, but at a much lower rate than low carbon.

Figure 4: Energy supply capital investment in EMDEs



	IEA in 2030	21-30	31-40	41-50
Low-carbon capex growth from 2022	4.8	7.2	10.2	9.5
Fossil fuel capex growth from 2022	0.5	1.7	1.2	0.9

Source: IEA NZE 2023, NGFS Phase 3, BloombergNEF. Note: Historical data from IEA. Investment outlook from BNEF's NGFS Net Zero by 2050 scenario for Latin America, Eurasia, Asia Pacific (excluding China and Japan), the Middle East and Africa. Dollar values are $2022 real. ESIR stands for Energy Supply Investment Ratio. Low-carbon energy supply includes low-carbon power generation and storage, transmission and distribution, carbon capture and hydrogen technologies.

Additional results from the IEA and NGFS scenarios

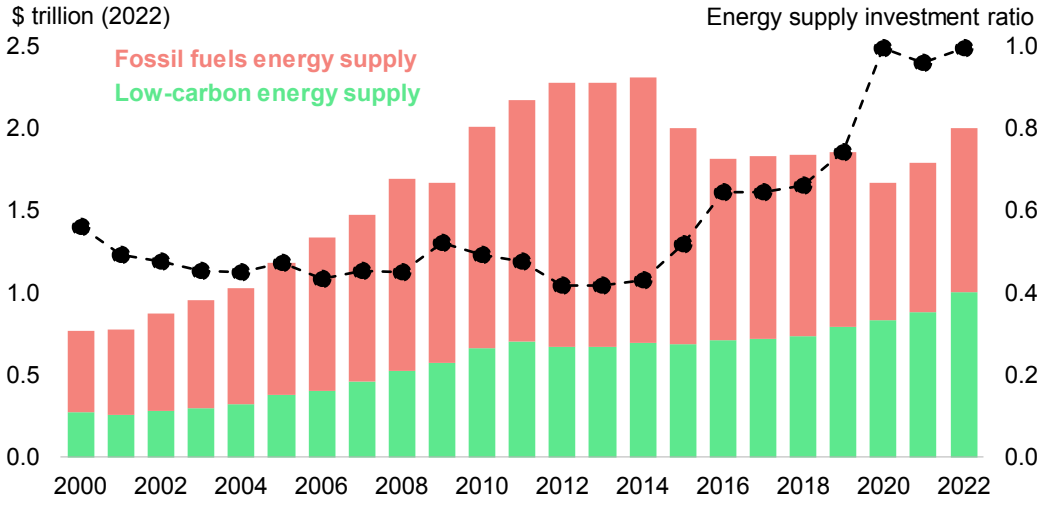
Commonly referenced 1.5C climate scenarios and reports – specifically from the International Energy Agency (IEA) and the Network for Greening the Financial System (NGFS) - indicate that energy supply capital investment in EMDEs should be around $1.1-2.1 trillion annually throughout this decade, with a ratio of low-carbon to fossil fuel supply investment of between 2:1 and 4:1 (Figure 4). The range is due to varying underlying narratives and change drivers implicit for each scenario. Economists Vera Songwe and Nicholas Stern, authors of a widely referenced report on this subject, state that $1.3 trillion to $1.7 trillion is required per year by 2030 for EMDCs (emerging and developing countries) other than China.[3]

According to the IEA, investment in 2022 was about $630 billion in both low carbon and fossil fuel, with an investment ratio of 0.4:1. The $190 billion in low-carbon investments included $67 billion in transmission and distribution (electricity grids), and over $100 billion in assets that generate low-carbon power. Meanwhile, fossil fuel investment increased to $440 billion, with 85% of this going to oil and gas supply.

EMDEs invest more in fossil fuel energy supply than in low-carbon

The IEA estimates that global energy supply investment exceeded $2 trillion in 2022. The ratio of low-carbon to fossil fuel supply capital investment is improving and in 2020, reached parity (1:1), a doubling from 0.5:1 in 2015 (Figure 5). Commonly-referenced scenarios imply an increase in the total energy supply investment of 1.5 to 2.3 times and 2.3 to 3.6 times for low carbon to reach the annual levels required across this decade. However, EMDE low-carbon energy supply investment must scale up faster, to increase between 5 and 7 times. For more on energy supply investment in commonly referenced scenarios, see BNEF's *Investment Requirements of a Low-Carbon World: Energy Supply Investment Ratios*.

Figure 5: Global energy supply capital investment



Source: BloombergNEF, International Energy Agency.

The volume and ratio of low-carbon to fossil fuel energy supply capital investment will differ by region (Figure 6). In **Advanced Economies**, investment in low-carbon energy supply surpassed

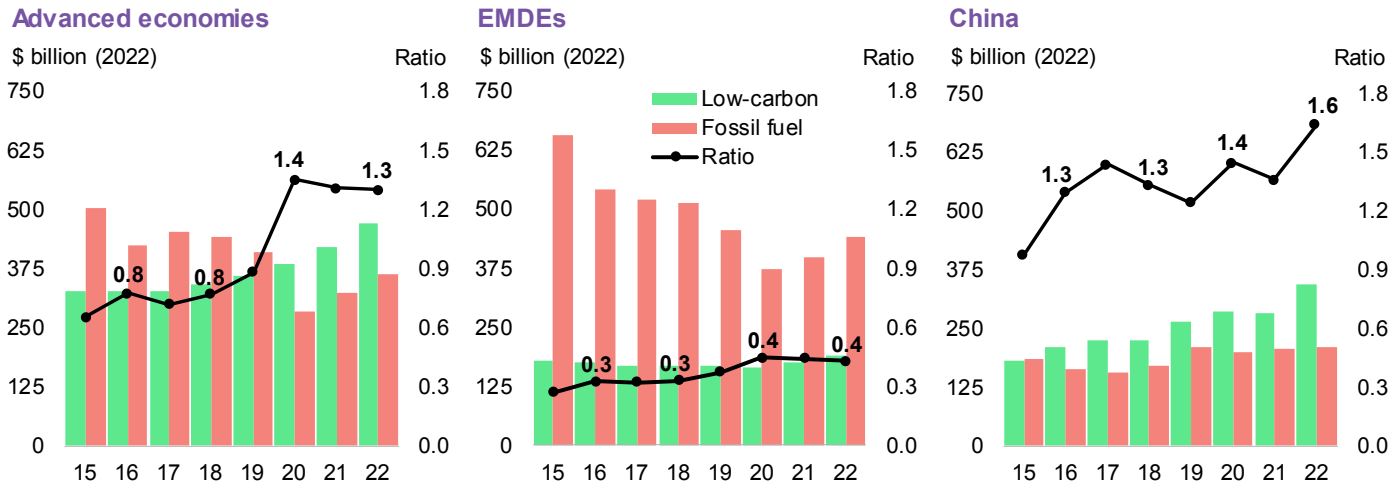
[3] Songwe and Stern 'Financing for climate action', London School of Economics, 2022.

that of fossil fuels in 2020, due to the favourable policy environment, and in some regions such as Europe, efforts to reduce import dependence on oil and natural gas. The adoption of the Inflation Reduction Act in the US and REPowerEU and Fit for 55 packages in the European Union may see the ratio increase further in 2023.

In **China,** energy supply capital investment parity was reached in 2015 due to limited domestic oil and natural gas resources and a strong emphasis on low-carbon energy investment to offset rising import dependence, reduce domestic pollution and build new industries such as solar. In 2022, the ratio increased year-on-year from 1.4:1 to 1.6:1, driven by a $55 billion jump in renewable energy and electricity grids investment. Coal investment – and production – in the region is still high, with investment increasing by $19 billion in 2022.

In contrast, **EMDEs (excluding China)** have lagged on low-carbon energy supply capital investment. Fossil fuel energy supply capital investment continues to outweigh low carbon by over two to one. Capital outlay on fossil fuels was three to four times larger than low carbon earlier in the decade, responding to high oil prices and resilient international demand for oil and gas.

Figure 6: Energy supply capital investment by country group



Source: International Energy Agency, BloombergNEF. Note: For more on regional classification, please see Appendix B.1.

Higher income countries and major oil suppliers lead EMDE fossil fuel investment

A substantial portion of the increase in fossil fuel investment in EMDEs comes from high and middle-income countries which are major oil and gas producers, and pivotal suppliers to the international market (Figure 7 and Figure 8).

High income countries in this group include Middle Eastern states Saudi Arabia, UAE, Qatar, Kuwait and Oman, whose economies are largely dependent on the oil industry. Saudi Arabia was the country with the highest growth in fossil fuel supply investment in 2022, mainly due to high crude prices and increased production guidance from Saudi Aramco, the kingdom's national oil company and the largest producer of oil and gas in the world.

Three upper-middle income countries also made the top 10 ranking for annual fossil fuel investment, notably Iraq, Malaysia and Indonesia. In Malaysia, state-owned oil and gas producer Petronas doubled down on offshore exploration activities in 2022. Lastly, Iran and India – both lower-middle income countries – also made the top 10, with combined year-on-year fossil fuel investment growth of over $9 billion.

Figure 7: Fossil fuel supply capital investment in EMDEs

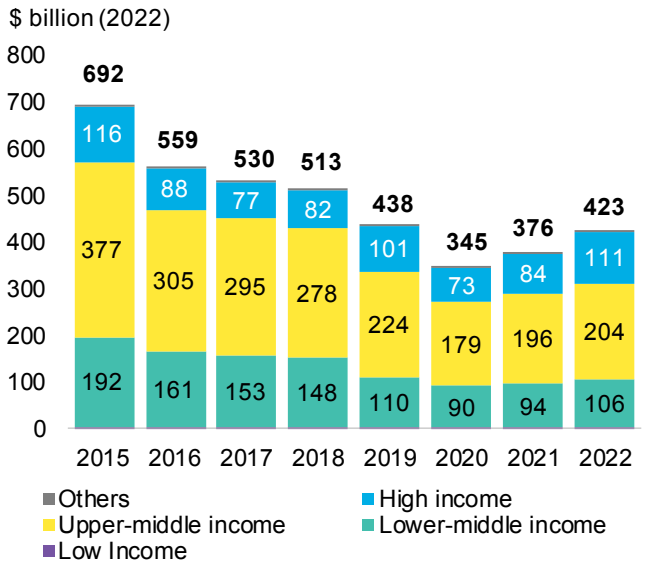
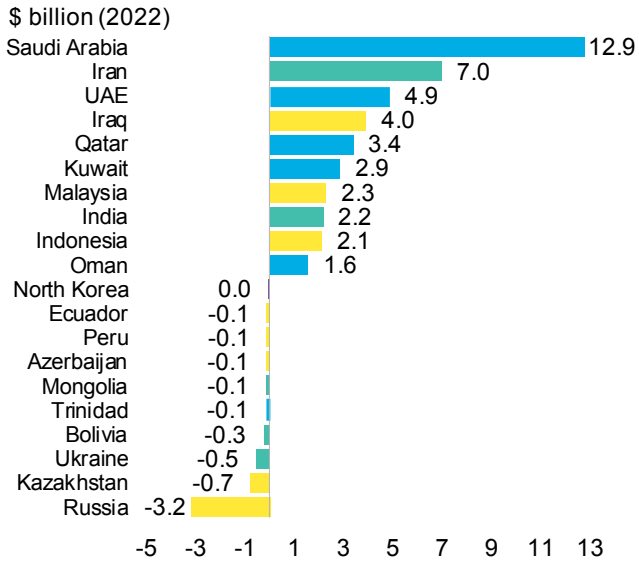


Figure 8: Change in fossil fuel supply capital investment, 2021-22



Source: BloombergNEF, International Energy Agency, Energy Institute. Note: Data aggregated and estimated by BNEF by indexing regional investment numbers from the IEA's World Energy Investment 2023 to the fossil-fuel production from each region in the world. Income group classification based on World Bank income groups.

Low-carbon energy supply capital investment in China topped non-EMDEs

Globally, investment in low-carbon energy supply reached a record high of $595 billion in 2022, up 21% from the previous year, according to BNEF (Figure 9).

China accounted for 51% of the world's investment and led the global growth, with a 48% spike to $303 billion in 2022. This was mostly driven by solar, due to record low prices of PV modules (Figure 10). Non-EMDE investment slipped 1% to $206 billion, accounting for 35% of the global total.

Figure 9: Low-carbon energy supply investments, by country group

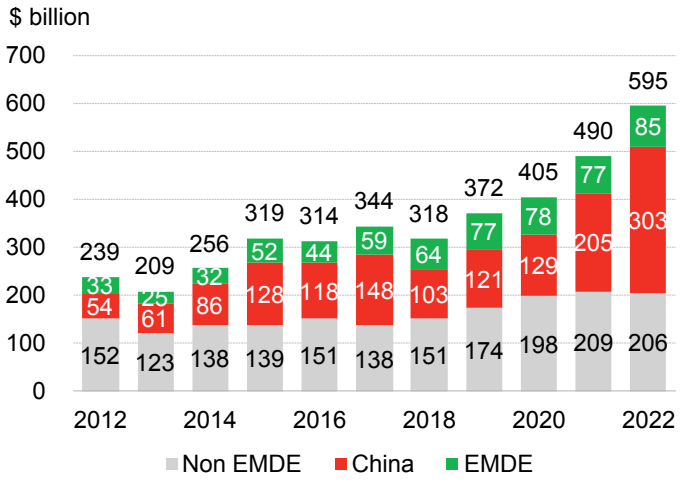
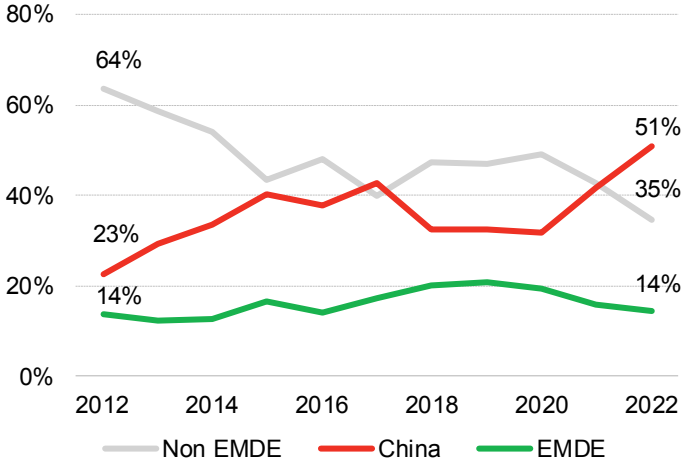


Figure 10: Share of low-carbon energy supply investments, by country group



Source: BloombergNEF. Note: Low-carbon energy supply includes renewable energy, nuclear, energy storage, hydrogen and CCS. Excludes transmission and distribution (T&D) and large hydro and energy efficiency. Total volumes exclude small-scale PV investment buffers.

Low-carbon energy supply capital investment in EMDEs reached a record high in 2022, but still represents less than 15% of global total

In EMDEs, low-carbon energy supply investment jumped 11% to $85 billion, reaching a record high in 2022. Still, emerging nations accounted for just 14.4% of the global sum, the lowest share since 2016. Renewable energy investment represents 83% of the total, or $71 billion, and rose 8% from 2021. Renewable energy investment includes utility-scale solar, wind biomass and waste, geothermal, marine and small hydro projects, in addition to small-scale PV. Nuclear investment fluctuated over 2017-2022 at $10-13 billion per year. Hydrogen, energy storage and CCS combined reached $1.3 billion in 2022 (Figure 11).

While utility-scale renewable energy projects still dominate the investment numbers, small-scale PV has been growing rapidly as solar module prices fall. With a 68% rise, investment in small-scale solar in EMDEs reached $24 billion in 2022, or a third of the total. This is up from just 6% of the total in 2017 (Figure 12).

Figure 11: EMDE low-carbon energy supply investments, by sector

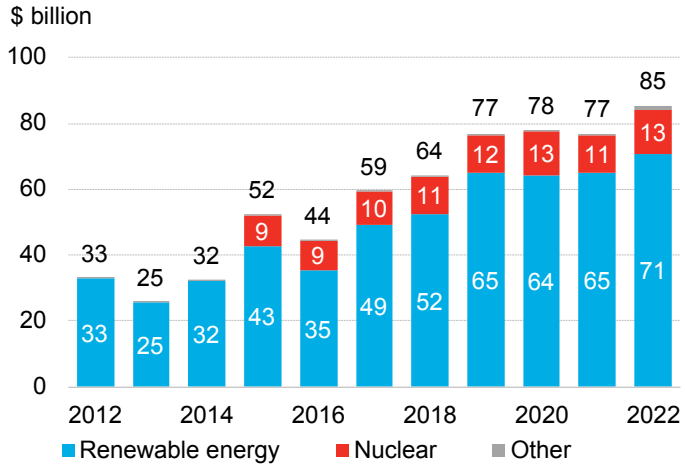
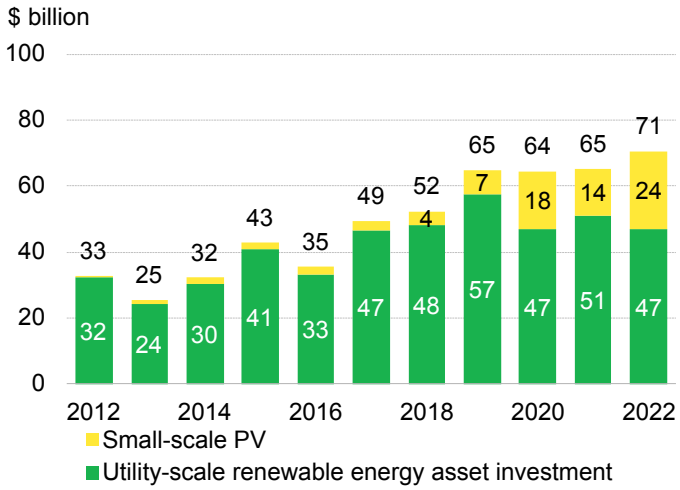


Figure 12: EMDE renewable energy investments, by sub-sector



Source: BloombergNEF. Note: Excludes transmission and distribution (T&D) and large hydro. "Other" includes energy storage, hydrogen and CCS. Utility-scale renewable asset investment includes wind (on- and offshore), solar (large-scale), biofuels, biomass & waste, marine, geothermal and small hydro.

Investment in utility-scale renewable energy projects dropped 8%, to $47 billion last year. Solar was 56% of total utility-scale renewable investment. The decline in utility-scale renewable energy investment was not exclusive to emerging markets. After five years of consistent growth, wealthier nations have seen an even steeper decline in investment, with a 15% drop from $147 billion in 2021 to $125 billion in 2022. This was mainly due to a drop in wind build, not fully offset by an increase in solar build, as solar is lower-capex.

In EMDEs, low-carbon energy supply investment has become more centralized in the highest income groups

Investment in EMDEs remains concentrated in a small number of countries and has become more centralized in upper-middle income nations. The top 10 EMDEs by investment volume combined account for over 80% of total investment, and Brazil and India together represent more than half of the total (Figure 13).

Figure 13: EMDE renewable energy investment, by country

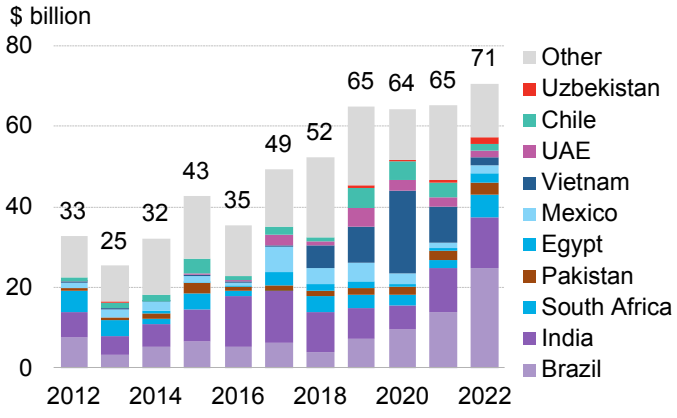
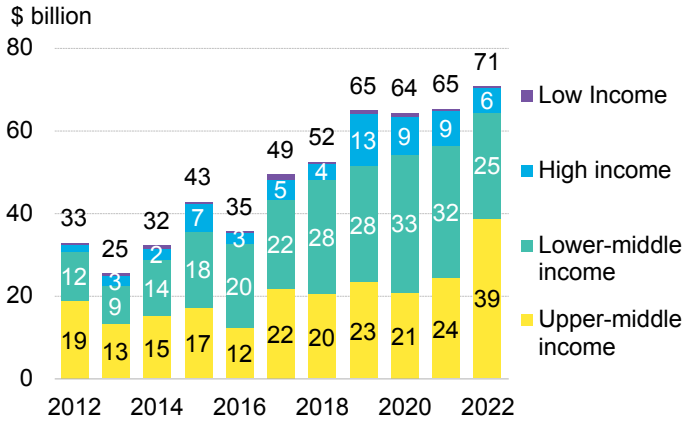


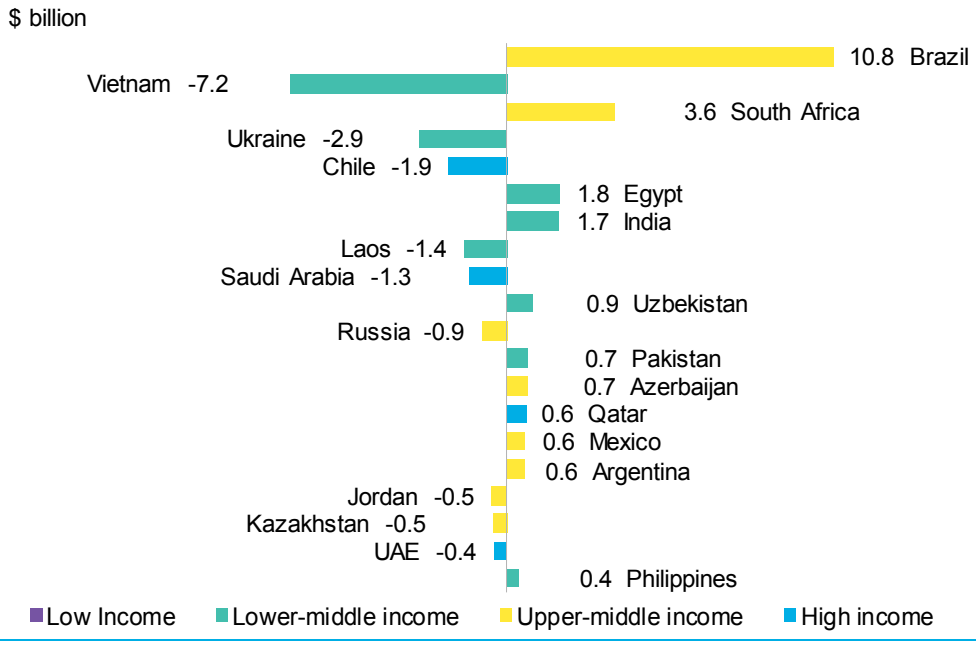
Figure 14: EMDE renewable energy investment, by World Bank income group



Source: BloombergNEF. Note: Includes small-scale PV and utility-scale renewable energy asset investment.

In upper-middle income markets, renewable energy investment expanded 58% in 2022 to $39 billion. For the first time since 2013, this country group now accounts for the majority of financing among emerging nations, with 55% of the total. Investment in lower-middle income countries slipped 20% from 2021 to $25 billion (Figure 14). These changes are, however, the result of growth or contractions in a small number of big markets.

Figure 15: EMDE renewable energy investments, 2021-22 change



Source: BloombergNEF. Note: Includes small-scale PV and utility-scale renewable energy asset investment.

Among upper-middle income countries, Brazil and South Africa led the increase in financing. Brazil alone accounted for 35% of all renewable energy investment in EMDEs with an additional $10.8 billion, or a 77% jump compared to 2022 (see Section 3.2 for more details). Among the lower-middle income country group, Vietnam, Ukraine and Laos recorded the largest declines (Figure 15).

Renewable energy accounted for three quarters of the new power-generating capacity added in EMDEs

In 2022, EMDEs installed 94GW of new capacity, down from 113GW in 2021. Renewables (including hydro) represented 74% of all power installed last year, up from 52% in 2021 and just 23% in 2013. Wind and solar alone represented 63% of the total last year (Figure 16).

Annual installations of solar plants reached a new high of 52GW, or 56% of the total new power generation capacity installed in EMDEs last year. New wind additions dropped by half from 14GW installed in 2021, to 7GW in 2022. The share of fossil fuels in total capacity added plummeted to the lowest level ever at 26%. Additions of natural gas reached a new low since at least 2006, with 10GW installed, down from 38GW in 2021. Coal saw 9GW of new plants commissioned, in line with 2021 levels (Figure 17).

This comes as good news and contrasts the ratio of low-carbon to fossil fuel supply investment in emerging markets presented above. While the high fossil fuel investment in EMDEs is highly concentrated in fossil fuel supply in oil and gas nations, the share of fossil fuel power-generating capacity highlights that countries are benefiting from the improving competitiveness of clean power technologies, regardless of their fossil fuel resources.

Figure 16: Share of net capacity additions in EMDEs

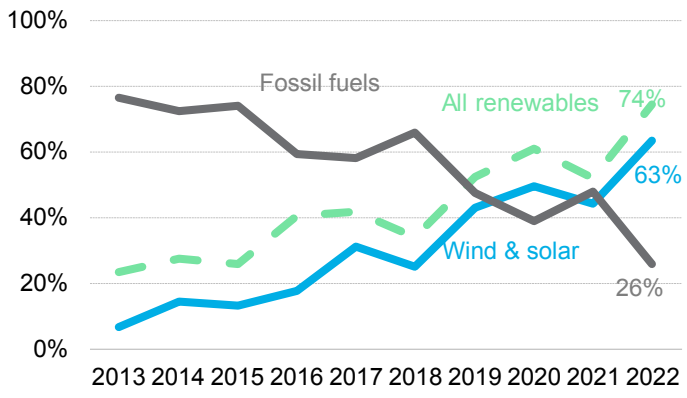
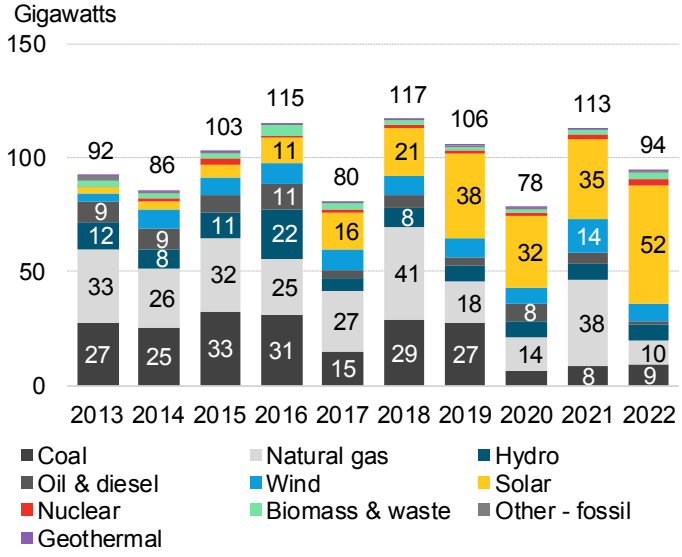


Figure 17: Capacity additions in EMDEs



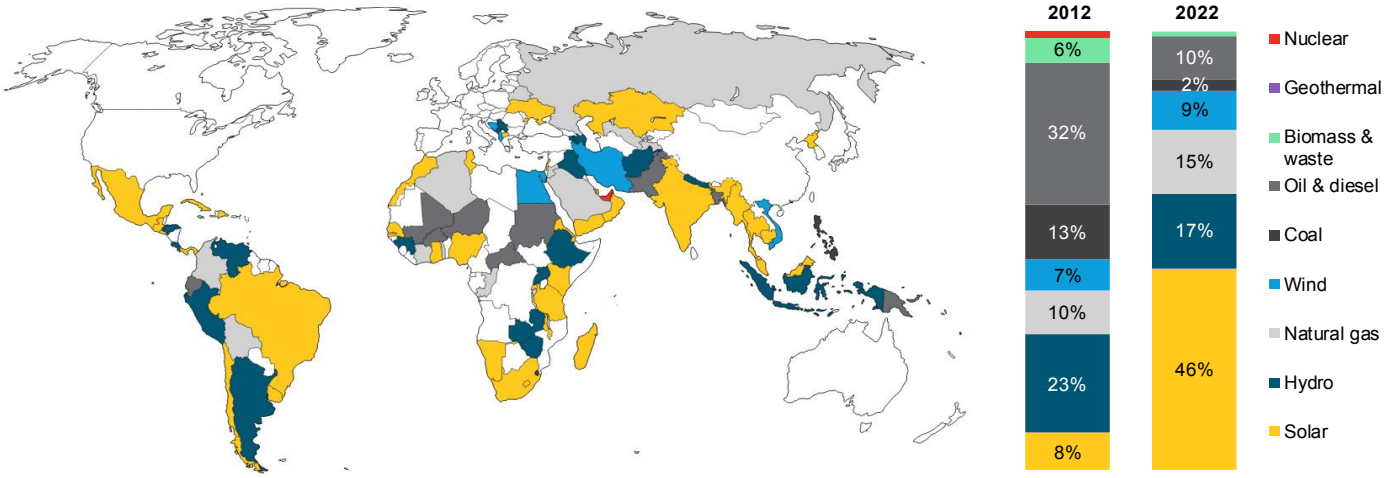
Source: BloombergNEF. Note: Other – fossil' accounts for plants that use more than one fuel or fuels other than coal, oil, gas, hydro and nuclear. Renewables include hydro.

Almost half of EMDEs made solar their top choice in 2022

While renewables additions and investment in absolute terms remain concentrated in the largest EMDEs, these technologies are quickly proliferating to more markets. This is true most of all for PV. Cost declines, aligned with the modular nature of the technology, mean that solar is no longer a privilege available just to wealthier nations.

In 2022, solar was the primary technology installed in 46% of the EMDEs, up from just 8% in 2012, meaning these countries installed more solar capacity than any other individual technology. Hydro and gas followed with 17% and 15%, respectively. In 2012, oil and diesel-fired plants was the most popular technology, with a third of countries making it their top choice, but this figure has declined to just 10% in 2022 (Figure 18).

Figure 18: Most popular new power-generating technology installed, 2022



Source: BloombergNEF. Note: Map colored by which technology was the most installed in 2022. Bar chart depicts the percentage of markets that installed the most MW of each technology. Bar chart is based on market-level data for 140 markets, but excludes markets that have not recorded any capacity additions. Solar includes small-scale PV.

In 2022, at least 87 EMDEs build at least 1MW of solar. This is more than twice the number of nations that added at least 1MW of gas and more than four times the number of countries that added at least 1MW of coal.

Global foreign direct investment in utility scale renewables declined

Global foreign direct investment (FDI), excluding investments flows into China, for utility-scale renewable energy projects plummeted by almost a third in 2022, from $76 billion the year before to $52 billion, the lowest level since 2014. The majority of FDI continues to flow toward richer nations, which account for over two-thirds of the total global (excluding China). Still, FDI flows to non-EMDEs sunk to a five-year low, at $36 billion, down 36% from $56 billion in 2021 (Figure 19).

EMDEs also saw flows drop, but less sharply at 19% to $16 billion in 2022, from $20 billion the year before. Private investment led the decline with a 21% retraction to $14.6 billion, while FDI from public sector sources for renewable energy projects struggled since the start of the Covid pandemic, standing at just $1.8 billion in 2022, 11% of total FDI (Figure 20).

Figure 19: Global utility-scale renewable energy foreign direct investment, by recipient group

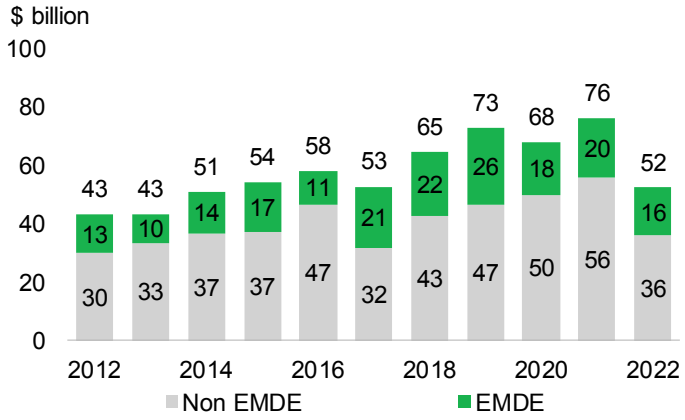
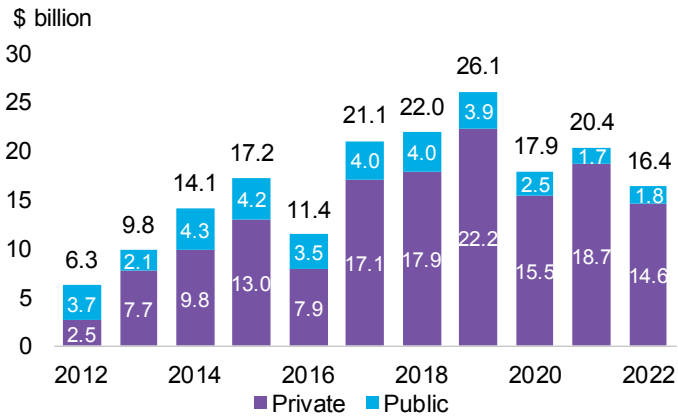


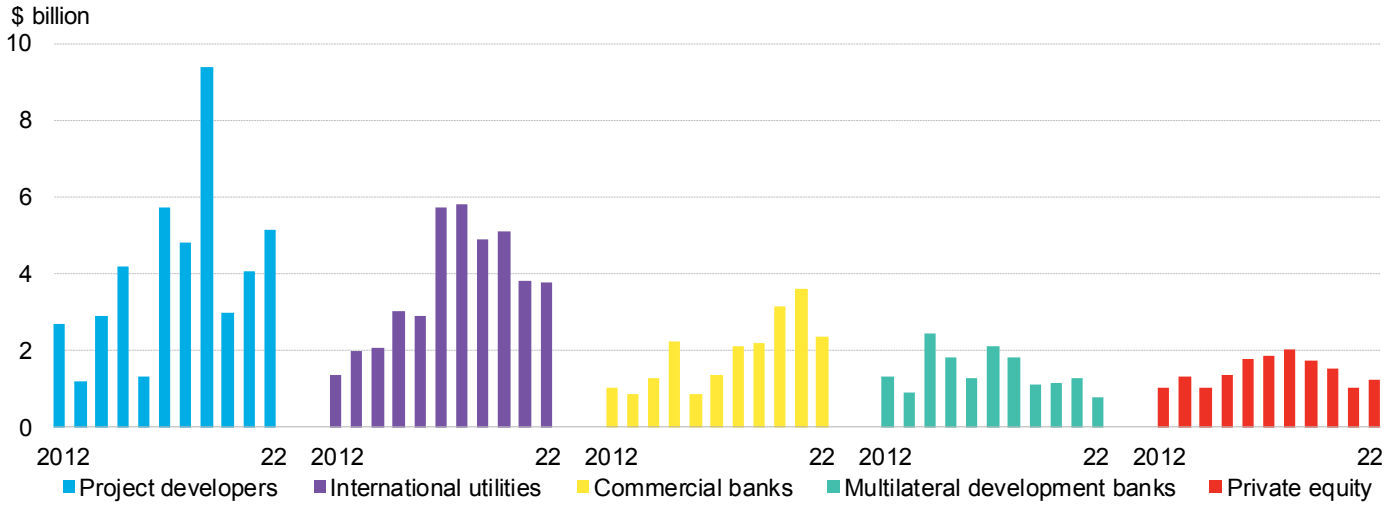
Figure 20: Utility-scale renewable energy foreign direct investment to EMDEs, by ownership



Source: BloombergNEF. Note: Excludes undisclosed data.

Project developers and international utilities remain the largest foreign direct investors providing capital to EMDEs, with $84.7 billion, or 45% of the total, from 2012-2022. They were followed by commercial banks with $20.5 billion, multilateral development banks (MDBs) with $16.0 billion and private equity with $15.9 billion (Figure 21).

Figure 21: Utility-scale renewable energy foreign direct investment to EMDEs, by type of investor



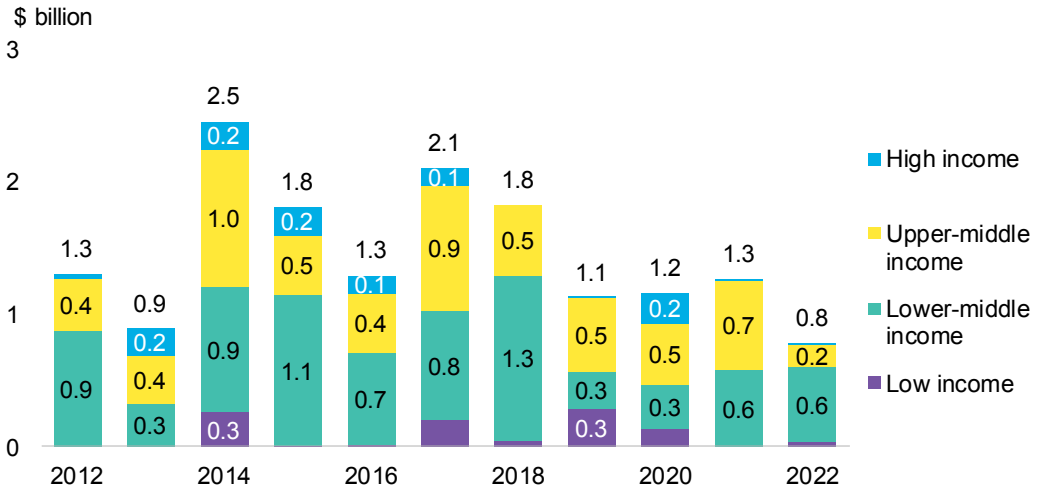
Source: BloombergNEF. Note: Excludes undisclosed data.

MDBs' investment is concentrated in middle income countries

Lower-middle and upper-middle income countries have together accounted for the vast majority (87%) of investment provided by MDBs to renewable energy projects in 2012-2022. Low-income countries represented just 6% of the total over the period and only 5% in 2022. Meanwhile, high income countries have received $1,184 billion, or 7% of the 2012-2022 flow, most of it in Chile and Uruguay (Figure 22).

In 2022, Uzbekistan, Egypt and Côte d'Ivoire attracted the majority of MDB investment for renewables. Among upper-middle income countries, the main recipients over 2012-2022 were Mexico, Brazil and Indonesia. In lower-middle, Morocco, India and Egypt. In the low-income category, Burundi, Gambia and Mali were the most significant investment targets.

Figure 22: Utility-scale renewable energy foreign direct investment to EMDEs from multi-national development banks, by income group

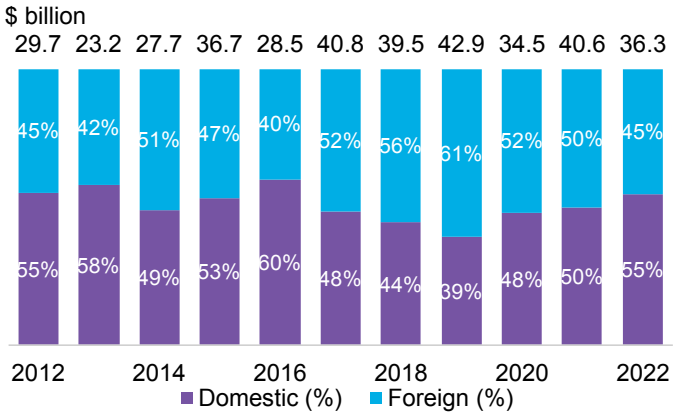


Source: BloombergNEF. Note: Excludes undisclosed data.

Domestic investment remains more stable in EMDEs

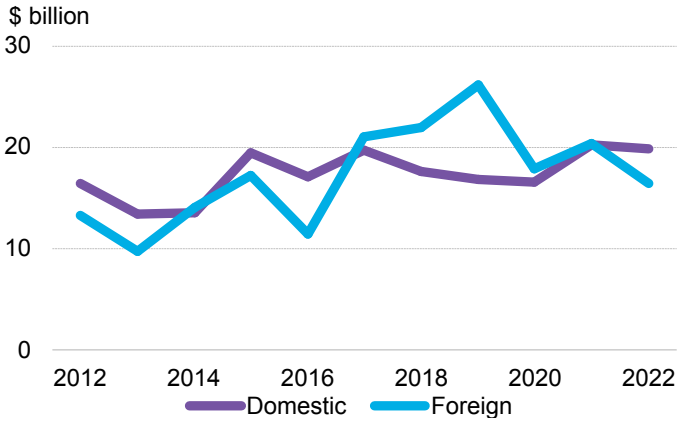
While foreign investment in renewable energy overall plummeted, domestic investment remained flat in absolute numbers at $19.5 billion, despite the overall decline in investment (Figure 23 and Figure 24). Domestic investment was 55% of renewable energy investment in EMDEs in 2022.

Figure 23: Renewable energy investment into EMDEs by type of investor



Source: BloombergNEF. Note: Excludes undisclosed data.

Figure 24: EMDE renewable energy investment, by type of investor

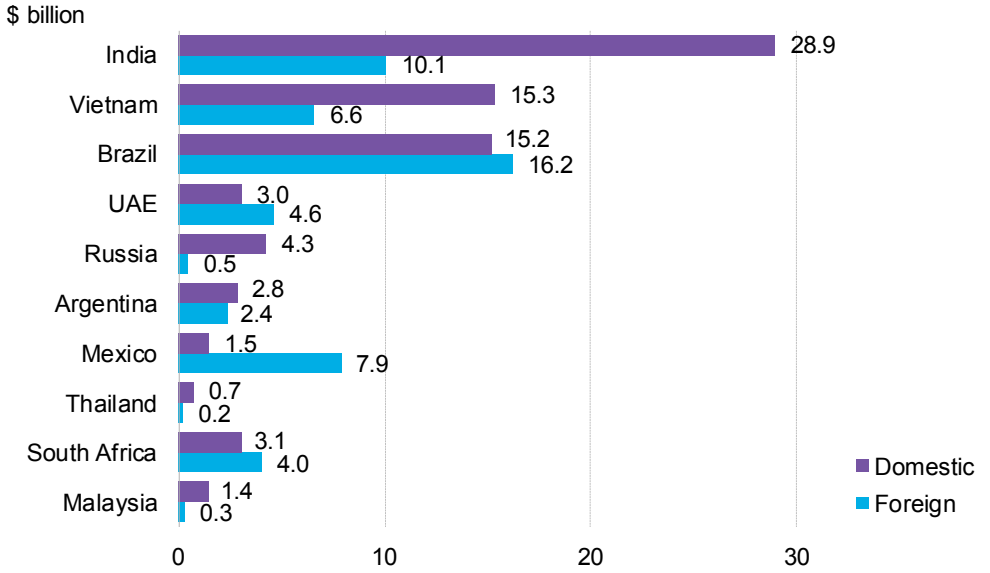


While top low-carbon EMDE markets have recorded both foreign and domestic flows, the relative shares vary widely from country to country (Figure 25). In India, Vietnam and Brazil, for example,

domestic investors have played a major role and been fundamental to kicking off and scaling the renewable energy sector (see Section 3 for more details).

Domestic financial institutions and investors can help channel both foreign and domestic investment, thus scaling renewables deployment in EMDEs. Domestic financial institutions can act as financial intermediaries and collaborate with international debt or equity providers. Some national commercial or development banks, for example, have in-depth knowledge of local clean energy sectors and are well connected to foreign investors. Domestic banks have knowledge on the local renewables sector that is vital to support the work of development finance institutions and private investors.

Figure 25: Renewable energy investment to top 10 EMDEs for domestic investment by type of investor, 2018-2022



Source: BloombergNEF. Note: Includes disclosed data only.

2.2. Energy supply bank-facilitated financing

The introduction to Section 2 examined the difference between investment – money invested in real assets and facilities by real economy companies – and financing, the money raised by real economy companies through various instruments such as bonds, loans, equity offerings and project finance from various sources. It also revealed that the majority of capital investment in EMDEs in 2022 was made using the balance sheets of real economy companies. However, financing is important when corporations are endeavouring to accelerate their capital investment programmes beyond what their operating cash flows allow.

The degree and cost of access to equity and debt finance to fund energy transition activities varies across organizations. For example, state-owned entities often have governance requirements which limit equity fund raising, some private companies lack the track record to raise large scale funds, and the financial markets in some countries lack maturity and depth[4].

[4] 'The Paris Summit Agenda to Deliver on a New Global Financing Pact', June 2023, London School of Economies, at URL

Low-carbon energy supply bank-facilitated financing increased as a ratio of total energy

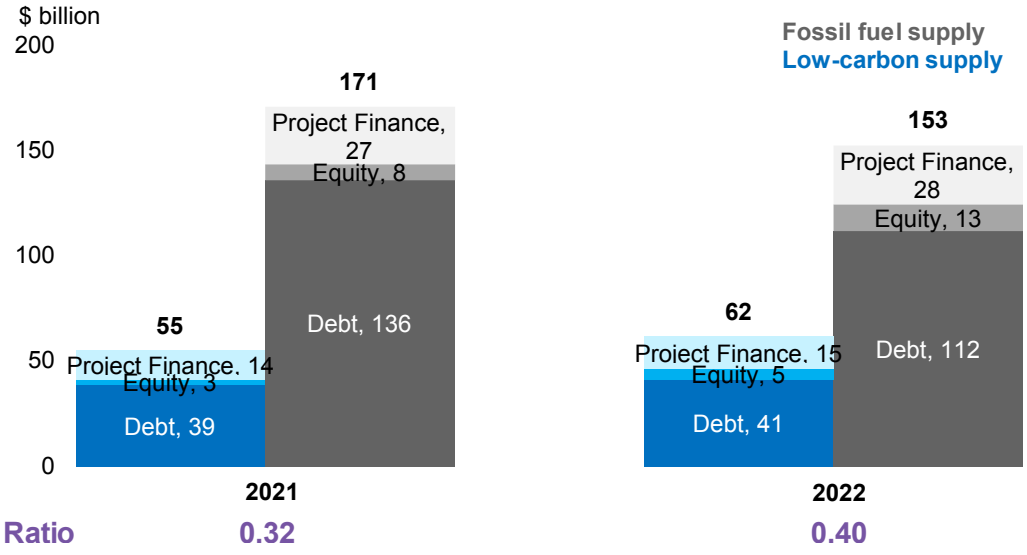
Low-carbon energy supply financing (including from domestic and foreign banks) increased from $55 billion in 2021 to $61 billion in 2022, while fossil fuel supply financing decreased from $192 billion to $153 billion. Low-carbon equity issuance included the partial sale – privatization – of the Brazilian utility Eletrobras.

The Energy Supply Banking Ratio (ESBR) is BNEF's estimate of banks' facilitation of fundraising in the energy sector. This is measured by the underwriting of debt and equity instruments issued by companies active in energy, as well as energy project finance. The ESBR is indirectly related to global capital investment.

Overall, the low-carbon to fossil fuel ESBR for EMDEs was 0.32 in 2021. It increased to 0.40 in 2022, driven by stable low-carbon investment and an approximately $40 billion drop in fossil fuel supply financing. The current ratio for capital investment is 0.43 and the target is 3.9 (Figure 26).

The split between corporate debt and equity and project finance in EMDEs is similar to that in Advanced economies. However, the overall proportion of bank facilitated financing vs capital investment is significantly lower, driven by the large proportion of balance sheet financing done by major oil and gas producers such as Saudi Aramco.

Figure 26: Energy supply bank financing, by instrument type, 2021-22

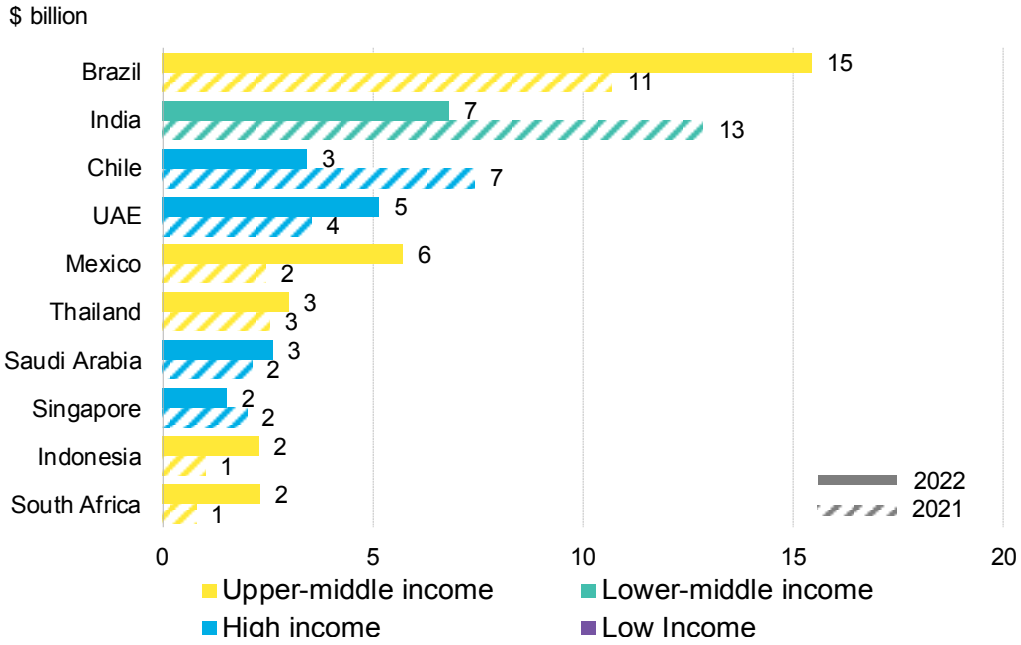


Source: Bloomberg LP, BloombergNEF, IEA, Urgewald, Rainforest Action Network, IJGlobal.
Note: EMDE is the region of risk. Bank financing numbers include project finance, debt and equity.

Low-carbon capital market fundraising by EMDEs is concentrated in a few countries

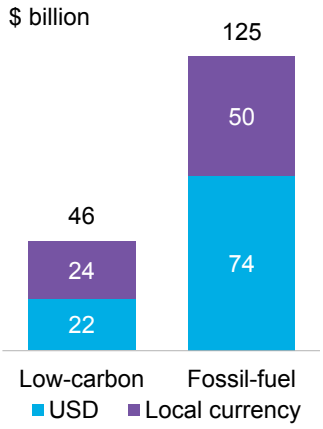
From the total of $46 billion raised by EMDEs, 10 countries were responsible for 85% ($39 billion) of the investment. Except for India, high income and upper-middle income countries were responsible for most fundraising. Low-income countries had close to zero activity. Regionally Latin America led the 2022 ranking with Brazil and Mexico raising $15 billion and $6 billion, respectively (Figure 27).

Figure 27: Low carbon supply funds raised, by EMDE countries 2021 and 2022



Source: BloombergNEF. Note: Capital market funds raised are listed debt and equity. Regions are the region of risk. Values are nominal.

Figure 28: EMDE corporate debt and equity fundraising in 2022, by currency



Source: BloombergNEF. Note: Capital market funds raised are listed debt and equity. EMDE is the region of risk.

Most of the low-carbon fundraising in 2022 was in local currency

More than half (52%) of debt and equity funds raised by corporates focused on low-carbon energy in EMDEs was in local currency (Figure 28). While revenues such as electricity sales are likely to be in local currency, which would encourage local currency issuance, technology like solar panels is priced in US dollar-linked currencies, such as the Chinese yuan, which would encourage US dollar issuance.

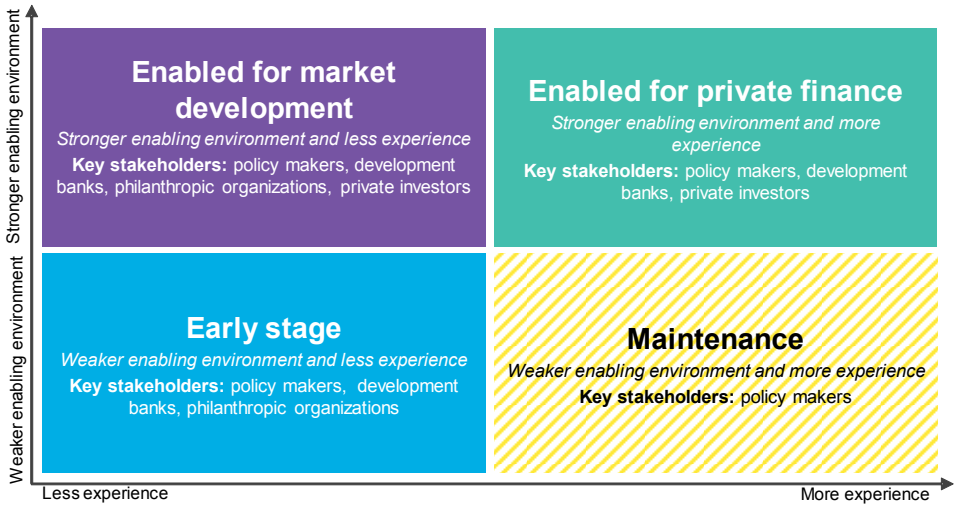
The Brazilian real accounted for nearly a quarter ($11.1 billion) of the corporate debt and equity fundraising, reflecting deal volumes and the developed state of domestic capital markets. The US dollar represented a larger share (60%) of fossil fuel fundraising. This may reflect various factors, including the associated revenues for oil and gas being paid in dollars on export or based on US dollar-price benchmarks such as Henry Hub or West Texas Intermediate or the indexing of cost factors to US dollar-based cost benchmarks. Over a fifth (20%) of fossil-fuel fundraising was in UAE dirham ($12 billion), Indian rupees ($8 billion) and Brazilian reals ($7 billion).

Section 3. Country progress and investment showcase

Getting on track to net zero in emerging markets will require unprecedented collaboration between stakeholders to ensure that countries move fast through the four different stages of becoming attractive for private finance for low-carbon technologies at scale (Figure 29):

- **Early stage.** Countries have weak enabling environment and thus have seen no significant experience in deploying the technology.
- **Enabled for market development.** Once appropriate policies and regulations are in place, the country is ready for deployment of the technology. However, unlike in developed nations where first movers usually have advantages, in EMDEs, the cost of entering a market early presents additional costs. These usually relate to lack of experience from stakeholders, and tountested policies, regulations, and infrastructure.
- **Enabled for private finance.** As the perception of risk diminishes, private investment can quickly flow in to finance the technology.
- **Maintenance.** As penetration of the technology grows, it's essential to maintain the enabling environment to avoid market saturation.

Figure 29: Energy transition stages



Source: BloombergNEF

The case studies below describe how six countries - Argentina, Brazil, Egypt, India, South Africa, and Vietnam - have progressed through these stages. These countries have been selected due to major changes in their low-carbon energy supply investment flows in 2022.

These lessons are particularly important as leaders seek consensus to triple global installed renewable energy capacity by 2030, from a 2022 baseline. This goal, which equates to 11 terawatts of renewables capacity by 2030, will take center stage at the United Nations climate summit in the United Arab Emirates as the COP28 Presidency seeks international agreement on it. While the last tripling of capacity happened over 12 years, from 2010 to 2022, the next needs to take eight.

The aim to triple capacity is global and does not have to be met by each region individually. For regions that were earlier adopters of renewables, including China, the US and Europe, tripling is the right goal. For other regions, a goal of tripling renewables by 2030 is not sufficiently ambitious to set a pathway to net zero due to a small starting base. This is particularly true in south and southeast Asia, the Middle East and Africa, all of which need to set a steeper trajectory away from fossil fuels while meeting growing electricity demand. The Nairobi Declaration, signed in September 2023 ahead of COP28 negotiations, acknowledges the need for greater ambition in its call for $600 billion of investment to achieve a 5x growth in Africa's renewables capacity, backed by a multilateral financing system. For more details, see the BloombergNEF report 'Tripling Global Renewables By 2030 Is Hard, Achievable and Necessary to Achieve Net Zero'

3.1. Argentina

Argentina's experience since the introduction of its main renewable energy law (Law 27.191) in 2015 provides valuable lessons on how to leverage policy frameworks and financial instruments to attract capital for the renewable energy sector, despite complex macroeconomic conditions.

The law was introduced to boost renewables and reduce dependence on fossil fuels for power generation, and created a strong framework for clean energy development and significantly increased attractiveness for investment. The key aspects of the law included:

- A clean energy target to reach 20% of renewable energy in national electricity consumption by 2025.
- Fiscal incentives and benefits to manufacturers and project developers to reduce overall project cost and enhance profitability.
- A renewable energy auctions program, called Renovar, to stimulate competition and transparency.
- The creation of a clean energy fund (FODER) to mitigate risks, help execute clean energy auctions and ensure the feasibility of renewable energy projects.

The Argentina case, however, also highlights the limits of risk-mitigating mechanisms during periods of deep economic distress.

Auctions accelerated renewable energy deployment

Argentina's clean energy auctions, dubbed RenovAr and a centrepiece of Law 27.191, led to more than $7 billion in private investment in renewable energy through an innovative regulatory and financial mechanism based on a multi-level guarantee scheme.[5] RenovAr aimed to boost renewable energy as part of the country's clean energy target. It was intended to help encourage competition and heighten investor confidence in a volatile market, and was designed around three main complementary elements for facilitating the full process:

- A clear and transparent set of tender rules.
- A bankable power purchase agreement (PPA).
- A strong guarantee scheme to reduce risks.

Auction winners were awarded 15–20-year PPAs with the wholesale electricity market operator Cammesa (the Argentine Wholesale Electricity Market Clearing Company). The table below lays out some of the key strategies to mitigate risks:

[5] See RenovAr Programme Case Study from RELP for more details.

Table 1: Argentina Renovar renewable energy auction risk mitigation strategy

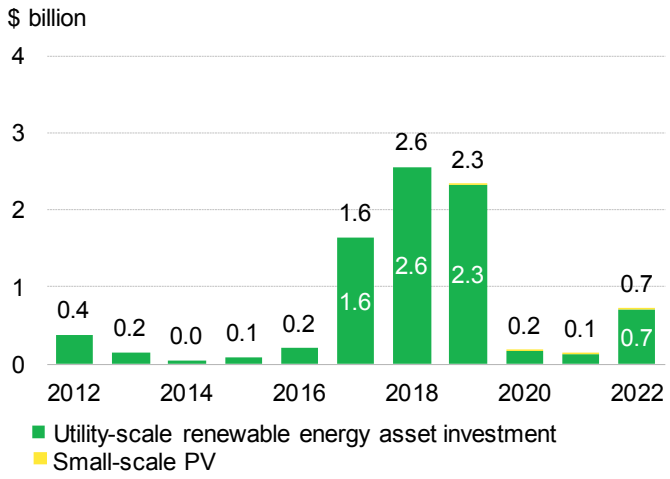
Main risk	Details	Risk mitigation mechanisms
Country risk and long term exposure	The country has a history of economic instability, and this investment is for at least 20 years	20-year FODER and World Bank guarantees
Corporate risk (Cammesa)	Cammesa, Argentine Wholesale Electricity Market Clearing Company, has a history of power payment delays, and is a highly leveraged company with no investment grade	20-year FODER and World Bank guarantee
Financing	Local and international banks have limited credit availability	FODER as a potential lender and availability of multilateral financing
Currency risk	The Argentinian peso is devaluated and the economy dollarized	US-dollar-denominated contracts for auction winning projects
Transmission and distribution systems	Grids have little available capacity, and there is limited vision for expansion	Transparency about transmission capacity available; grid access priority

Source: BloombergNEF

These measures proved to be effective and drove over 4.5GW in contracts in three rounds over 2017-19 at some of the lowest prices at the time, as well as roughly $7 billion for projects (Figure 30 and Figure 31).

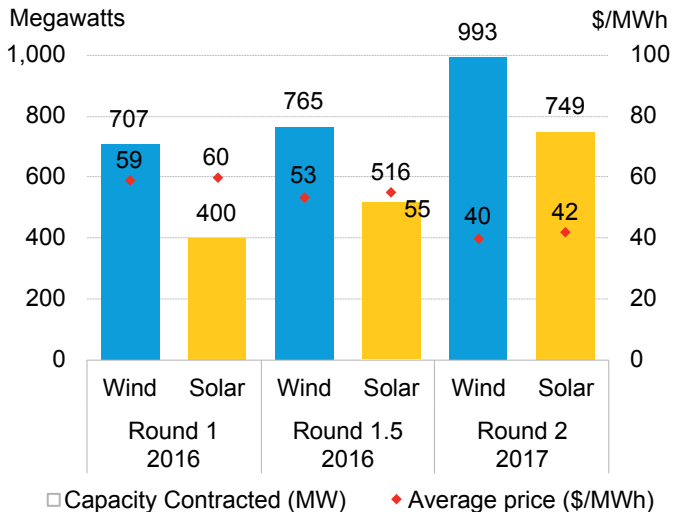
By year-end 2022, Argentina's total installed power capacity reached 43.7GW, of which over half came from gas generation, while wind and solar capacity combined made up roughly 10% of the total. Altogether, 1.8GW of wind projects and 1.1GW of solar projects that won auction contracts have already been commissioned.

Figure 30: Argentina renewable energy investments, by sub-sector



Source: BloombergNEF. Note: Utility-scale renewable asset investment includes wind (on- and offshore), solar (large-scale), biofuels, biomass & waste, marine, geothermal and small hydro.

Figure 31: Argentina's RenovAr auctions by capacities and prices



Source: BloombergNEF. Note: MW is megawatts, MWh is megawatt-hour.

Guarantees allowed for bankable projects

Law 27.191 also introduced the Fondo Fiduciario para el Desarrollo de Energías Renovables (FODER), a clean energy fund that supported renewable energy projects. FODER was fundamental to increasing investor confidence, mitigating risks and making projects bankable in a volatile economic environment. The RenovAr Programme Case Study from RELP[6] explains how FODER worked:

The mechanism established a three-level guarantee provided through and by FODER and the government of Argentina. The three levels are:

Non-payment and/or delayed payment for produced and delivered electricity. If Cammesa delays making the monthly payment to the special purpose vehicle (SPV) for the produced electricity, FODER will automatically kick in and make the payment on time, guaranteeing a steady cash flow for the project. Cammesa must repay Foder immediately when funds become available, to replenish the energy payment fund. To provide better security for the projects, each RenovAr round is guaranteed via a separate and independent trust account within FODER.

Early termination of the contracts through compensation implemented via a put option for the sale of the project's assets to FODER under certain circumstances. Such events may occur under certain circumstances triggered under the PPA and/or at the macroeconomic or political level. In this way, the project may continue to supply clean electricity to the national grid under the same PPA but with a different owner. This obligation is guaranteed by the Government of Argentina via the issue of treasury bills, which are deposited in FODER's custody earmarked for each electricity generator. If the investor decides to exercise its put option, the Treasury must pay the outstanding bills in US dollars in a local or foreign bank account, as designated by the beneficiary. In this case, FODER purchases and receives all of the assets of the project, which continues to operate, keeping the PPA in force. All liabilities of the SPE remain with it; only the project's assets are transferred to FODER. The SPE is required to keep these assets in good operating condition up to the time of transfer. The put option may be triggered by the power producer upon the occurrence of certain trigger events, namely:

- Non-payment by Cammesa for four consecutive months or any six months within a rolling 12-month period
- Non-compliance by Cammesa under any ruling of the arbitration tribunal
- Unilateral elimination of the FODER Guarantee structure by the government
- Non- convertibility of Argentine pesos to US dollars to pay lenders or equity
- Non-transferability of funds out of the country.

Non-payment of any sovereign obligation under the contracts up to the amounts guaranteed by the World Bank, when applicable. The third level of guarantee (the Sovereign Default Guarantee) was offered as part of RenovAr as an optional feature. The so-called World Bank Guarantee was specially crafted for the programme by the RenovAr team to partially cover the Government of Argentina obligation (via FODER) to purchase and pay for the project upon the exercise of the put option by the awarded project. For this guarantee to be triggered, the sequential backstop of the put option obligations by the FODER, the FODER trustor, and the Treasury (payment of the treasury bills) would need to fail first. In these extreme circumstances,

[6] RELP is a non-profit founded by the former team at Argentina's Ministry of Energy responsible for drafting these mechanisms. It supports governments to implement the right policies and provides them with innovative credit-enhancement tools to attract investment, foster competition, and lower the cost of renewable energy generation while reducing GHG emissions.

the World Bank would be called as last-resource payer under the Guarantee Agreement executed with FODER and the Indemnity Agreement executed with the country.

The World Bank Guarantee was offered as an optional feature to investors. Given the limited amount available to the country, it was allocated to eligible projects based on their bid price and other competitive variables as defined in the tender documents. Each project could request coverage of up to $500,000/MW. In Rounds 1 and 1.5, the combined envelope was US$500 million; in Round 2 it was $250 million. The optional nature of this guarantee was important to magnify the impact and effect on the program. Even those who did not request the guarantee felt safer because the World Bank participated in overseeing the tenders, the design and functioning of the contracts, and of FODER. Indeed, in Round 1 the offered capacity was oversubscribed by a factor of six, and that factor increased to eight in Round 2, reflecting the creditworthiness of the regulatory framework and the guarantee system.

While the first-level guarantee is activated every month, the second- and third-level guarantees have never been used.

Further macro and microeconomic conditions have limited capital flows post-2019

The RenovAr and FODER mechanisms have spared renewable energy investors from the consequences of a worsening economic situation since 2019, but have not been able to ensure high levels of investment flows during a deep economic distress.

According to RELP, while all thermal projects and nuclear power plants that have contracts with Cammesa have had payments delayed, projects awarded under the RenovAr program (and backed by FODER), have been receiving their revenues on time since they reached commercial operation status. In the long run, this will be fundamental to maintain trust in the program.

However, since late 2018, a deep economic crisis has pushed investors away. In December 2021, the government published Resolution 1260/2021, allowing projects awarded in these auctions to cancel their contracts. In total, 30 wind, solar, biogas and biomass projects have voluntarily cancelled their contracts by 2022, totalling nearly 800MW, mostly from Renovar Round 2 held in 2017.

This illustrates that risk-mitigating initiatives can attract investment by shielding investors from manageable macroeconomic-related challenges, but not solve or compensate for the macro issues in moments of deep crisis. Action from both domestic and international leaders is needed to manage these risks and their impact. Section 3The main domestic factors are for countries to further enhance economic governance capacity, including the role of central banks in managing responses to monetary tightening or inflation.

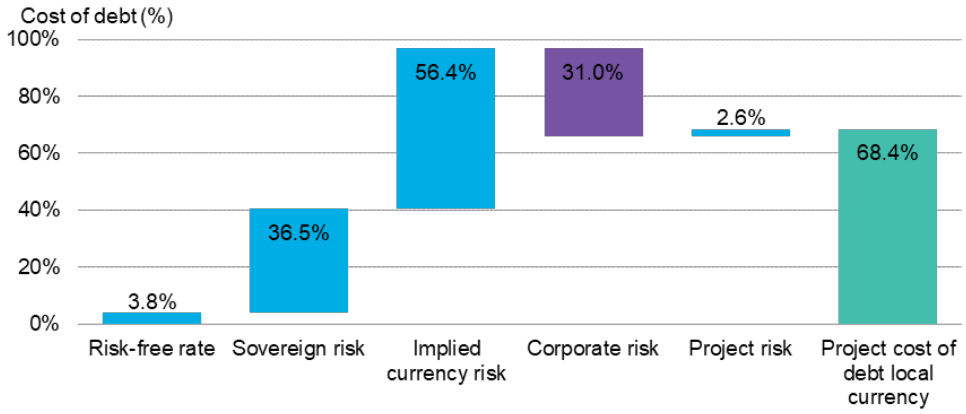
Sky-high inflation and cost of debt are holding back new investments in Argentina

Sovereign risk and implied currency risk are responsible for an increase of almost 100 percentage points in cost of debt. A new cycle of currency crisis and fiscal mismanagement suggests a multinational corporate is a safer bet than the government, resulting in a negative corporate credit spread.

Since 2019, Argentina has had an annual consumer price inflation (CPI) rate of about 50%, taking fewer than two years for average goods and services prices to double. The Central Bank raised the base rate to 133% in October 2023. Despite some severe macroeconomic headwinds, the country did manage to return to positive real GDP growth in 2021 and 2022, bucking the three-year trend of negative growth.

Figure 32 below, shows a peso borrowing cost of 68.4%. This shows how bleak the Argentinian economy would be for investors if they were limited to borrowing from international lenders in peso and were doing so without the aid of development finance (see Appendix A for more details on cost of capital).

Figure 32: Argentina renewable energy project cost of debt build-up illustration



Source: Bloomberg LP, BloombergNEF. Note: All market rates taken as of June 30, 2023.

3.2. Brazil

Brazil has the cleanest electricity mix among G-20 countries and continues to invest significantly in renewable energy. In 2022, it was the top EMDE country for renewable energy investment. Brazil's success is driven by a strong and stable policy framework, aligned with consistent support – over several decades – from national development banks.

Policies and regulations helped drive over $93 billion in renewable energy investment over 2012-2022

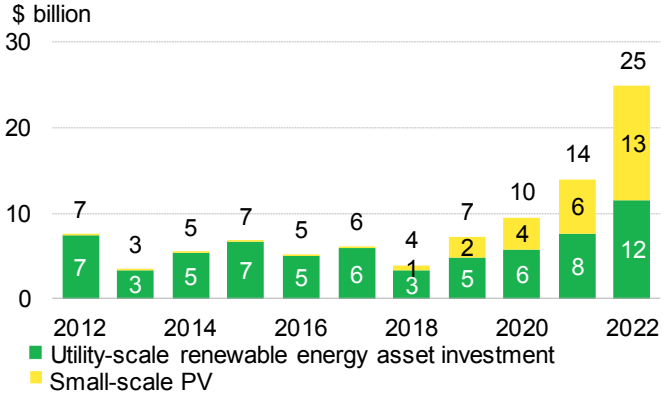
Brazil has one of the most inviting renewable energy enabling environments among EMDEs, which helped drive over $93 billion in investment in 2012-2022 (Figure 33). Its policies cover both utility- and small-scale projects, and are aligned with attractive regulations for the free market.

The country has pioneered competitive auctions for utility-scale projects, which led to over 39GW contracted since 2009. This success is driven by a combination of long-term contracts, competitive prices, and priority grid access.

Brazil's net metering scheme drove over $23 billion to small-scale photovoltaic solar (PV) capacity in just three years. The policy allows retail electricity consumers to install up to 5MW of self-generation facilities, deliver surplus power to the grid and be compensated in the form of billing credits. In practice, this framework has allowed over 2.2 million consumers to install solar systems at residences, small businesses and buildings, as well as in rural areas.

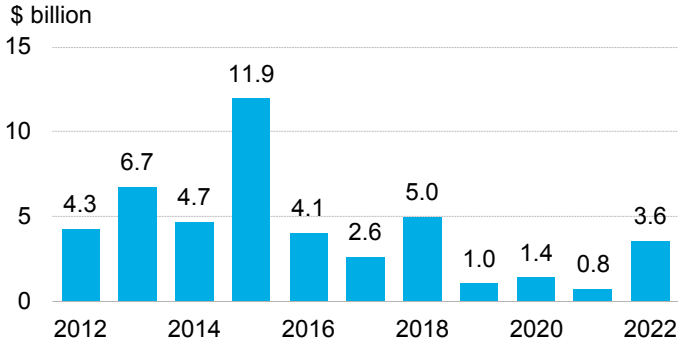
The sub-5MW solar market is rapidly expanding in the country and will likely continue to be until the end of the decade. The segment had a banner year in 2022 with 10.7GW of additions, bringing cumulative capacity to 23GW. BloombergNEF expects such capacity to grow to over 100GW by 2030, which would make small-scale solar the single largest electricity source by capacity, exceeding large hydro.

Figure 33: Brazil renewable energy investments, by sub-sector



Source: BloombergNEF. Note: Utility-scale renewable asset investment includes wind (on- and offshore), solar (large-scale), biofuels, biomass & waste, marine, geothermal and small hydro

Figure 34: Brazil's transmission investment via reverse auctions, 2012-2022



Source: Aneel, BloombergNEF. Note: Investment figures estimated based on auction results.

Brazil's renewable energy success was further enabled by consistent investment in transmission infrastructure, which totaled $46 billion over 2012-2022 (Figure 34). This has allowed the integration of intermittent generation from both utility-scale and distributed generation projects.

Despite being the fifth-largest country in the world, Brazil has a single interconnected grid covering the whole country, with the exception of some regions in the Amazon forest. This allowed renewable energy projects to be installed in areas with higher capacity factors and still supply distant high-demand zones.

In May 2023, the Minister of Mines and Energy announced an additional 56 billion reais ($11.2 billion) for new auctions to be held over 2023-24. This aims to address recent grid access bottlenecks that are limiting deployment of new wind projects.

Corporations have taken the lead on utility-scale buildout in 2021-22

The unregulated electricity market has also played a critical role in the boom of new clean energy projects. Of 11GW of wind and solar commissioned in 2021-22, 75% (8.6GW) was developed under bilateral agreements outside the regulated market. In 2022, those investments hit a record $12 billion. This trend should continue even as auctions remain an important planning mechanism.

This trend is a clear sign of the maturation of the renewables market. As corporate bilateral power contracts tend to be shorter in duration, they are only feasible as investors' perception of project and market risk declines.

BNDES was fundamental to the development of the renewable energy sector

The Brazilian National Development Bank (BNDES) is by far the largest supporter of utility-scale renewable energy in Brazil. It provided $19.2 billion to the renewable energy sector in 2012-2022, which has been fundamental to ensuring the success of the auction mechanism since its inception. More recently, investment from the regional development bank Banco do Nordeste (BNB) has been playing an increasingly important role, reaching more than $4 billion over 2017-2022 (Figure 35).

As the sector matures and the capacity developed to sell into the 'free power market' increases, investment from international commercial banks and corporations has grown. This includes Santander Bank and the utility companies Enel and Engie (Figure 36).

BNDES has also driven a successful local content policy, which was fundamental to creating a national wind turbine manufacturing industry without posing barriers to investors. Local content measures put in place not as requirements, but as incentives in the form of access to concessional debt from the development bank. As the clean energy sector in the country matured, local content requirements to access the incentives were raised progressively. This stands in contrast to many emerging markets, where local-content requirements are qualifying conditions for successful auction participation.

Figure 35: Brazil lead investment providers, 2012-2022

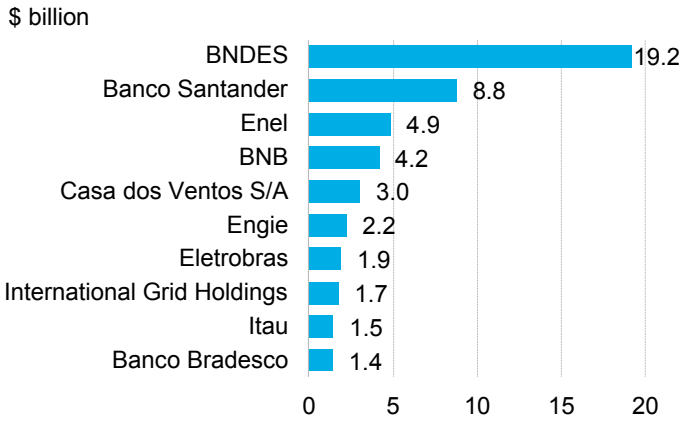
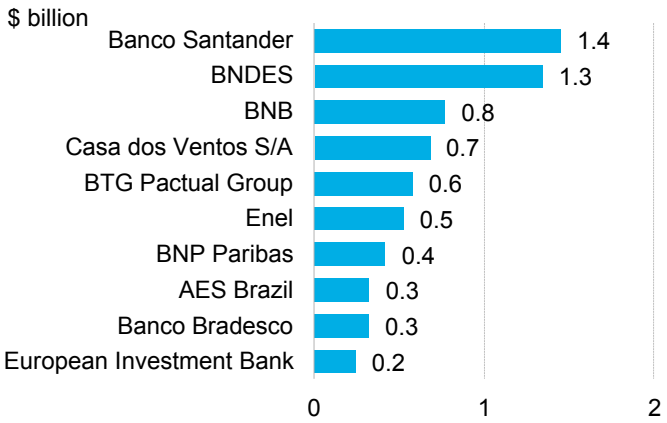


Figure 36: Brazil lead investment providers, 2022



Source: BloombergNEF. Note: New investments and refinancing data. It includes debt and equity, including balance sheet investment. BNDES is Brazilian National Development Bank, BNB is Banco do Nordeste.

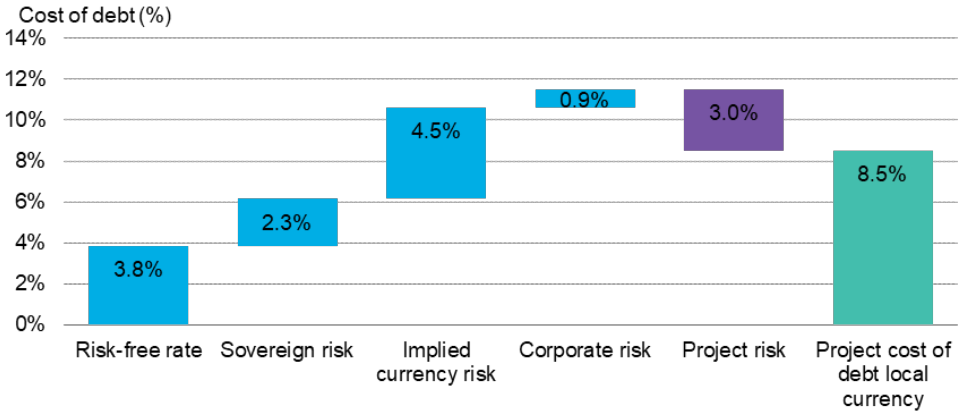
Lower cost of debt had a strong impact on the cost of clean technologies

The cost of debt for energy projects in Brazil is lower than in most other EMDEs. Development banks BNDES and BNB have largely facilitated this through concessional finance and their ability to take the first loss on a project. The cheaper financing, alongside excellent wind capacity factors, led the country to one of the world's cheapest levelized costs of electricity (LCOEs) for onshore wind. In the medium term, this may also lead to the lowest-cost green hydrogen in the world.

BloombergNEF estimates that the average cost of debt for an onshore wind project in Brazil was 8.5% in Brazilian reais (BRL) in the first half of 2023. The value of concessional finance, and the different risk factors that contribute to the cost of borrowing in local currency, can be illustrated by analysing different prevailing market interest rates.

For example, the yield on a 10-year BRL-denominated sovereign bond was 10.6% on June 30, 2023. The US dollar (USD) denominated equivalent was 6.15%, implying a 4.5-percentage-point currency risk premium. The 10-year yield on a bond issued in USD from a large corporate offtaker such as Electrobas (the only Eletrobras bonds that have credit rating data are USD denominated) was 7% on June 30, 2023, suggesting a credit spread of 0.9% over the sovereign. And that sovereign yielded 2.3 percentage points above the global risk-free rate (US 10-year treasury), which is an implied sovereign/political risk premium (Figure 37).

Figure 37: Brazil renewable energy project cost of debt build-up illustration



Source: Bloomberg LP, BloombergNEF. Note: All market rates taken as of June 30, 2023.

The largest single risk factor is currency risk. The build-up framework indicates that the cost of borrowing could have been as high as 11.5% in June 2023, but concessional finance from a development financial institution (DFI) – BNDES - helps to reduce this figure. As such the effective interest rate for renewable energy projects in Brazil is just 8.5. This is lower than the Brazilian central bank interest rate, or 'Selic rate', of 13.75% at the end of 2022 and means in effect that the project risk premium is negative."

Central Bank promotes economic stability, ensuring investments continue to flow

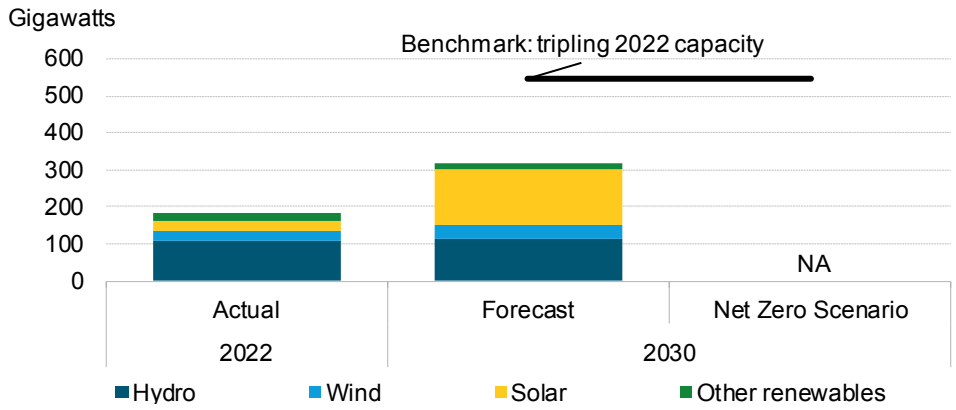
The autonomy of the Brazilian Central Bank was fundamental in promoting economic stability and attracting investment. It gained formal autonomy in February 2021, with the goal of protecting Brazil's monetary policy from political influence and enhancing the overall stability and predictability of the economy. This is a notable achievement that most emerging markets do not enjoy.

The management of the Selic was one of the main tools that the Central Bank has employed to tackle inflation and stabilize the economy. This has helped the country bring inflation back within its target range despite local and global challenges after the Covid-19 crisis.

Pathways to 2030

The BloombergNEF report 'Tripling Global Renewables By 2030 Is Hard, Achievable and Necessary to Achieve Net Zero' highlights that unlike most EMDEs, Brazil does not need to grow its renewable energy capacity, as low-carbon sources already represent more than 85% of the country's power generation. Brazil has 181GW of renewable energy capacity, of which 110GW is high-capacity-factor hydro. Tripling this to 544GW by 2030 would beat BloombergNEF's forecast and would also be far more renewable energy than the country realistically needs (Figure 38).

Figure 38: Brazil renewables capacity, 2022 vs. 2030 BNEF forecast



Source: BloombergNEF. Note: A Net Zero Scenario was not calculated for this region.

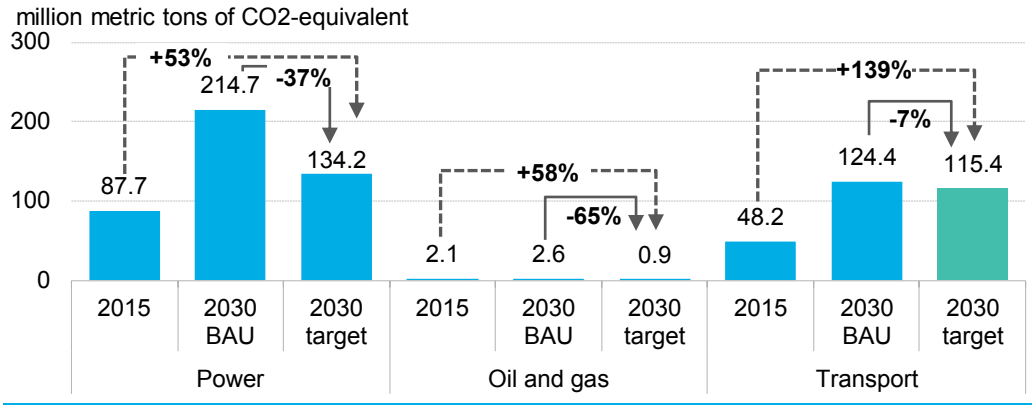
3.3. Egypt

Egypt's story shows the impact of MDB technical and financial support on renewable energy investment flows. One of the main drivers of investment in energy transition in the country was the collaboration of the Egyptian government with MDBs. The International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) helped the government design a set of power purchase agreements and other incentives offered to developers through a competitive mechanism. In parallel, the Multilateral Investment Guarantee Agency of the World Bank (MIGA) provided guaranteed for projects under the program. This helped drive $3.3 billion in 2017, up from nearly nothing in 2015.

Egypt's new target shows commitment to increase renewable generation capacity

Egypt submitted an updated Nationally Determined Contributions (NDC) in July 2022 including, for the first time, quantitative emission targets for 2030, though these only cover specific areas of its economy. In June 2023, the country released another update to the NDC which aims to bring 2030 electricity-sector emissions 37% below the government's projected business-as-usual (BAU) scenario by 2030 (Figure 39). The power sector is the main source of emissions in Egypt, followed by the transport sector.

Figure 39: Egypt greenhouse-gas emissions based on sectoral NDC targets



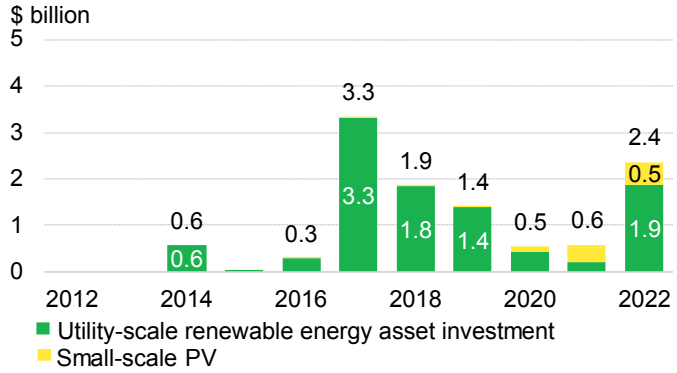
Source: Egypt NDC, CAIT, BloombergNEF.

Renewable auctions designed and backed by the World Bank are driving energy transition investments

One of the main drivers of investment in energy transition in Egypt was the partnership of the Egyptian government with World Bank institutions. The International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) helped design what it called a solar feed-in program, a set of power purchase agreements and other incentives offered to developers through a competitive mechanism, to attract private investment in renewable energy. The IFC led a consortium of nine international banks to invest $653 million in the Benban solar project in 2017.[7] This initiative guaranteed set prices for the power produced from renewable sources, providing investors with predictability and stability, which are crucial for long-term investments.

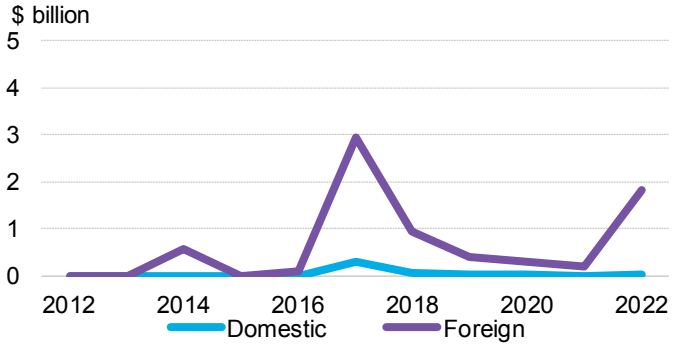
Because of that, foreign investment in 2017 increased 29 times from the previous year, reaching $3.3 billion annually (Figure 40). In total, from 2017-2022 renewable energy investment hit $9 billion, mainly driven by utility-scale investment. In 2022, the small-scale PV segment reached $1 billion annually.

Figure 40: Egypt renewable energy investments, by subsector



Source: BloombergNEF. Note: Utility-scale renewable asset investment includes wind (on- and offshore), solar (large-scale), biofuels, biomass & waste, marine, geothermal and small hydro.

Figure 41: Egypt renewable energy investment, by type of investor



Source: BloombergNEF. Note: Excludes undisclosed data.

Projects under solar feed-in program also benefitted from guarantees provide by the Multilateral Investment Guarantee Agency of the World Bank (MIGA). The organisation enabled the private investments by providing $210 million in political risk insurance to private lenders and investors involved in the Benban solar park, where most of the capacity under the solar feed-in tariff program was developed. In addition, in 2022 MIGA the agency issued a $98.3 million guarantee covering a tranche of bond issuance as part of the $334.5 million refinancing the solar farm.[8]

Of the top 10 lead arrangers for renewable energy investment over 2012-2022, five are multinational development banks. Institutions like KfW, EBRD, EIB and AIIB were responsible for

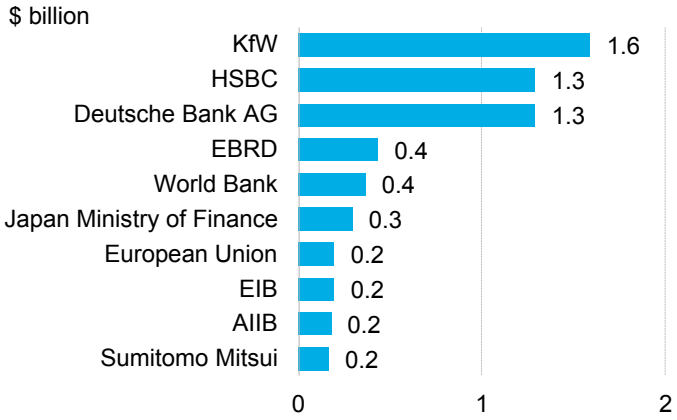
[7] Arab Republic of Egypt: Providing Affordable Clean Energy

[8] MIGA Scatec Bond

over $2.4 billion in investments. The private sector also responded to the policy support, with HSBC and Deutsche Bank investing $1.3 billion each (Figure 42).

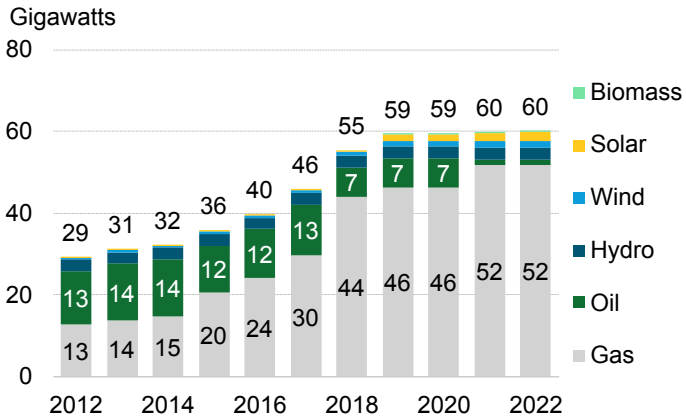
Egypt's electricity sector, however, still depends heavily on fossil fuels, with natural gas plants 87% of total installed capacity. However, oil and diesel generation have fallen in the country since 2017. According to the World Bank, fossil fuel energy subsidies fell from 6.6% of the country's GDP in fiscal year 2013/14 to 3.2% in 2017/18[9]. Renewables were only 6.7% of the country's installed capacity in 2022 (Figure 43). BloombergNEF expects cumulative solar capacity in the country to reach 12GW by 2030.

Figure 42: Egypt lead investment providers, 2012-2022



Source: BloombergNEF. Note: Includes new investments and refinancing. KfW is Kreditanstalt fuer Wiederaufbau, EBRD is European Bank for Reconstruction & Development, EIB is European Investment Bank, AIIB is Asian Infrastructure Investment Bank.

Figure 43: Egypt renewable energy cumulative capacity



Source: BloombergNEF.

Poor government creditworthiness pushes up cost of debt

Despite the favourable regulatory framework, projects in Egypt have high financing costs for private sector investments in renewable energy (Figure 44).

The likely interest rate that would be incurred by a PV project developer in 1H 2023 is almost 30%, according to the Climate Policy Initiative (CPI). This is the second highest local currency cost of debt tracked in this report. S&P have given the government a speculative grade credit rating due to high inflation and a currency crisis. While the situation is not as severe as the one in Argentina, there is a similarity between the borrowing ability of the two countries: a large corporate can borrow at more attractive rates than the government can. Hard currency denominated 10-year government bonds yielded 17% in June 2023, and there was a 7% additional spread on the Egyptian Pound (EGP) denominated equivalent.

Conversely, a corporate producing oil and gas can issue a bond yielding almost 9% lower than a government bond of the same issuing currency and tenor.

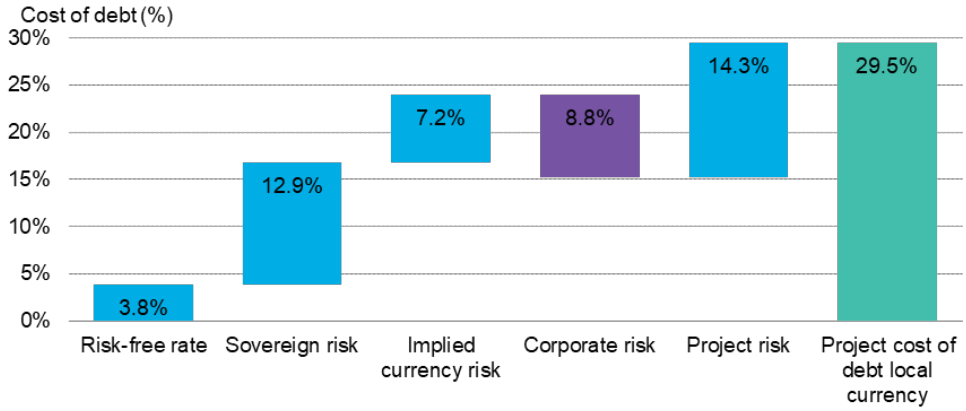
It appears that the Egyptian government is planning to take targeted action to rectify the high borrowing costs for low carbon energy projects. As part of the country platform called Nexus of Water, Food and Energy (NWFE) Program, the Minister for International Cooperation, along with

[9] US$3.15 Billion Program Supports Egypt with Improving the Economy and Creating Jobs

MDBs such as the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB), are aiming to mobilise $10 billion of investment in renewable energy over the next five years. The plan includes financial support such as concessional financing and credit guarantees, which would help to maintain a lower cost of financing.

Egypt is the only case study country in this report where BloombergNEF does not track a debt cost for a renewable energy project. There are also few bonds available on the Bloomberg Terminal.

Figure 44: Egypt renewable energy project cost of debt build-up illustration



Source: Bloomberg LP, BloombergNEF. Note: All market rates taken as of June 30, 2023.

3.4. India

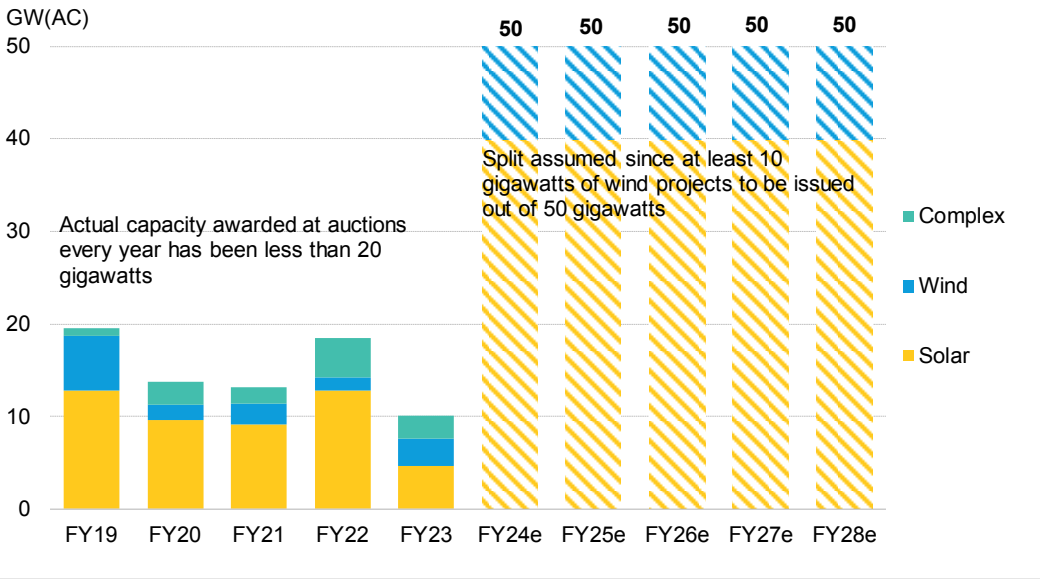
Since 2012, India's government has designed policies, auction programs and an enabling environment to attract foreign investments, and has successfully ramped up the country's renewable energy market. The guidelines supported the market on two fronts. On the one hand, policies like FiTs, capital subsidies and tax benefits supported renewable energy supply; and on the other hand, separate policies incentivized the demand for renewable energy with mechanisms such as Renewable Purchase Obligations (RPOs) and open access for corporate clean power purchases.

The energy transition taking place in India was made possible not only by the development of supportive policies and an enabling environment, but also the role of the central bank in allowing the use of new financial instruments in the country.

India auctioned an average of 15GW of clean power capacity in the last five fiscal years

India is a role model in terms of renewable auction volumes and regularity, with an average of 15GW of renewables capacity auctioned in each of the last five fiscal years. India's Ministry of New and Renewable Energy (MNRE) announced that it would hold tenders for 50GW of clean energy capacity every year from FY2024 (April 2023 to March 2024) to FY2028. At least 10GW of this will be for wind power. The increase in tender volumes is intended to help India reach its goal of having 500GW of cumulative installed capacity from non-fossil-fuel sources by 2030 (Figure 45). According to the MNRE, India had 132GW of installed capacity at the end of October 2023, including solar, wind, biomass and small hydro.

Figure 45: Renewable energy auction volumes in India



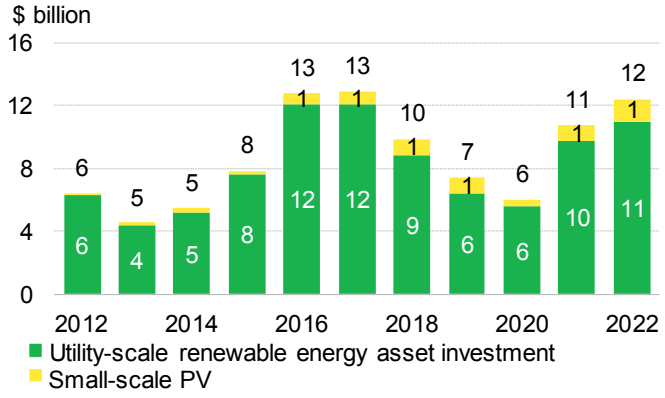
Source: Ministry of New and Renewable Energy, BloombergNEF. Note: Chart only shows auctions for utility-scale projects. Excludes standalone energy storage auctions and the manufacturing-linked auction of 2019 that awarded 12GW of solar power plant capacity. Complex auctions mandate use of multiple technologies. FY24 runs from April 2023 to March 2024. GW(AC) is gigawatts (alternating current); e in the x axis means the data is an estimate.

Asset investment growth driven by energy reforms and the local market

Over 2016-17, the country saw roughly $13 billion of new renewable energy investments annually, thanks to both the National Solar Mission (NSM) announced by the Prime Minister of India and sectoral policy reforms (Figure 46). These reforms include the use of accelerated depreciation, which allows developers to reduce tax payments at the beginning of the project's life; generation-based incentives linked to the amount of power generated, providing additional financial support and shifting the wind market from mostly retail customers to professional independent power producers (IPPs); capital grants from the government bridging the gap between project cost and the price quoted by the developer; and waivers on transmission charges for all wind and solar projects commissioned through June 2025.

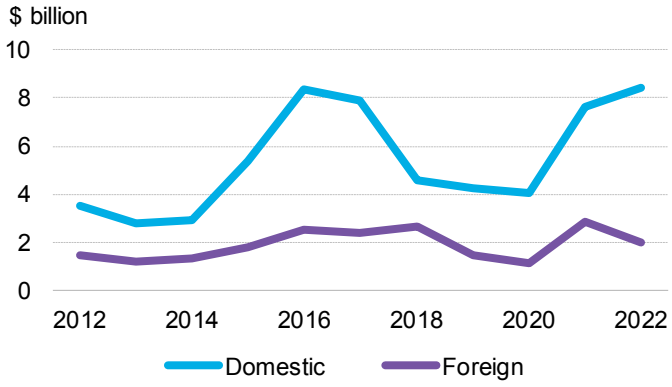
India has also been a leading country at implementing diverse instruments to unlock domestic investment, boosting confidence within domestic financial institutions. Domestic investment almost doubled from 2014 to 2016 and was four times as much as foreign investment in 2022 (Figure 47).

Figure 46: India renewable energy investments, by subsector



Source: BloombergNEF. Note: Utility-scale renewable asset investment includes wind (on- and offshore), solar (large-scale), biofuels, biomass & waste, marine, geothermal and small hydro.

Figure 47: India renewable energy investment, by type of investor



Source: BloombergNEF. Note: Excludes undisclosed data.

In addition to these federal debt instruments, power producers, the Indian Renewable Energy Development Agency (IREDA) and renewable energy manufacturers have issued $43 billion in labeled and unlabeled green bonds between 2014 and 1H 2023.

India's central bank controlled inflation and secured renewable project returns

The Reserve Bank of India (RBI) raised its benchmark repo rate by 250 basis points (bps) between May 2022 and February 2023 (Figure 48) as it sought to control inflation and roll back easy monetary policy introduced during the Covid-19 pandemic. The 'repo rate' is the rate at which the RBI lends money to commercial banks. Since March, the RBI has kept the rate unchanged on three successive occasions as it balances supporting economic growth with inflation control.

As a result of this interest rate management, India's consumer price inflation has largely stayed below 6% in 2023 (Figure 49), the upper limit of the central bank's target range, after being above this level for most of last year. This reduces the chances of further rate hikes by the RBI, which means that debt rates may not rise much further. Inflation reduces the real returns realized by investors, as tariffs for renewable energy projects in India are not indexed to inflation.

Figure 48: India central bank repo rate

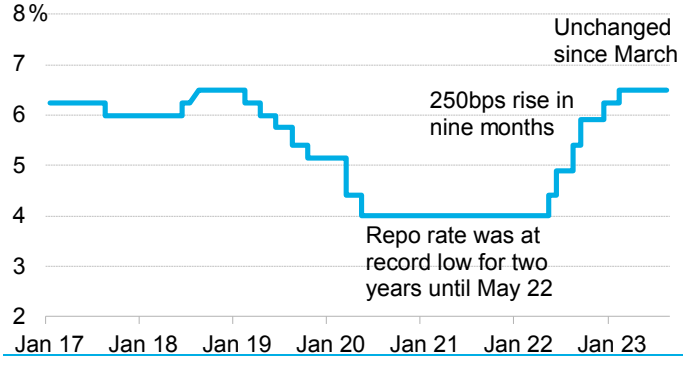
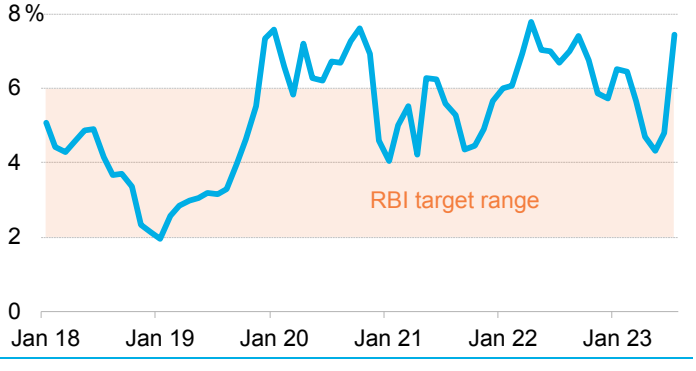


Figure 49: Year-on-year change of India's consumer prices



Source: Bloomberg, Reserve Bank of India (RBI), BloombergNEF. Note: The repo rate is the rate at which the RBI lends money to commercial banks. One basis point (bps) is 1/100th of 1%.

Source: Bloomberg, BloombergNEF. Note: Terminal users can access the data from the ticker INFUTOTY Index.

Credit spread drives Indian renewable borrowing rate

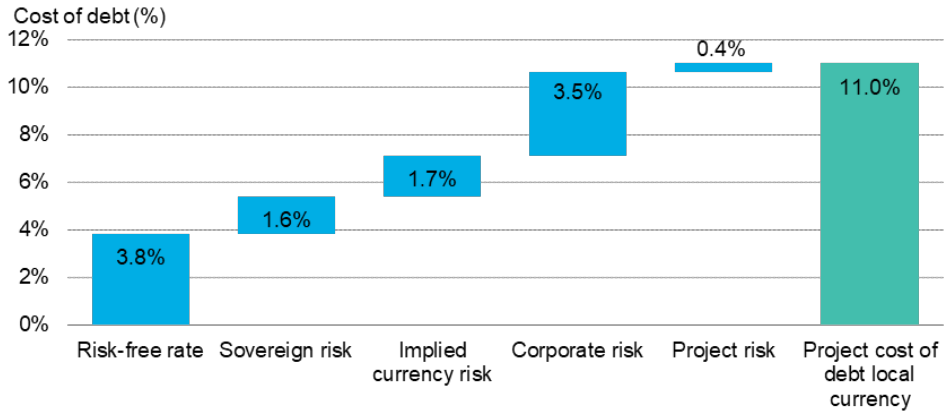
Recently there have been discussions about debt policies that could unlock domestic investment potential and attract more capital flows into the country. The policies include the use of **interest rate subsidies**, a mechanism where financial institutions receive the full interest rate for a loan given to developers while government pays a percentage of it, reducing the debt burden for the developer; the use of **extended-tenor debt**, where the government directly provided loans to renewable energy projects at commercial rates with a longer tenor; and the use of **reduced cost loans**, where the government offers lower interest rate loans to developers at the same maturity of commercial loans.

One example of this type of debt support – or at least the plans for it – is IREDA's plan to provide foreign-currency-denominated debt for renewable energy, which could incentivize an inflow of foreign capital. An office in Gujarat International Finance Tec-City (GIFT city), for instance, could be classified as a foreign office and thereby avoid costs associated with currency hedging.

The corporate credit spread is the largest component risk factor in the cost of debt for an Indian Renewables Project. In this case, the corporate credit spread is the difference in debt yield between a large energy-linked corporate such as Adani Electricity and the government yield in the same issuing currency, same tenor and similar cash flow profile.

The relatively small macro risk premiums indicate that, compared to other EMDEs, India boasts a developed policy environment and mature, well-functioning capital markets. The corporate spread of 3.5 percentage points seen in India is similar to the spread between US energy firms and the US treasury curve (Figure 50).

Figure 50: India renewable energy project cost of debt build-up illustration



Source: Bloomberg LP, BloombergNEF. Note: All market rates taken as of June 30, 2023.

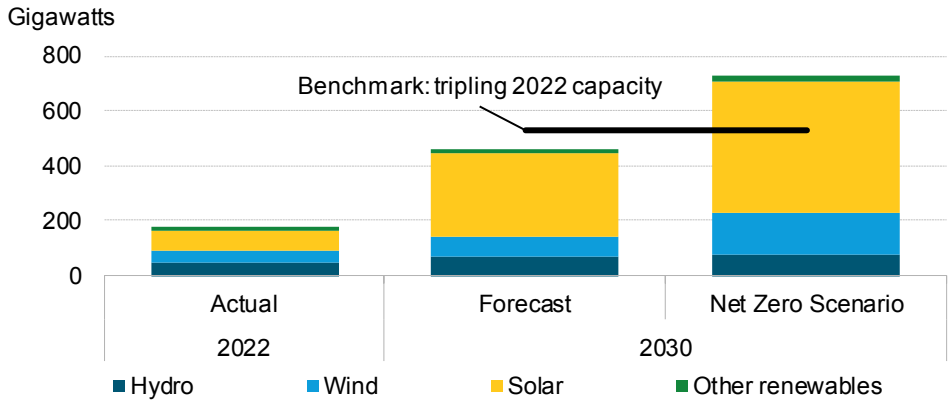
Pathways to 2030

The BloombergNEF report 'Tripling Global Renewables By 2030 Is Hard, Achievable and Necessary to Achieve Net Zero' highlights that India is not on track to triple renewables by 2030,

nor would this be sufficient to align with a net-zero path. India needs to quadruple renewables capacity by 2030 to align with BNEF's Net Zero Scenario.

India has 177GW of renewables installed. BNEF forecasts show a 2.6x growth in installed capacity by 2030, falling short of our modelled net-zero path (Figure 51). BNEF's Net Zero Scenario also has a large amount of new solar in India, partly because much of the additional power demand will be due to air conditioning and hence have a demand profile matching solar generation profiles quite well.

Figure 51: India renewables capacity, 2022 vs. 2030 BNEF forecast and Net Zero scenario



Source: BloombergNEF

Investment in power system flexibility is crucial to back up and enable rapid electrification of new demand sectors in India and to decarbonize the power mix. This includes investment in batteries, pumped hydro and dispatchable clean power capacity – the latter of which the round-the-clock auctions serve to support. Markets to support flexibility, including India's announced overhaul of ancillary services, are also vital.

3.5. South Africa

Despite being a mature renewables market in terms of procurement experience and financing capacity, South Africa faces major energy transition stumbling blocks in its policy instability, regulatory tightness and political risk. When enforced properly, its clean power incentives, such as auctions, have led to build in the past decade, but retroactive changes and cancelations have damaged investor confidence. All necessary entities are in place to provide the funds needed to 2030, but these depend on a sound enabling environment in the power sector and a foreseeable project pipeline. Improving the financial health of the state-owned utility Eskom is also fundamental to ensuring reliable power generation, lowering offtake risks and reducing burdens on government generation.

Auctions drove $33.8 billion in investment, but instability in policies led to volatility

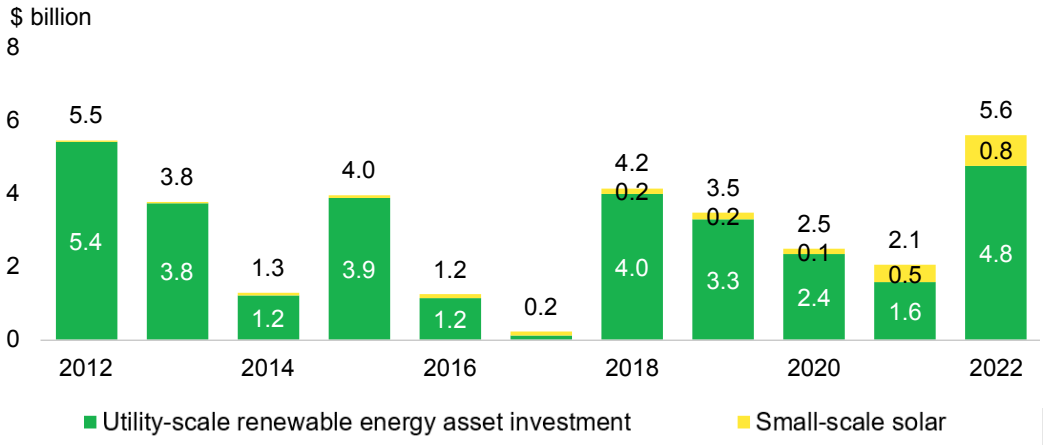
The majority of South Africa's installed renewable energy capacity has been driven by competitive auctions under the Renewable Energy Independent Power Producer Procurement Program (REIPPPP). The mechanism is widely considered a success story in deploying renewable energy at scale in EMDEs, but has faced challenges that offer lessons.

In August 2011, the government began running REIPPP to facilitate private-sector investment into grid-connected renewable energy generation. The program guarantees PPAs for 20 years, attracting international and national independent power producers. The government procured 12.5GW of capacity through the program over 2011-2022, of which 5.6GW is solar and 4.4GW is wind. Independent Power Producer (IPP) generation as a portion of total supply in South Africa reached 7% in 2022, up from just 2% in 2012. BNEF tracked $33.8 billion of investment into new renewable energy in South Africa over 2012-2022, with the majority going to utility-scale renewable energy asset investment, largely on the back of the auction program (Figure 52).

However, the government refused to sign PPAs won under the fourth REIPPPP round for two years, delaying financing decisions for projects. The government also waited four full years between announcing its fifth auction round (in 2017) and actually holding it (in 2021).

South Africa has since made efforts to restabilize the frequency of REIPPPP auction rounds, awarding PPAs to 2.6GW of clean energy capacity in round five in 2021. However, other challenges have affected the success of the program more recently. In 2022, a lack of available grid capacity for connections at locations where developers proposed to build projects led to just 860MW of solar and 0MW of wind securing PPAs in round six, compared to a target of 5.2GW across both technologies, and despite 4.1GW of bids being submitted by developers.

Figure 52: South Africa renewable energy investments, by sub-sector

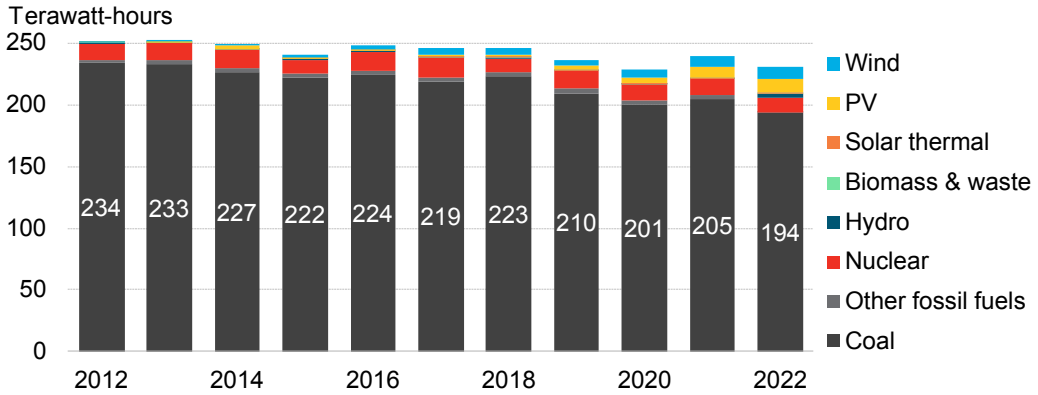


Source: BloombergNEF. Note: Utility-scale renewable asset investment includes wind (on- and offshore), solar (large-scale), biofuels, biomass & waste, marine, geothermal and small hydro.

South Africa must prepare for coal fleet retirements

South Africa will need to attract investment in new generating capacity as coal unit retirements accelerate. The country's 43GW of coal plants supplied 84% of generation in 2022. National utility Eskom's aging coal fleet has reduced output over the last decade due to plant maintenance issues and operational failures. Coal generation fell to 198 terawatt-hours (TWh) in 2022, its lowest level in over a decade and a 17% decline from 2012 levels (Figure 53).

Figure 53: South Africa annual gross generation by technology



Source: BloombergNEF, National Energy Regulator of South Africa (Nersa). Note: 'Other fossil fuels' includes oil and diesel.

South Africa's coal fleet faces a long-term decline as closures exceed new-build capacity additions. The country's ongoing power supply crisis has increased pressure on Eskom to resolve operational issues affecting plant availability and called into question the coal decommissioning schedule.

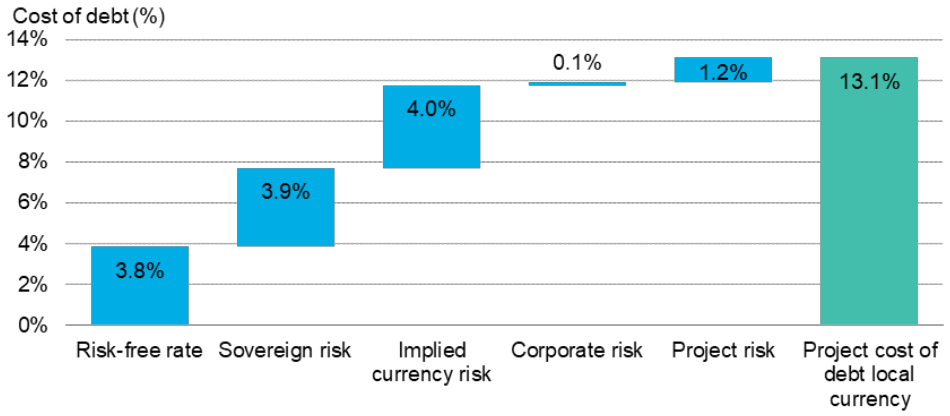
Eskom plans to close most of its coal plants, which are built for a 50-year lifetime, by 2040, starting with the oldest units first. Eskom has put some of its schedule into action, for example in decommissioning one of its oldest plants (Komati) in 2022, but has changed its retirement plans for others. It delayed closure of three of its smaller and older coal plants, Grootvlei, Camden and Hendrina, until 2023-27; all were previously due to decommission by 2020. Further delays to decommissioning these three, as well as the older plants Arnot and Kriel and the newer plants Kendal and Lethabo, are now under discussion, according to news reports.

Delays or not, South Africa must plan for coal retirements. Without investment in lifetime extensions, the majority of Eskom's coal plants will need to close by the end of the 2030s. By 2050, it is possible that only the newest coal plants in South Africa, representing around 18% of installed coal capacity in 2023, will remain operational.

Eskom and macroeconomics drives energy financing costs in South Africa

Onshore wind developers in South Africa could borrow at a rate of 13.1% on average in 1H 2023, according to BloombergNEF. The largest risk factor components in the borrowing cost of renewable energy project investment are macroeconomic in nature. The spread of the hard currency debt over the global risk-free rate and the additional spread generated by the South African Rand government issuance are both around 4 percentage points. There is an element of project risk over the country and corporate factors, at 1.2% points (Figure 54).

Figure 54: South Africa renewable energy project cost of debt build-up illustration



Source: Bloomberg LP, BloombergNEF. Note: All market rates taken as of June 30, 2023.

In this analysis, Eskom has been used to represent the corporate borrower. The state-owned utility can borrow at a similar rate to the government, hence there is a relatively small corporate premium on a USD-issued Eskom 10-year bond. However, Eskom saw a $1.2 billion loss in the 12 months through March 2023. This represents the sixth loss year in succession. While some large corporate energy offtakers in emerging markets can borrow at cheaper rates than the governments of those countries, such as Pampa in Argentina, Eskom's yield may be being held artificially low by state control, and its income statements in the last six years are unlikely to inspire confidence that the company will be able to service its debt.

Cash flow had grown from 2020 to 2022, and losses appeared to shrink, but 2023 saw a relapse in which free cash flow sank to near zero and the size of the loss almost doubled compared to 2021. If Eskom is to continue its role as the largest offtaker in South Africa, then it needs to get its financial house in order.

Consumers are turning to small-scale solar amid rolling blackouts

Solar installations are growing rapidly, driven by the power crisis, rising retail tariffs and regulatory support. In 2021, the government allowed private generators under 100MW to connect to the grid without a generation license. In January 2023, this threshold was removed entirely, allowing businesses to add their own solar for local self-consumption, or sell it through the grid ('wheeling') with a connection agreement.

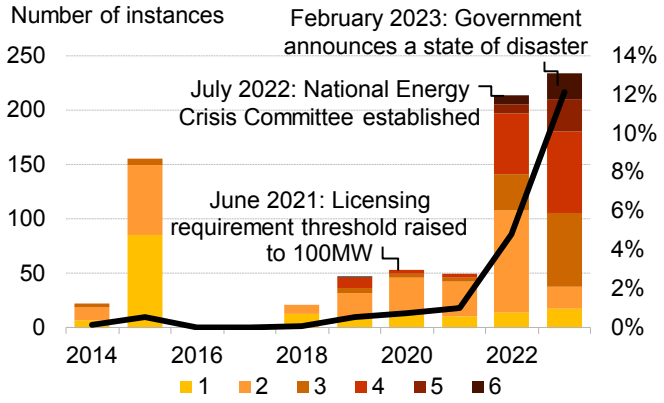
As of March 2023, businesses in South Africa can reduce their taxable income base by 125% of the cost of an investment in renewables. Residential consumers can claim a one-off tax rebate of 25% of the cost of the panels on their 2023/24 tax liability, up to a maximum of 15,000 rand ($822). This tax incentive is valid for only one year.

Anecdotally, a main driver for residential solar is avoiding blackouts, which have worsened over 2022-23. Load shedding (rolling blackouts) exceeded 14TWh over January-June 2023 alone, the equivalent of 12% of net generation. This compares to 10.9TWh, or 5% of net generation, in all of 2022 (Figure 55). Many local firms are selling reliable power services from a rooftop solar and battery system for a monthly payment.

Good data for the rooftop solar market in South Africa is hard to obtain in the rush to install. Eskom published an estimate of rooftop solar capacity in a weekly system adequacy report in June, and these show that about 1.8GW has been commissioned over January-September 2023,

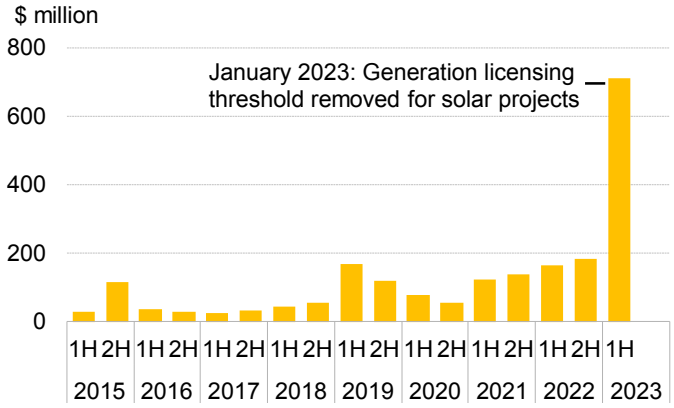
of which 1GW was in May and June alone. Export data for solar cells and modules from China shows a surge in 1H 2023, with $773 million or about 3GW directed to South Africa (Figure 56). BNEF expects 3.5-5GW of residential and commercial solar to be added annually from 2023 to at least 2025, or until the load shedding crisis ends.

Figure 55: Load shedding instances by stage and as a proportion of net generation, South Africa



Source: BloombergNEF, EskomSePush. Note: 2023 data until June 26. Load shedding 'stage' refers to the severity of blackouts. Stage 1 equates to Eskom temporarily reducing supply for up to 1,000MW of instantaneous load on the national grid, stage 2 is 2,000MW, and so on.

Figure 56: Exports of solar products from China to South Africa



Source: SinoImex, BloombergNEF

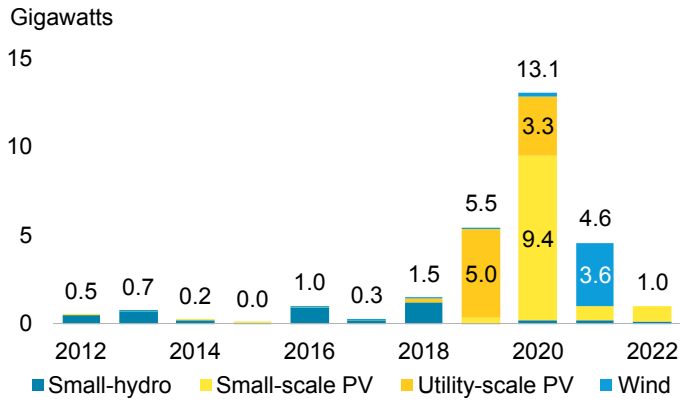
3.6. Vietnam

The Vietnam case illustrates how quickly investments and installed capacity can rise after a suitable set of policies are implemented. It is also an example of how opportunities can vanish in the absence of specific strategies to reassure stakeholders – especially financial institutions, developers and producers – and highlights the need for grid infrastructure planning aligned with policies that incentivize renewables.

Feed-in tariffs drove wind and solar boom

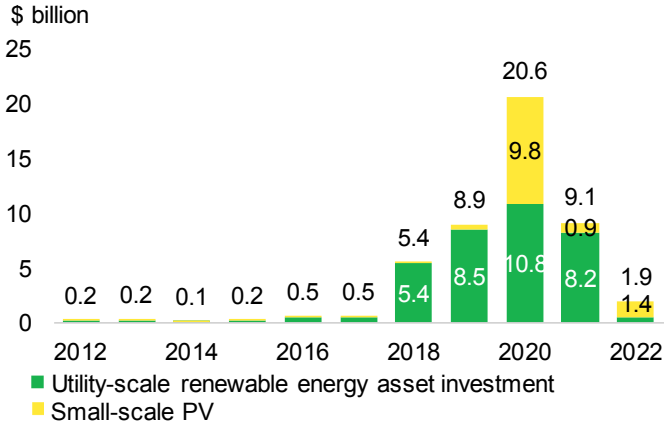
Generous feed-in tariffs (FiT) kicked off a boom in solar and wind, resulting in the installation of around 20GW and 4GW of capacity, respectively, in just four years (Figure 57). Long-term power purchase agreements paid in Vietnamese dong, but with provisions for adjustments based on currency fluctuation, incentivized financial players and increased low-carbon installed capacity within the country. The tariffs provided developers a guaranteed price, offering certainty and driving $44 billion to the sector over 2018-2022 (Figure 58).

Figure 57: Vietnam's renewable energy capacity additions



Source: BloombergNEF.

Figure 58: Vietnam renewable energy investments, by sub-sector



Source: BloombergNEF. Note: Utility-scale renewable asset investment includes wind (on- and offshore), solar (large-scale), biofuels, biomass & waste, marine, geothermal and small hydro.

In 2017, solar projects received government support under the requirement that projects be commissioned by 2020 – investment rose tenfold in 2018 and doubled in 2020. The solar subsidy was then removed, as volume had far exceeded the 850MW by 2020 target and the cost to public finances had risen accordingly. On- and offshore wind investments also expanded in 2018 after the Ministry of Industry and Trade (MOIT) increased offshore FiT for projects that became online by November 2021. However, after that year, new clean investments, especially for utility-scale projects, dropped.

Lack of clarity and infrastructure bottlenecks led to steep drop in investment

Vietnam's solar FiT was set too high and the boom went bust. Lack of clarity on future policies led to a rapid decline in renewable energy investments, from $21 billion in 2020 to just $2 billion in 2022.

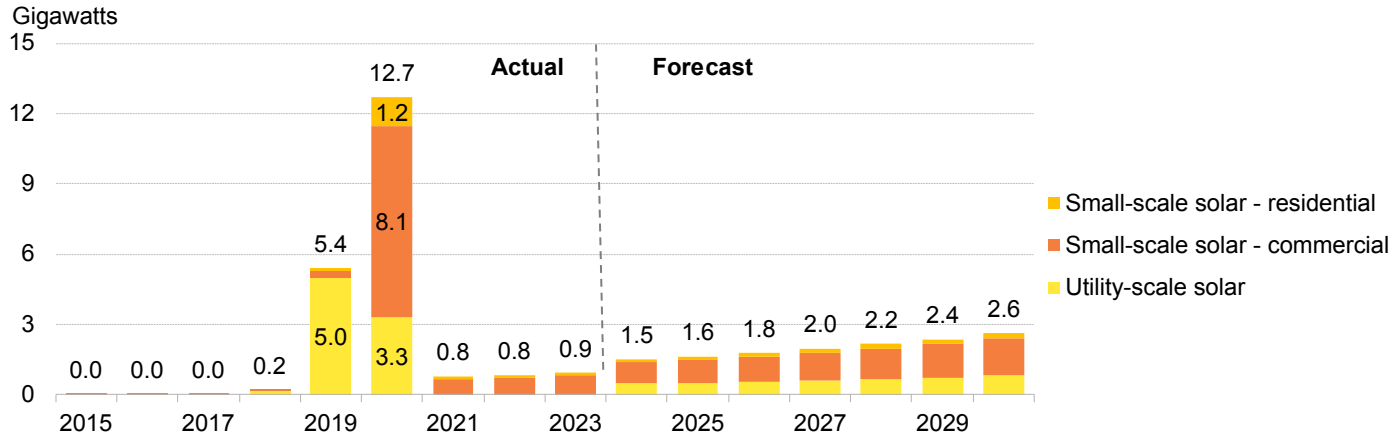
The rapid increase in generation in certain regions not necessarily adjacent to demand centers also led to grid overload, which created bottlenecks for further expansion of utility-scale projects. This highlights the need for grid and storage policies accompanying measures that are aimed at boosting renewables.

Government prioritizes distributed solar to ease grid congestion

Solar, which led Vietnam's renewable energy boom in 2019 and 2020 with over 20GW of capacity build, is now taking a backseat. Vietnam's 2023 power development plan expects solar capacity additions to increase by only 4.1GW by 2030, with two-thirds of this, or 2.6GW, coming from systems used for self-consumption. The rapid growth of solar also led to curtailment and grid operational challenges. To ease grid congestion, the country wants to prioritize solar systems for self-consumption, primarily rooftop installations: under the government's current target, half of the country's office and residential buildings will have rooftop solar by 2030. BNEF expects the government will try incentivizing project development closer to existing demand centers, such as in northern Vietnam, as well as in areas with higher grid capacity.

BNEF expects Vietnam will add over 15GW of solar between 2023 and 2030, led by both commercial/industrial and residential systems, exceeding the government's targets (Figure 59). The growth will be driven by increased economic competitiveness thanks to the continued fall in solar system costs as well as the rising demand for clean power procurement by industrial and commercial users. The recent impact on business operations from the load-shedding schedules and unscheduled blackouts would also prompt interest in rooftop solar systems for enhanced energy reliability for corporations.

Figure 59: BNEF's Vietnam solar capacity forecast

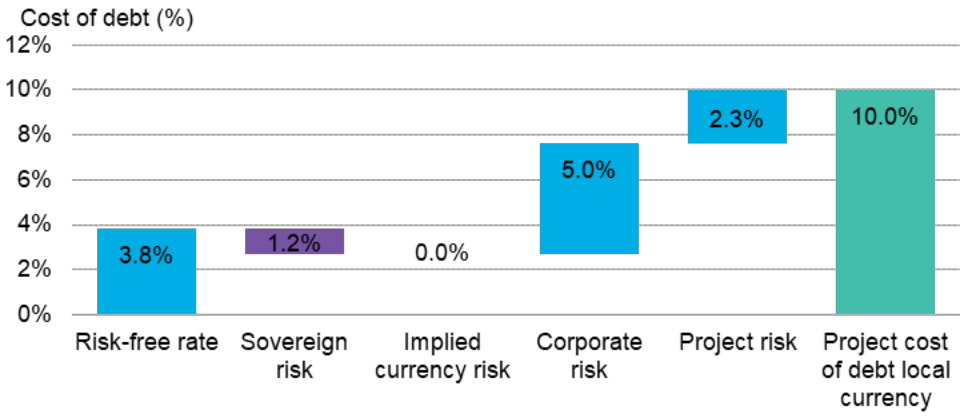


Source: BloombergNEF.

Low debt costs a boon to renewables, but Vietnam could be tapping into foreign markets

Borrowing to invest in renewable energy projects in Vietnam is relatively cheap compared to rates in other EMDEs, with the average cost of debt being 10% in 1H 2023 according to BNEF analysis (Figure 60). This is the second-lowest borrowing rate in the case study countries explored in this report. Inflation rates at a comparable level to advanced economies have given the State Bank of Vietnam, Vietnam's central bank, room to cut the base rate to 4.5% in a bid to boost growth.

Figure 60: Vietnam renewable energy project cost of debt build-up illustration



Source: Bloomberg LP, BloombergNEF. Note: All market rates taken as of June 30, 2023.

These low rates are also reflected in government bond yields, which were trading at 2.6% at the 10-year point on the curve in June 2023, 120 basis points (bps) lower than the equivalent US treasury bonds.

However, determining the risk factors that contribute to the spread between the government bond rate and the cost of borrowing for a solar project is difficult given the closed nature of the Vietnamese bond market and the command and control approach to economic management. Almost all bonds issued in Vietnam are denominated in Vietnamese dong and purchased locally, and the risk-factor stack is hard to apply to closed economies. By the numbers, Vietnam exhibits negative sovereign spread, despite the Vietnamese government have a lower credit rating than the US. This is because there are no hard currency sovereign bonds against which to compare local currency bonds and therefore no data on from which to derive a currency spread. Although the managed currency of the Vietnamese dong relative to the US dollar means that the spread may be low, if hard currency bonds were issued by the government, theoretically, there could be liquidity, currency and country (sovereign/political) risk premiums associated with the cost of debt. The result should be interpreted as illustrative only.

Retiring coal plants is fundamental to keeping Vietnam on track for net zero

As of 2022, Vietnam's total installed power capacity was 80GW, 32% of which is coal-fired power plants. Hydro power (29%) and solar power (21%) come in second and third place for installed capacity, respectively. Solar and wind together generated 13% of electricity in 2022, exceeding gas.

Retiring coal power plants and accelerating deployment of renewables is fundamental to ensuring Vietnam is on track to reach its decarbonization commitments. However, most of Vietnam's coal power plants are less than 10 years old, making it difficult to retire them in a short time. As mentioned in Section 5.4, Vietnam is attempting to introduce the necessary reforms to systematically price coal out of the market; these efforts should be watched closely. Initiatives that drive collaboration across stakeholder groups, such as the Just Energy Transition Partnership (JETP), can accelerate necessary changes.

On August 31, 2023, Vietnam approved an implementation plan for its $15.5 billion Just Energy Transition Partnership deal with international partners secured last year. The roadmap to 2030 prioritizes grids, battery energy storage and offshore wind for funding, and welcomes participation from public and private-sector developers.

Reinforcing the grid to enable greater integration of renewables is a top priority for Vietnam, which wants to avoid a repeat of the curtailment problems caused by solar boom from 2019 to 2020. Under its latest energy development proposal, Vietnam envisages the addition of 23.9GW of onshore and offshore wind by the end of this decade. The goal has prompted industry players including Sembcorp Industries, Enterprize Energy, and Copenhagen Infrastructure Partners to propose gigawatt-scale projects.

Among the critical tasks highlighted in the blueprint is the release of the JETP Resources Mobilization Plan, which will detail how funds will be mobilized over the next three to five years. While approving the implementation plan is a signal of Vietnam's commitment to its net-zero target, Indonesia's experience has shown that negotiating the finer points of projects can be challenging. For Vietnam's JETP to succeed, it will need to reach a consensus with financing partners on key points of the plan, including the technology to be financed and the cost of funds.

Section 4. Accelerating and executing the transition

The case studies above show that to increase annual low-carbon supply investment volumes five times in the next six years, unprecedented collaboration between stakeholders is needed. This growth rate is possible, and has been achieved, for example in Argentina, but has proven difficult to sustain.

To gain and maintain the momentum required in all markets, decision makers will need to look across the whole policy ecosystem to select and execute accelerating mechanisms that unlock capital flows. This is fundamental as policies will need to be aligned to national interests and economic and fiscal plans. Thus, a framework that maps the wide variety of macro and micro factors – many of them illustrated in the case studies above - affecting investment and the interests of key stakeholders is needed. These determine the needs and opportunities for all players involved.

Macro and microeconomic factors affect investment flows in and to EMDEs

Macro and microeconomic factors play a critical role in determining the viability of energy transition, and the cost of capital is a key indicator that captures these dynamics and significantly influences the economics of projects. As a result, significant research on the climate finance mobilization challenge has focused on the impact of various risks on the cost of capital, often emphasizing one over another (see Appendix A for more detail). However, evidence suggest that both macro and micro factors are usually important.

Some factors are outside of individual governments' control (more macroeconomic), but some can be affected by individual governments (more microeconomic). The IMF's "Financial Programming and Policies" (FPP) (Table 2) include:

- **External factors** which an economy cannot easily control. For example, natural disasters which affect physical infrastructure or an economic crisis in a trading partner.
- **Intrinsic factors** which are those an economy cannot change, or that can only be changed slowly over time. For example, natural resources, population, economic growth.
- **Economic policies** which are levers that a country has and can use to affect the state of its economy. For example, fiscal policy, monetary and exchange rate policy and sectoral policies.

By mapping the full range of factors, it is possible to represent and understand current de-risking and investment environment improvement efforts and relationships to oft-cited issues. These efforts and the issues they are intended to address are broadly represented by two arguments – those which argue for an emphasis on top-down macroeconomic factors and those which argue for a focus on bottom-up microeconomic factors. Depending on pre-conceptions there is a tendency to conclude that macroeconomic factors alone, microeconomic factors alone or both together are most important.

Table 2: Factors affecting the enabling environment

More macro ↓ More micro

Enabling environment framework	Challenges	Solutions	Key stakeholders
1. External factors (*Factors external to the economy and that the economy alone cannot easily control)*	International monetary tightening; international commodity prices; major economy inflation; international supply chain disruption; health crises; natural disasters; conflict; climate risk; restrictive sustainable investing practices	Central bank reforms, overall international framework; linking debt relief to climate policy; international financial institution reform, key performance indicators and expansion	Multilateral financial institutions (IMF); central banks; national government
2. Intrinsic factors *(Factors that are intrinsic to the economy and that the economy cannot change, or that can be changed but only over time)*	Political stability, legal risk, economic growth and macroeconomic stability, strength and stability of local financial markets, information gaps, credit risk and resulting cost of capital, lack of scale	Central bank reforms; increasing capacity of domestic capital markets; political risk insurance; guarantees to local financial institutions; reducing information gaps	Multilateral development banks; finance ministries; central banks; financial regulator
3. Economic policies *(Levers that a country has and can use to affect the state of its economy)*			
3.1. Fiscal policy	Fiscal constraints; tax revenue from energy; distortionary taxes and subsidies; production subsidies (royalties, rents); consumption subsidies (excise duties, sales taxes); pricing of externalities (carbon); customs/import duties	Creation of a medium-term fiscal plan aligned with National Determined Contributions; fiscal transparency; reducing distortionary taxes and subsidies; introducing carbon prices, taxes	Finance ministries; international financial institutions; national governments
3.2. Monetary and exchange rate policy	Currency risk/stability; domestic inflation and interest rates	Central bank reforms, various currency hedging, pricing or other solutions	Finance ministries; central banks
3.3. Sectoral policies	Lack of clear strategic vision and associated pathways, roadmaps, plans and targets; limited institutional capacity; regulatory uncertainty; lack of competition; power market design; power sector planning; power grid planning; permitting; procurement; creditworthiness of offtakers; project pipelines; lack of competition; sunk costs of pre-existing assets	Long-term climate strategy, roadmap plans and targets; technical assistance; investment in power sector and power grid planning; improved procurement and contracting; offtake guarantees; investment in project development; increasing market access.	National governments; energy and environment ministries, finance ministries, sector focused regulators, electricity system operators, multilateral development banks

Source: BloombergNEF, IMF, OECD, World Bank, IEA, IEA-IFC, RMI, LSE – Songwe and Stern, Oxford, Imperial, Persaud, A., IEA, CPI, IRENA and others. See methodology and full list of sources in Appendix B. Note: IFI is International financial institutions.

Literature review

A selection of 77 relevant reports and frameworks from private sector, NGO and multilateral organizations mention around 400 factors that affect the clean energy investment environment in EMDEs. The literature addresses factors from the more macroeconomic such as foreign exchange risk, to more microeconomic issues such as power market design and grid planning.

Given the wide ranging macro- to micro-economic factors at play, an economic framework which has similar breadth is required. The options considered included the OECD's "Framework to Decarbonise the Economy", the IMF's "Financial Programming and Policies" (FPP) and "How to Make the Management of Public Finances Climate-Sensitive - Green PFM". The final framework is founded in the IMF's FPP framework with additions from the Green PFM framework, specifically the need for national strategic or development plans, medium-term fiscal frameworks, and nationally determined contributions (NDCs).

4.1. External factors

Economies cannot easily control geopolitical tensions and conflict, global commodity prices, health crises, supply chain disruption, major economy monetary tightening, the emergence of crises in economic partners or natural disasters. These factors can drive a country to indebtedness and risk of default. Both domestic and international leaders can take some action to manage these risks and their impacts. Domestic leaders can further enhance economic governance capacity including the role of central banks in managing responses to monetary tightening or inflation, and the role of treasury in building up sufficient financial reserves to weather short-term challenges.

Multilateral financial institutions have an important role to play to address external factors

The international community already takes significant action, for example through the IMF's emergency lending programs. It is also where new initiatives such as the Climate Debt Resilient Clauses (CDRC), which pause sovereign debt repayments when a climate shock or natural disaster hits, should help. These were developed in the run-up to COP26 by the UK Treasury[10] and a specially convened private sector working group and have been widely promulgated since then, with the World Bank adopting them in 2023 as part of a wider toolkit to support countries after natural disasters[11]. The IMF's Resilience and Sustainability Trust, formed in 2022 to provides funds in return for policies to improve the private sector investment environment and domestic regulatory support for resilient infrastructure[12] , is in a similar vein of financial instruments intended to provide either safety net or safety net preparation to vulnerable countries.

Three further factors could be considered external – global commodity prices and their impact on national economies which are either heavily import or export dependent, monetary policy of major economies, and the impact of international financial regulation such as Basel III. However, depending on the situation each of these may or may not have effective responses from national economic institutions, as such we address each of them in the Economic Policies section below.

4.2. Intrinsic factors

In the literature on mobilizing capital in and to EMDEs, intrinsic factors are principally issues relating to economic growth, macroeconomic stability, political risk, legal risks, transfer risks,

[10] 'Climate Resilient Debt Clauses (CRDCs), Chair's Summary' UK-convened Private Sector Working Group, November 9, 2022 at URL

[11] 'World Bank Group Announces Comprehensive Toolkit to Support Countries After Natural Disasters', World Bank, June 22, 2023 at URL

[12] 'Mobilizing Private Climate Financing in Emerging Market and Developing Economies', IMF, July 27, 2022 at URL

general ease of doing business, the lack of scale in a market and resulting high transaction costs, the depth of domestic capital markets and challenges determining counterparty risks. Much of this can be grouped as country risk and emerges as a higher cost of government borrowing in US dollar terms. These are separate to currency risks, which are addressed on economic policies, and macroeconomic stability is addressed on monetary policies. Transfer risks, political and legal risks and counterparty risks are some of the main intrinsic factors affecting investment in EMDEs.

National leadership and multilateral development banks play a central role in addressing intrinsic factors

There are three main ways to mitigate intrinsic risk factors or reduce their impact on capital investment in low carbon energy:

- **Developing domestic financial and capital markets**[13] and reducing barriers to cross-border capital flows (transfers), so that they are not the sole source of investment. Restrictions on capital transactions and cross border capital flows should be monitored and kept to a minimum.[14] Multilateral development banks and institutions can give support through credit lines[15], guarantees or credit enhancements to local financial institutions, enabling them to increase their lending volumes, reduce their lending costs, or provide longer tenor loans to suit the revenue profiles of low carbon energy investments.[16] There is also a major role here for domestic leadership from the finance ministry, central bank and financial regulator to support the development of a vibrant and resilient domestic financial system to facilitate general economic activity including low carbon investment.
- **Reducing the political risk** that private sector investors are exposed to. Multilateral development banks can provide political risk insurance and guarantees[17] against retroactive regulatory changes, sovereign breach of contract and expropriation.[18] Simultaneously national governments can take actions to reduce political risk. These could range from committing to no retroactive changes to policy and regulation to recognising international arbitration of conflicts around power purchase agreements.
- **Evaluating counterparty risks.** For example, ongoing efforts to make Global Emerging Markets Risk Database access more open. The database "pools data on credit defaults on the loans extended by consortium members, the migrations of their clients' credit rating and the recoveries on defaulted projects."[19] Although much of this data will need to be discounted by commercial lenders who do not have the preferred creditor status that some MDBs have, it would increase the data available to commercial lenders and investors to evaluate the counterparty risk.

[13] 'Infracompass – Financial Markets', Global Infrastructure Hub, at URL

[14] 'Capital flows in Indonesia: challenges and policy responses', Bank for International Settlements, January 29, 2009 at URL

[15] Draft paper 'Scaling Blended Finance - Perspectives from Private Creditors' Institute for International Finance (IIF), May 30, 2023

[16] 'GuarantCo Local Currency Credit Solutions' Private Infrastructure Development Group, 2023 at URL

[17] 'Some (Un)pleasant Transition Arithmetic: Reuters Global Energy Transition Summit - Keynote Speech' Mark Carney, June 7, 2023

[18] 'Financing the Low-Carbon Future: A Private-Sector View on Mobilizing Climate Finance', Climate Finance Leadership Initiative, September 2019 at URL

[19] 'Global Emerging Markets' Risk Database Consortium at URL and 'Mobilizing Private Capital: Where to Start with MDB and DFI Reform', Citi, June 13, 2023 at URL

Other options to reduce intrinsic risk include upholding the separation and effective operation of executive and judicial arms of the state, removal of restrictions on capital account transactions[20] and being aware that ESG metrics may constrain investment into emerging market assets with lower disclosure.[21]

4.3. Economic policies

Economic policies are levers that a country can use to affect the state of its economy. These broadly fall into three main groups: fiscal policy and national strategy; monetary and exchange rate policy; sectoral policies.

Fiscal policy and national strategy

Fiscal policy is the use of a government's revenues and spending to affect the economy. Here we assume that national strategy refers to budgets or medium-term fiscal frameworks, and nationally determined contributions or long-term climate strategy. Too often these are considered separately, leading to insufficient consideration of the fiscal risks and opportunities of sectoral policies and vice versa. Primary problems include:

- Lack of long-term climate strategy
- Need to manage public sector debt
- Fossil fuel consumption subsidies, general inefficiencies in fossil fuel production or consumption and the impact of the phase-out of subsidies on poorer communities
- Lack of carbon prices or the lack of a framework to utilize voluntary carbon markets

Finance ministries are crucial part of the solution to country climate strategies

Fiscal and carbon budgeting is one of the solutions. It includes the creation and alignment of a strategic or development plan, a medium-term fiscal framework[22], and a long-term climate strategy.[23] This requires the optimization of fossil fuel consumption and production taxes and subsidies to get the greatest economic growth for the least carbon emissions. Broadly, this means reducing subsidies for fossil fuel consumption where more competitively priced alternatives exist. For example, Nigeria's cuts to subsidies on imported gasoline for consumers in 2023 could lead to a significant increase in small-scale solar system purchases, and there are early indications in the solar product export stats from China that this is happening. Increasing taxation on fossil-fuel production can maximise government take and at the same time to encourage the switch to low-carbon electricity.

Pricing or taxation of carbon emissions can create an opportunity to capitalize on corporate demand for voluntary carbon markets. The European Carbon Border Adjustment Mechanism (CBAM) is acting as a significant incentive for EMDEs to accelerate on carbon pricing this decade. The European Commission (EC) will extend CO_2 pricing to imported goods where it was feared that local carbon pricing – set to rise rapidly in future – would give imports the upper hand. As of October 2023, the carbon border adjustment mechanism (CBAM) requires importers of

[20] 'Country Ceilings Criteria' Fitch Ratings, July 1, 2023 at URL

[21] 'Opportunities for IFIs to Support the Scaling of Transition Finance' Intellidex 2023 at URL

[22] 'How to Make the Management of Public Finances Climate-Sensitive–"Green PFM"', IMF, December 8, 2022 at URL

[23] 'Climatescope' BloombergNEF at URL

covered products (steel, aluminum, cement, power, fertilizers and hydrogen) to file estimates of how much was emitted in their production. Pricing will be phased in over 2026-34, at which point it will reflect the carbon price that is levied on EU industrial and power plants on a 1:1 basis.

Monetary and exchange rate policy

Currency risk, capital buffers for lenders required by Basel III[24] and domestic regulation, differentiated cost of capital for specific priority sectors and wider macroeconomic management of inflation and interest rates are important issues for mobilizing capital that are the responsibility of finance ministries, central banks and prudential regulators.

Currency risk is a problem for international investors wherever revenues are denominated in a currency that is volatile or not easily exchanged. This can range from being a problem that countries can manage – if the root causes are domestic – to one which is out of their control (if the root causes are to do with monetary policies of major economies or the impact which oil and gas prices (either because of import or export dependency) have on domestic economies. Solutions look different for countries in different income brackets.

1. Those for low-income countries should primarily be anchored in the pre-existing Currency Exchange Fund (TCX) framework which provides hedging solutions for 'emerging and frontier' currencies and its potential expansion[25].
2. Those for lower-middle income countries should be differentiated based on the scale of the scale of ramp-up in investment required and ability to meet this via domestic capital markets. Larger markets with larger needs– such as India – but which also have well developed domestic capital markets have sufficiently advanced central bank and treasury capabilities to establish their own appropriate mechanisms[26]. Smaller countries could benefit from bilateral or plurilateral arrangements with domestic lenders to enable them to scale financing before tapping international capital markets, or via export credit agencies to reduce specific risks regarding the import of low carbon equipment.
3. Upper middle-income countries are best positioned to manage this risk themselves via pre-existing commercial foreign exchange trading and hedging markets.

Solution designers need to be careful not to shift currency risks onto public budgets in the form of foreign exchange liabilities as this has proven financially unsustainable. For example, Vietnam's linking power offtake agreements to the US dollar. As a result, the solutions can occasionally be indirect, for example the management of the underlying drivers of the currency volatility as being proposed in Argentina[27].

Capital requirements underpinned by instrument-specific risk weightings were introduced for internationally active banks after the 2009 financial crisis via the Bank of International Settlements' Basel III regulations. These are agreed internationally, then implemented by national regulators, and as such can be considered both beyond and within countries' control. The capital held by a bank should correspond to the risk on its balance sheet, to provide sufficient liquidity in

[24] Basel III is an international regulatory accord that introduced a set of reforms designed to mitigate risk within the international banking sector by requiring banks to maintain certain leverage ratios and keep certain levels of reserve capital on hand.

[25] 'Creating Currency Risk Markets to Mitigate Currency Risk at Scale', TCX, 2023 at URL

[26] 'Report on Currency and Finance', Reserve Bank of India, May 3, 2023

[27] 'Mark Mobius Sees Argentina Dollarization as a Huge 'Boost' to Economy', Bloomberg News, November 21, 2023 at URL

times of crisis. The risk weightings for different assets determine the capital required. It affects the cost and willingness of international bank's provision of finance.

Basel III standards are primarily designed for large cross-border banks in advanced economies[28] but this is not solely an EMDE issue. In fact, proposed rule changes by US regulators would disadvantage tax equity – a commonly used instrument for investing in low carbon energy in the US – by changing the risk weighing from 100 to 400%, increasing the cost to the banks of conducting this business by increasing the amount of capital that must be held to balance the risk.[29] However, EMDEs can be unduly affected by the setting of higher risk weights in the absence of data.[30]

Since bank capital requirements affect international banks' ability to finance EMDEs, they could be considered an external factor. However, nationally set capital requirements and risk weighting also affect domestic capital provision and thus could be considered a factor for monetary and exchange rate policy decision makers.

In EMDEs such as India, debates such as this can manifest through the Collateral Framework for Statutory Liquidity Ratio (SLR) and the question of whether or not corporate – including green – bonds can be counted as qualifying capital[31]. More broadly, different jurisdictions treat guarantees provided by the Multilateral Guarantee Agency (MIGA) differently for risk weighting purposes. For example, the US does not allow these to provide capital relief, while EU and UK rules do. Given the goal of reducing the appropriate risk-adjusted cost of capital to low carbon energy projects, rule changes which affect risk weightings for related assets should be carefully considered[32], potentially via a forum connecting financial institutions trade bodies such as the Institute for International Finance (IIF), policymakers and regulators on the subject.

Differentiated cost of capital for priority sectors can boost low-carbon technologies. Brazil has for decades provided financing at below the central bank rate to sectors it deems important, mostly through development bank BNDES. This typically provides a ~4 percentage points reduction in the cost of debt for specific types of low carbon energy projects. This is now being considered by the Reserve Bank of India as part of a package of reforms to spur further investment in low carbon energy.[33] This is different to the risk weighting and capital requirements because it is about the provision of government funding in the form of low cost – concessional – loans to specific sectors, rather than the treatment of pre-existing assets.

[28] 'Making Basel III Work for Emerging Markets and Developing Economies', September 14, 2017, Center for Global Development (CGD) at URL.

[29] 'Proposed Basel III Rules could be catastrophic for the traditional tax equity market', Norton Rose Fulbright, September 5, 2023 at URL

[30] Making Basel III Work for Emerging Markets and Developing Economies', September 14, 2017, Center for Global Development (CGD) at URL.

[31] 'Unlocking sustainable investments: The Reserve Bank of India's crucial role in energy transition', Institute for Energy Economics and Financial Analysis, June 8, 2023 at URL

[32] Several groups working on this including the Institute for International Finance and Global Infrastructure Hub at URL.

[33] 'Unlocking sustainable investments: The Reserve Bank of India's crucial role in energy transition', Institute for Energy Economics and Financial Analysis, June 8, 2023 at URL and 'Report on Currency and Finance', Reserve Bank of India, May 3, 2023 at URL.

Sectoral policies

Sectoral policies include, for example, sector-specific targets and roadmaps, renewable energy procurement mechanisms, grid infrastructure planning and power market reforms. As highlighted in the case studies, these have proven to have a direct correlation with investment flows.

Setting **targets** represents the starting point for most renewable energy policy frameworks and is fundamental to provide clarity to investors. However, an objective alone is not enough to create a vibrant local clean energy sector. Targets must be accompanied by more specific policies that ensure stakeholders have sufficient incentives to act. BloombergNEF's Climatescope 2023 found that 93% of the EMDEs covered have renewable energy targets in place, up from 82% in 2021 (Figure 61). However, conducive policies are still lacking.

Auctions have been the most effective policy mechanisms in creating and maintaining a pipeline of bankable projects, as highlighted in the Brazil and India case studies above. However, these are only present in 57% of the EMDEs surveyed by Climatescope.

The depth of policy framework varies significantly by income level. While 10% of low-income countries have no renewable policy mechanism and 35% have just one in place, over half upper-middle and high-income countries have at least 3 policy mechanism legislated (Figure 62).

Figure 61: Share of EMDEs where key renewable power policies are present

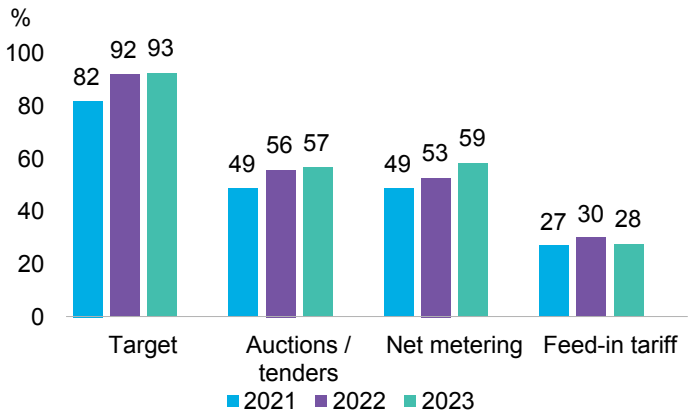
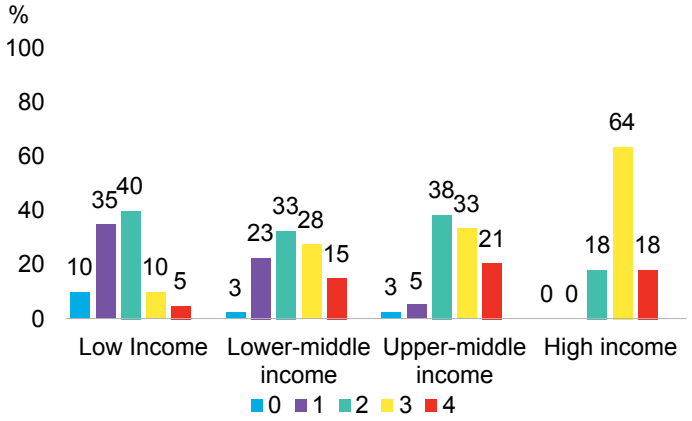


Figure 62: Share of EMDEs by income-level group with a specific number of policy mechanism in force



Source: Climatescope. Note: policy mechanisms include renewable energy targets, feed-in tariffs, net metering/billing and auction/tender policies for the 110 EMDEs surveyed by Climatescope The full country list is available at /www.global-climatescope.org

Grid infrastructure planning and grid procurement mechanisms are also fundamental to ensure consistent expansion of renewables, especially of intermittent renewable sources. A lack of investment can cause generation curtailment on existing plants, grid bottlenecks and long queues for new projects to obtain grid access. For example, grid bottlenecks may hurt Chile's plan to close all its coal power plants by 2040, or even achieve the short-term goal of decommissioning eight plants equivalent to 1.8GW of capacity by 2025. A consistent investment in transmission through regular auctions and an interconnected grid whenever possible can ensure the continuous growth of renewables, as in Brazil. In addition, reverse auctions for renewable projects should have grid access guarantees for awarded projects.

Section 5. Transformational initiatives

Cross-cutting transformational initiatives can accelerate the transition by ensuring appropriate multi-stakeholder collaboration, increasing and diversifying capital flows, and creating new strategies for outstanding challenges. These include an evolution of the mandate of multilateral development banks to focus on climate and private sector mobilization, leveraging country platform approaches to coordinate stakeholders, developing managed coal phase out solutions and enhancing voluntary carbon markets.

5.1. Multilateral development banks

In order to reach the scale of finance required for transition, which will require many EMDEs to more than triple their renewable capacity to reach the global 11 Terawatts of global capacity needed by 2030, development finance institutions, bilateral donors, and MDBs must all accelerate efforts to mobilize international private finance. MDBs are uniquely positioned to act as a key enabler to create the environment for private capital to flow at scale and tailor the activity based on country-specific challenges.

They play three major roles in supporting low-carbon energy investment in EMDEs:

1. **Providing technical and advisory support**, particularly around policy and project preparation. This is especially important for countries that are in the early stage of their energy transition or trying to create an enabling environment for newer low-carbon technologies.
2. **Providing financial support for projects**, particularly with the goal of launching new markets. This can be done through financial mechanisms that either lower the cost of capital of a project or reduce the country, project or technology risk so that other lenders will come in. These mechanisms include blended concessional finance, grants and guarantees.
3. **Mobilizing private capital** where it is commercially viable but there are still barriers to investment. MDBs need to help catalyze and mobilize larger amounts of private capital to EMDEs by providing tools, such as guarantees, that reduce barriers and mitigate risks.

Giving the relevance of the tools of MDBs in all stages of the transition, growing their capacity to support low-carbon technologies in EMDEs is fundamental. Thus, an evolution of MDBs to increase their support for the energy transition and identify opportunities to mobilize the private sector as a developer of assets and investor is critical to driving capital to EMDEs and achieving global climate targets. The volume 2 of the Independent Expert Group (IEG) report 'The Triple Agenda: a roadmap for better, bolder and bigger MDBs', provides a set of recommendations for implementation of MDB reforms, including:

- To convert the MDB's operational model to **shift away from individual projects towards programs** where national governments take a strong lead in identifying multi-year transformations with sectoral focus, achieved through scaled-up investments. This requires collaboration between all stakeholders to design country-level solutions that increase investor confidence in an EMDE. A country-platform approach, such as a JETP, offers a promising way forward.
- To bring **engagement with the private sector** to the center of MDB operations. The private financing arms of MDBs must be complemented by a whole-of-MDB approach to co-create

investment opportunities with the private sector, develop project pipelines including through a revamped and expanded role of the Global Infrastructure Facility (GIF), and crucially, to mobilize and catalyze much higher volumes of private finance. To this end, MDBs need to shift their own culture from one of risk avoidance to informed risk taking and reduce significantly the time for decision making. They also need to diversify their instruments, in particular by expanding the use of guarantees and foreign exchange risk management tools. The MDBs also have a significant database of their own activities that can be made available to private investors to permit them to analyze risk in a granular fashion.

- **To size MDBs to make a material difference at scale**. MDB financing should triple to $390 billion annually, of which $300 billion of non-concessional and $90 billion concessional, by 2030. This may seem seem ambitious but is essential if the EMDEs are to make adequate progress towards the SDGs and cope with climate change.

The MDB community has begun to respond to this challenge in recent years, signalling their intentions to increase blended finance activity and collaborate with the private sector, as exemplified by the creation of the World Bank Private Sector Investment Lab. However, more remains to be done.

5.2. Country platforms

Given the high level of cross-stakeholder coordination that is required to accelerate the transition, there is a need to create new collaboration frameworks. This is especially true as the energy transition has progressed from its initial focus on solar and wind development, to include the electrification of demand, investment in energy transmission infrastructure and fossil fuel phase out policies.

Country platforms are designed to bring stakeholders together around a comprehensive transition plan and mobilize financing for it, including from the private sector. These country-led initiatives set ambitious climate objectives with their execution conditioned to technical or financial support from global partners.

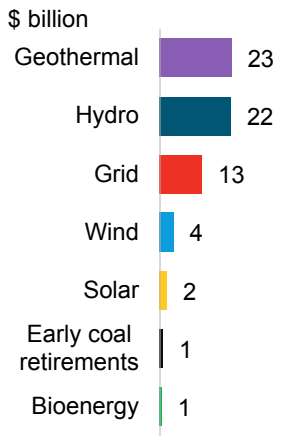
A prominent example is the Just Energy Transition Partnerships (JETPs), which aim to facilitate ambitious energy shifts in EMDEs. They accelerate a just transition from fossil fuels to renewables by identifying necessary policy changes, creating project pipelines and creating financing solutions. In 2021 a $8.5 billion deal was announced for South Africa at COP26 in Glasgow, following a $20 billion for Indonesia and a $15.5 billion agreement for Vietnam in 2022, involving a combination of public and private sector finance commitment each time.

Indonesia, for example, published its Just Energy Transition Partnership Comprehensive Investment and Policy Plan, better known as the JETP-CIPP, on November 21, 2023. This is the first version of the plan that aims to connect policy action, necessary projects, and various sources of funding, including the $20 billion committed to the partnership at launch, to the overarching goals for Indonesia's grid-connected electricity system:

- Peak emissions by 2030 at an absolute value of no more than 250 million tons of CO2.
- Accelerate the deployment of renewable energy to supply at least 44% of electricity generation by the end of the decade.
- Achieve net-zero emissions by 2050.

The JETP-CIPP identifies two coal plants for early retirement. These are the 969MW PLTU Pelabuhan Ratu plant, set to retire eight years earlier than planned in 2037, and the 660MW

Figure 63: JETP-CIPP focus area investment requirements



Source: Indonesia JETP Secretariat. Note: Hydro includes pumped hydro.

PLTU Cirebon 1, due to retire seven years ahead of schedule in 2035. In addition, the blueprint has identified $67 billion worth of specific projects as priority focus areas for the JETP funding (Figure 63). This is higher than the $20 billion JETP funding package as the list includes projects beyond this decade, and some of them overlap with those already included in the latest power development plan rom Indonesia's state-owned vertically integrated utility PT PLN.

In Vietnam, the $15.5 billion agreement is also expected to boost the country ambition to reach net zero, as mentioned in the country case study. The JETP targets for the country are the following:

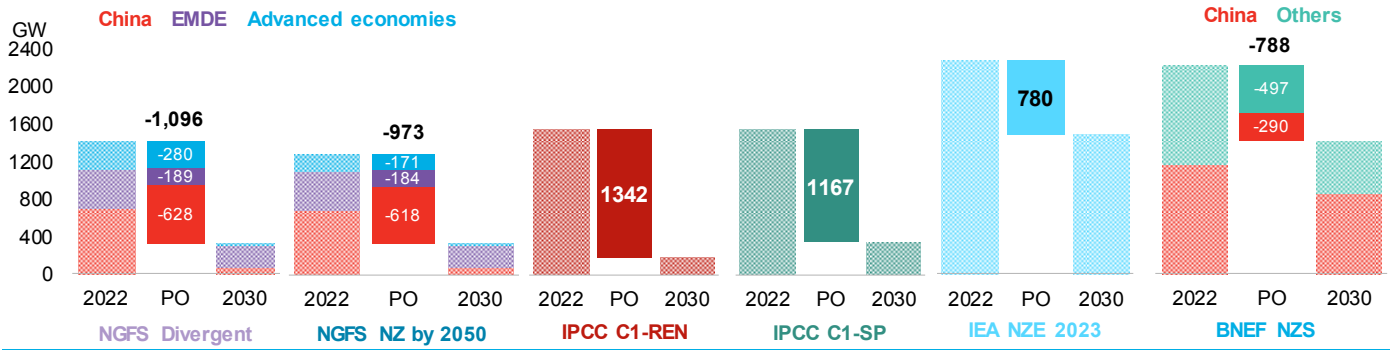
- Decarbonize Vietnam's electricity system from the current targeted peak emissions of 240MtCO2e with peak coal plant capacity at 37GW by 2035 to peak emissions at 170MtCO2e with 30.2GW of coal plant capacity by 2030.
- Reach net-zero emissions by 2050, meeting Vietnam's current target.
- Renewable energy should be 47% of the power mix generation by 2030

5.3. Managed phaseout of coal

Phasing out coal plants is one of the most important steps to decarbonize the global economy. While the number of pledges to shut down coal plants is rising, the process of effectively closing coal assets is complex and requires significant additional effort from policymakers, utilities, and investors. This will also require a transformation of the corporations, utilities, and communities that have historically relied on the operation of these technologies and bold policy support to ensure a just transition.

Commonly referenced climate scenarios imply that between 780GW (the IEA Net Zero Emission Scenario) and 1,350GW (IPCC C1-Renewables) of unabated coal or coal-fired power stations (CFPP) need to be phased out between 2022 and 2030 globally. Of this, between 290GW and 630GW are in China, and the remainder, up to 190GW, in other EMDEs. EMDEs with substantial amounts of existing coal-fired power plants are India (236GW), Indonesia (41GW) and Vietnam (25GW), Turkey (20GW) and Malaysia and Philippines (13GW each)[34]. Not all of this will need to be decommissioned by 2030, but it is a good indication of the most important markets (Figure 64).

Figure 64: Installed capacity for unabated coal power generation in 2023 and 2030 across commonly referenced scenarios



[34] 'Financing the Managed Phaseout of Coal-Fired Power Plants in Asia Pacific' webinar, GFANZ, July 26, 2023 at URL.

Source: BloombergNEF, International Energy Agency, the Network for Greening the Financial System, Intergovernmental Panel on Climate Change. Note: NZ stands for Net Zero (NGFS), REN stands for Renewables, SP stands for shifting pathways (IPCC), NZE stands for Net Zero Emissions (IEA) and NZS stands for Net Zero Scenario (BNEF).

Efforts in developed markets to reduce coal use have focused on both divestment and the use of carbon pricing. Divestment includes direct reductions and exclusions in the provision of financial services and permits to coal-fired plants, both new and existing. Meanwhile carbon pricing, notably in Europe, can reduce the competitiveness of coal generation with cleaner power generation sources through wholesale power markets. In the US and Australia, competition from cleaner power generation sources – gas and renewables in the US, and renewables only in Australia – has had a major impact.

Even with carbon prices, some developed markets such as Germany and the UK have pushed for further mechanisms, such as reverse auctions for coal phaseout[35] or phaseout schedules. Further reforms to help accelerate the transition from coal are also being considered and implemented, notably the participation of coal-fired power plants in capacity mechanisms and the use of government funding to directly support just transition initiatives in coal regions in the European Union.

Estimates for the scale of capital involved range from a present value of $29 trillion to phase out all coal globally and replace with renewables[36], or an annual cost of $50 billion a year to 2030[37]. In part this is driven by the relative youth of the coal plants in certain regions. Coal plants in developed countries were older and therefore cheaper to phase out. Irrespective of methodology, the finance industry has recognized that the volume of capital tied up in coal is such that a proactive stance on both financing and policy is required, and that divestment alone would not be adequate.

In developed countries these mechanisms have delivered or are delivering a similar scale of coal phaseout to that required. Those attempted in EMDEs to date have, however, mainly focused on the transfer of capital from developed to developing markets via voluntary carbon markets (discussed in the section below) or multilateral development banks.

Power market reform has the potential to unlock the value in renewables, reduce the present value of coal assets and make reverse auctions and phase down mechanisms palatable to governments and investors. Vietnam is a making a systematic attempt to introduce the necessary market reform to systematically price coal out of the system, and this should be watched closely.

However, the complexity of power market reform means that it is politically very challenging to execute. As such, in some markets a less disruptive approach may be required. The provision of concessional capital at scale to refinance existing coal plants and bring forward shareholder returns and bank loan repayment without changing current ownership or power market structures may enable the early retirement of these assets. This is the model being developed by the Asian Development Bank's (ADB) Energy Transition Mechanism (ETM), which is pursuing two transactions in Indonesia: the $250 million refinancing of the Cirebon-1 plant, bringing retirement forward 15 years, and the Pelabuhan Ratu plant to bring retirement forward nine years.

[35] 'The Managed Phaseout of High-emitting Assets', GFANZ, June 22, 2022 at URL.

[36] 'Financing the Managed Phaseout of Coal-Fired Power Plants in Asia Pacific' webinar, GFANZ, July 26, 2023 at URL.

[37] P22-23 Songwe and Stern 'Financing for climate action', London School of Economics, 2022 at URL.

Increasing the funds available to the ADB to increase the scale of its ETM programme, coupled with power sector and grid planning, may be able to achieve the desired scale in some markets. In others, market reform and acceleration of renewables and accompanying grid planning is likely to be more effective.

5.4. Voluntary carbon markets

Voluntary carbon markets can become a relevant tool for the decarbonization of EMDEs if effectively scaled. They can help transfer resources from richer nations to EMDEs and provide financial incentives for emissions reductions in multiple sectors.

The voluntary carbon offset market, where verified emission reduction credits are bought and sold for sustainability purposes, has increased significantly in interest and activity in the past seven years. Carbon offset retirements, where a company purchases offsets and cancels them from the market to use for its carbon accounting, peaked at a record 161 million tons in 2021, before dropping slightly in 2022 to 154 million tons (Figure 65 and Figure 66). This has led to modest but growing transaction volume in the offset market, with latest estimates putting the offset market's annual value at $2 billion.

Figure 65: Carbon offset issuance, by sector

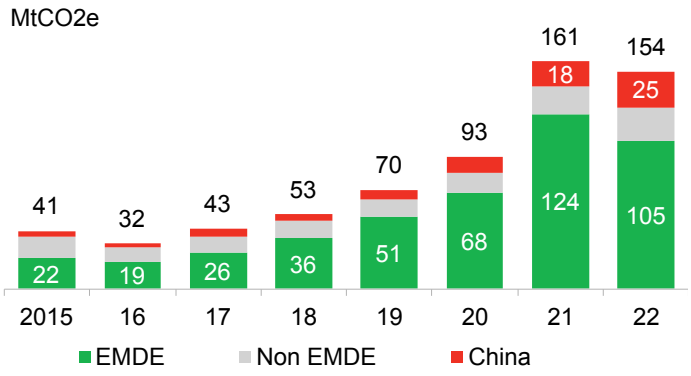
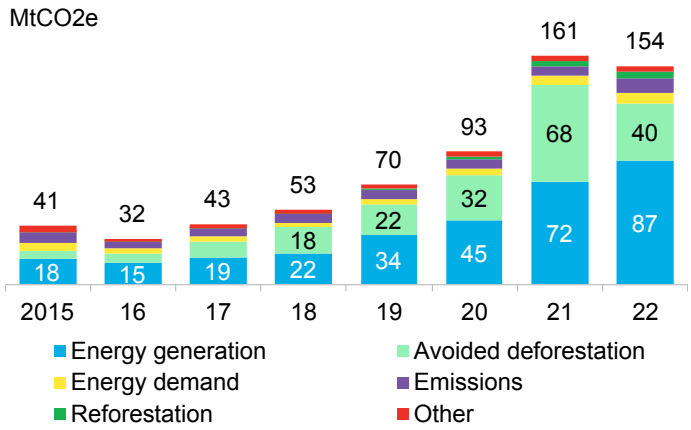


Figure 66: Carbon offset retirements, by sector

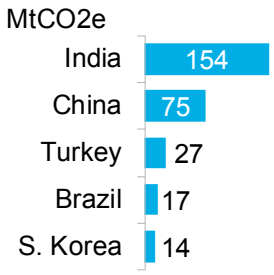


Source: BloombergNEF, VCS, GS, CAR, ACR. Note: MtCO2e is million metric tons of CO2 equivalent.

The offset market has been a lightning rod for investor and media criticism around greenwashing, quality concerns and a lack of transparency. Less attention has been given to its role as a source of capital for emerging markets. Some 68% (105 million) of carbon offsets retired in 2022 were created in EMDEs such as India (38 million), Brazil (5 million) and Indonesia (2 million). In 2022, 21 million credits were retired from China. Purchase of credits has led to job creation, subsidization of low-carbon activities and co-benefits beyond decarbonization, such as biodiversity.

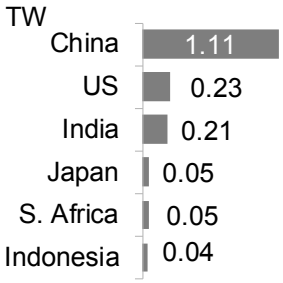
Nature-based solutions, including avoided deforestation and reforestation, have been popular sectors for many companies because of their co-benefits, making up 31% (223 million) and 2% (15 million) of retirements since 2015, respectively.

Figure 67: Top issuing countries of energy offsets



Source: BloombergNEF, Verra, Gold Standard, ACR, CAR.

Figure 68: Top coal power producing countries, 2021



Source: BloombergNEF

Energy generation offsets, which typically come from clean energy projects, have also been popular with buyers, making up 48% of carbon offset retirements since 2015. The sector has come under scrutiny from carbon offset registries and investors for its lack of additionality, meaning the revenue from offsets is rarely the catalyst of a clean energy project being built. Companies like Delta Air Lines (15.7 million), Volkswagen (6.9 million) and Telstra (5.8 million) have been the largest buyers of energy generation offsets. This culminated in Verra and Gold Standard, the two largest offset registries, banning energy generation projects from issuing new credits unless they are located in a UN-denominated Least Developed Country (LDC) – which are among the only remaining markets where clean energy isn't cost competitive. This limits future supply to a handful of countries and eliminates the most popular markets for retirement since 2015: India (154 million) and China (75 million).

Offsets in managed fossil fuel phase out

The decision by Verra and Gold Standard to ban energy generation offsets neglects an important part of the low-carbon transition: the managed phaseout of coal. In some of the largest coal-power producing countries in the world, including developing economies like China (1.11TW), India (0.21TW) and South Africa (0.05TW) – none of which are LDCs – carbon offsets can be a valuable tool to make clean energy cost competitive and phase out fossil fuels (Figure 69).

At a basic level, asset owners can be compensated with carbon credits in response to lowering emissions from fossil fuel projects gradually over time, with the offsets valued at revenue forfeited per ton of carbon emitted. This strategy could be important in coal-heavy emerging markets like India, where the economics for building solar and wind are at parity already, but coal plants are not being retired due to uncertainty in power demand. No examples of this type of offsetting exist today, but South Africa, Vietnam and Indonesia, in partnership with the Rockefeller Foundation, are actively developing a coal-to-clean-credit initiative that would have a similar effect. The Monetary Authority of Singapore (MAS) and McKinsey are exploring the use of "Transition Credits" specifically for managed phase out of coal plants[38], and Gold Standard has created a concept methodology for using avoidance offsets to phase out coal projects that have been operating for at least three years, and replace them with clean energy.

Figure 69: Illustration of offsets in managed phaseout

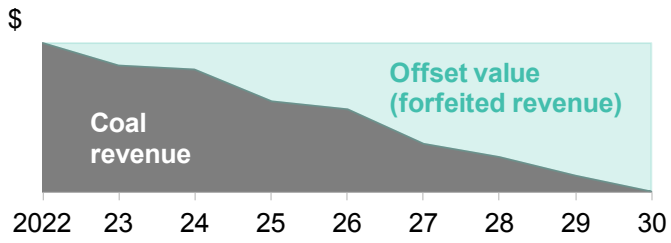
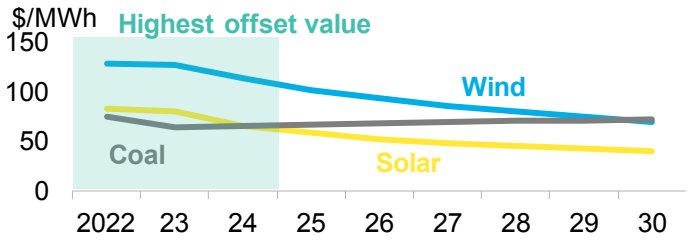


Figure 70: Levelized cost of electricity forecast, Indonesia



Source: BloombergNEF Note: Chart uses the mid-range LCOE estimate. LCOEs exclude subsidies, tax credits and grid connection costs, and include a carbon price where applicable.

The use of carbon credits for managed phaseout can, however, prove problematic in many of these markets due to the weak economics of alternative power generation sources. Offsets can be used to bridge the gap in cost between fossil fuels and alternative clean energy in these

[38] 'MAS and McKinsey Explore the Use of High-integrity Carbon Credits to Accelerate and Scale the Early Retirement of Asia's Coal-fired Power Plants', Monetary Authority of Singapore (MAS), September 26, 2023 at URL

markets, helping to scale up solar and wind power to replace it. In Indonesia, for example, coal has the cheapest new build levelized cost of electricity (LCOE) and there is 40GW of capacity online. An offset would be valued at the difference in cost between coal, which had an estimated LCOE of $75/MWh in 2022, and cleaner alternatives like solar ($83/MWh) and wind ($129/MWh) (Figure 70). The gap between these LCOEs would be divided by the carbon intensity of coal. Using an estimate of 0.95kg/MWh would put the value of offsets at $8/ton in 2022 and rising to $18/ton in 2023 to economically displace coal in Indonesia. The price of these offsets will be limited as solar and wind costs come down, but other cheaper supplies of offsets do exist.

National accounting challenges

While there is a clear business case to use carbon offsets in EMDEs for mechanisms like managed coal phaseout, several barriers exist to scaling beyond the economics mentioned above. At the highest level, continued bans on energy generation offsets from major registries – arguably the loudest voice in the offset market – will be a major roadblock. China and EMDEs like India and Indonesia would qualify for this ban, meaning other less reputable exchanges would need to be used for energy offset creation.

There are also country-level considerations that could impact offset markets in EMDEs across all sectors. The first is the nationalization of carbon markets. Many EMDEs, including Zimbabwe, Kenya and Mozambique, are now treating carbon as a sovereign natural resource and are taking over their domestic carbon markets. In the case of Zimbabwe, 30% of offset revenues were initially planned for government prioritized funds – from climate mitigation projects to the treasury or offset trade oversight or local authority fees. While this could lead to more support from national governments, the redirection of revenue could make project development less competitive and introduces a further uncertainty for potential investors and buyers.

The other challenge revolves around the treatment of carbon abatement in country-level emissions accounting and National Determined Contributions (NDC). BNEF estimates that 93 different countries, two-thirds (61) of which are EMDEs, have NDCs that exceed their nature-based carbon abatement potential. This means if they are to achieve their goals, they will need to fully maximize nature-based carbon abatement and there will likely be little left to export internationally as offsets. This led India to enact a temporary ban on carbon offset exports in 2022. For major EMDEs with similar challenges, like Chile, as well as markets like China, the UN's handling of "corresponding adjustments" and double counting will determine the future of those carbon markets. Should double counting not be permitted with a corresponding adjustment, it could cause foreign investment to dry up due to a lack of offset supply. These remain points of negotiation in Article 6.4 of the Paris Agreement.

Appendix A. Understanding the cost of capital

Macro and microeconomic factors affect the cost of capital of a project. Low-carbon projects tend to have high capital expenditure and low operational expenditure, which means that the cost of capital is important in determining economic attractiveness. The cost of capital can be measured in a number of ways based on the pricing of the instrument being used (debt, equity), the blend of instruments used to finance a company or project (the gearing or ratio of debt to equity) and the resulting blended cost (the weighted average cost of capital or WACC).

As private capital is invested in and to EMDEs via three primary intermediaries: 1) sovereign debt, 2) publicly listed corporate debt and equity, and 3) private debt and equity we examined the pricing of these instruments. Furthermore, as the IEA has been asked to devise recommendations for lowering the cost of capital[39] we structured this analysis to support these efforts. This section therefore describes the primary investment channels (or "intermediaries") and what the pricing - or cost – of these can tell us about how the cost of capital is broken down and differs between countries, currencies, corporations, and clean energy projects.

Private capital flows through three primary intermediaries

Recent literature on cost of capital has focused primarily on the cost of capital for governments, corporations, and clean energy projects in EMDEs. This covers the cost of borrowing for governments as represented through yields on sovereign bonds[40], the costs of debt and equity for corporations accessing capital markets[41], the reported or calculated costs at the level of single assets[42] or the annualized historic returns for equity investments[43].

[39] 'Proposed Roadmap', Summit for a New Global Financing Pact, June 2023 at URL

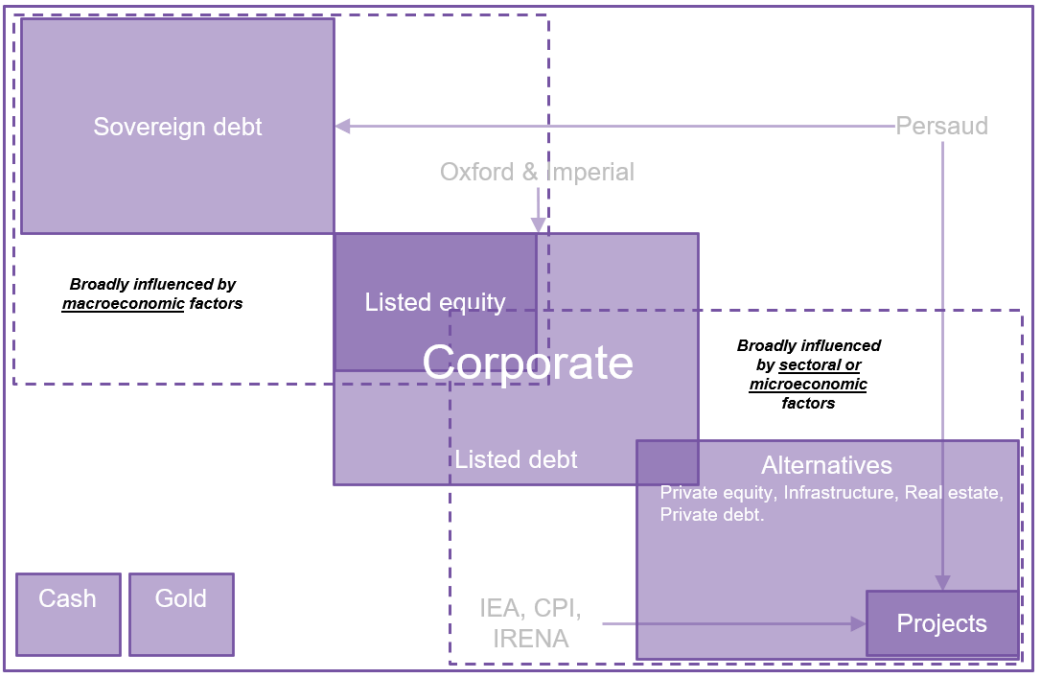
[40] Songwe, V., and Stern, N., 'Financing for climate action', London School of Economics, 2022 at URL and Persaud, A., 'A FX Guarantee for the Green Transformation in Developing Countries' Climate Policy Initiative, June 7, 2023 at URL

[41] 'Energy Transition and the Changing Cost of Capital: 2023 Review', Oxford Sustainable Finance Group, March 2023, at URL

[42] 'Cost of Capital Observatory' International Energy Agency at URL and 'The cost of financing renewable power', IRENA, May 3, 2023 at URL and 'Cost of Capital for Renewable Energy Investments in Developing Economies: And the need for a Global Credit Guarantee Facility', Climate Policy Initiative, June 2023, at URL

[43] 'Clean Energy Investing: Global Comparison of Investment Returns', Imperial Business School/IEA, March 2021, at URL

Figure 71: The investable universe



Source: BloombergNEF, Songwe and Stern, Oxford Sustainable Finance Group, Imperial Business School/IEA, Persaud, A., IEA, Climate Policy Initiative, IRENA.

Beyond identifying the investable universe, this literature on the cost of capital broadly reached three main conclusions:

- Macroeconomic factors such as the failure of forward markets – instruments which estimate future rates of exchange between relevant currencies and offers products which allow purchases to lock in those rates - to effectively price foreign exchange risks are of prime importance (Persaud)
- There is a high correlation between country credit ratings and the Weighted Average Cost of Capital for clean energy projects which reduces their economic competitiveness (Songwe and Stern, IEA, IRENA, CPI)
- Renewable energy corporations active in markets where policy support for clean energy is strong have lower costs of capital (Oxford).

However, it is not immediately clear how this literature fits together or is reconcilable. As such, BNEF has sought to identify a common thread through each of them and relate this back to the core question: what are the factors driving the cost of capital for low-carbon energy projects?

Pricing of debt instruments in these intermediary groups reveals the distribution of risks and costs

Although the cost of capital analyses found in the wider literature are broadly reconcilable, they risk either oversimplifying (through direct comparison of sovereign borrowing costs to project cost of debt) or overcomplicating (through reliance on calculation rather than observation) the nature of the risk premiums that countries, corporates and project SPVs face in the market. They also tend to overlook the role that real economy corporations play in aggregating projects, diversifying revenue streams, managing capital and operational costs, managing risks and reducing the cost of capital. For example, while the largest component – or risk factor – of the cost of debt for a

clean energy project in Argentina is the currency (the difference between Argentina's cost of borrowing in US dollar vs peso), in Egypt and Vietnam it is corporate risk (Table 3).

BNEF cost of debt methodology

A cost of debt stack is the yield on each instrument, starting with the global risk free rate (represented by the US 10-year treasury), followed by the borrowing cost for the country in USD (sovereign 10-year treasury denominated in USD), then the borrowing cost for the country in local currency (sovereign 10-year treasury denominated in local currency), then the cost of borrowing for a country and sector relevant corporate (10-year corporate bond in USD), then the cost of borrowing for an appropriate clean energy project (wind or solar cost of debt). All but the last data point are often publicly traded. The final data point on cost of project debt we crosschecked against IEA, CPI and IRENA observations and found them to be in line with the first two, though consistently higher than IRENA. Once this cost of debt stack is built, it is possible to identify the proportion of the cost of debt – or risk premium over the risk-free rate – attributed to any single factor. For more details, see Appendix B.3.

Factors can both increase or decrease the cost of debt. For example, in Argentina the risk or price of lending to a corporation is lower than that of the country, because of the wider macroeconomic challenges at the country level and the relative stability of corporate operations. Whilst in Brazil, the risk or price of lending to a specific project is lower that of corporations because of sector-specific concessional financing from the national development bank (BNDES).

Table 3: Cost of debt stack for clean energy projects by country, %

Broadly influenced by the following factors: **More macro** ← → **More micro**

Country	Risk Free Rate	Sovereign risk premium	Implied currency risk premium	Corporate risk premium	Project risk premium	Project cost of debt local currency	Largest Risk factor
Argentina	3.8%	36.5%	56.4%	-31.0%	2.6%	68.4%	Implied currency risk premium
Brazil	3.8%	2.3%	4.5%	0.9%	-3.0%	8.5%	Implied currency risk premium
Egypt	3.8%	12.9%	7.2%	-8.8%	14.3%	29.5%	Project risk premium
India	3.8%	1.6%	1.7%	3.5%	0.4%	11.0%	Corporate risk premium
South Africa	3.8%	3.9%	4.0%	0.1%	1.2%	13.1%	Implied currency risk premium
Vietnam	3.8%	1.0%	1.4%	2.8%	0.9%	10.0%	Corporate risk premium

Source: Bloomberg LP, BloombergNEF, CPI, IEA, IRENA. Note: Data as of June 30, 2023. See Methodology, Specific Instruments and Data Sources in Appendix B.3.

Real economy corporations are central to the aggregation and management of asset-level risks

Real economy corporations develop, build, and operate assets, and in so doing manage risk and lower the cost of capital. By doing so, they create sufficient scale and transparency so that international financiers and investors with lower return expectations can invest.

They are central to the aggregation and management of asset-level risks, and by extension the cost of capital and capital formation. Examples of these include utilities such as Adani Green Energy in India, Eletrobras in Brazil, PLN in Indonesia and Eskom in South Africa.

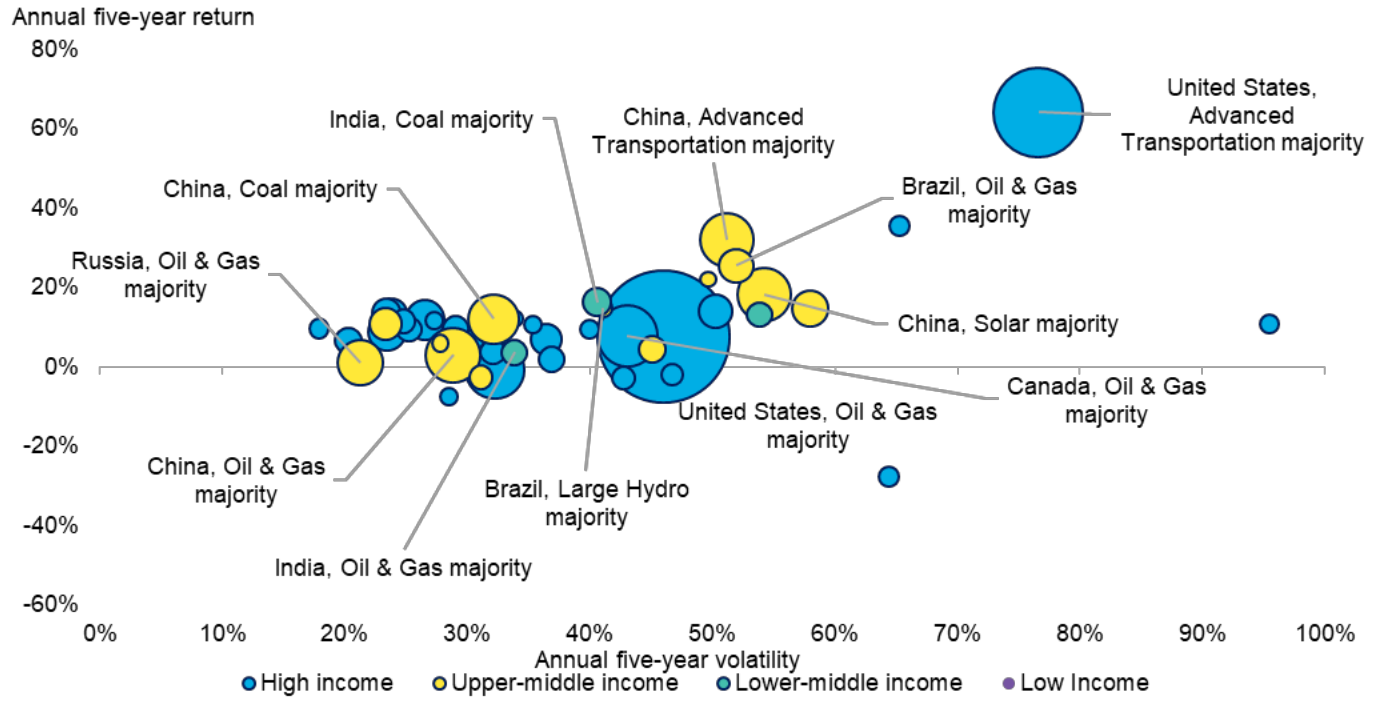
Asset managers are the large low-cost pools of capital which real economy corporations access

Strong corporations can attract investment and further reduce the cost of capital by being considered low risk for the return that they offer. A conventional proxy for assessing risk and return is the volatility in stock prices versus the absolute return to a holder of that stock over the same period. These can vary in real -time due to non-fundamental factors such as changes to market sentiment and speculation.

Figure 72 shows, however, that for the countries and sectors in the scope of this report there is no clear pattern between low carbon and fossil fuels, or across country income groups.

What this demonstrates is that conventional risk adjusted return measures are an imperfect measure for examining improvements to the enabling environment and the mobilization of private capital. To mobilize the large low-cost pools of capital held by e.g. asset managers it is important to take into account additional frameworks such as the return on invested capital, return on capital employed, internal rate of return, net present value, terminal value, total expected returns and risk adjusted returns[44] as well as associated regulatory requirements (see Section 4.3 on capital requirements).

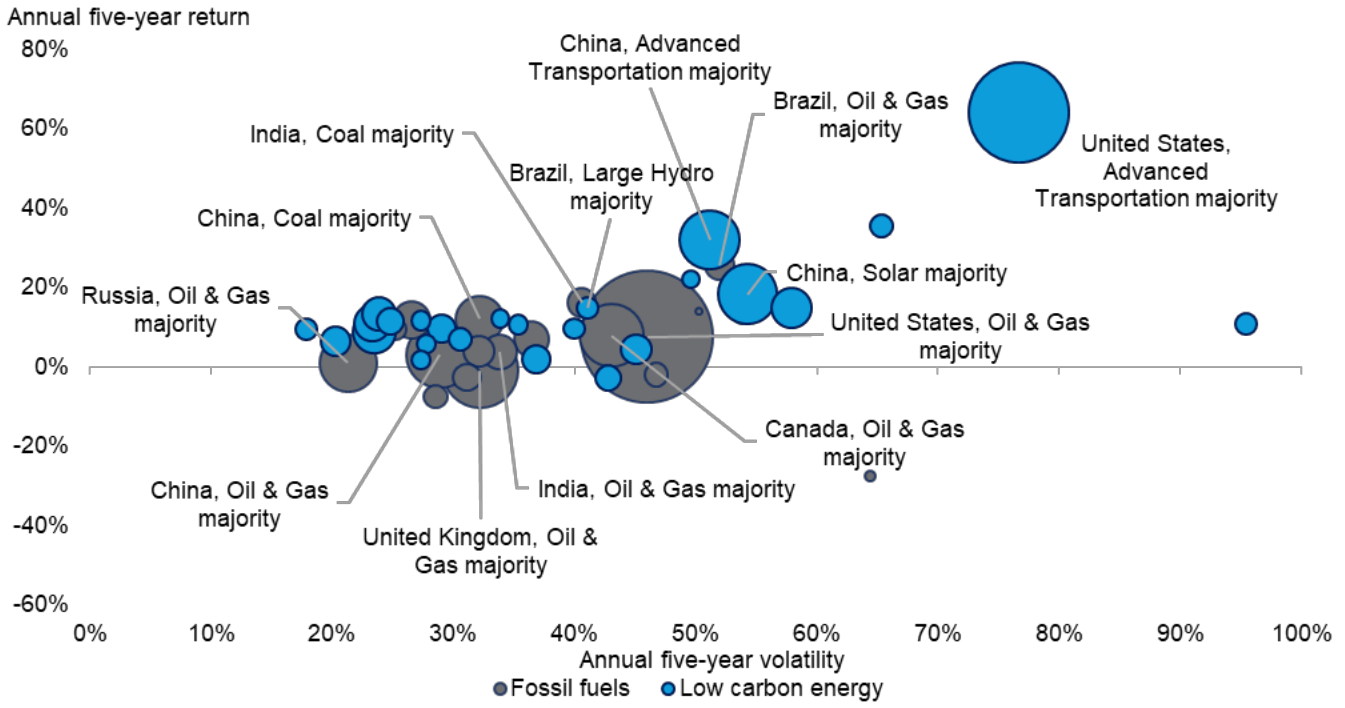
Figure 72: 5-year return vs 5-year volatility of clean energy and fossil fuel equities by income group, 2018-23



Source: Bloomberg LP, BloombergNEF, Urgewald. Note: Bubble size reflects current market cap. Data as of September 30, 2023.

[44] 'Scaling-up Private Sector Financing for Clean Energy Transitions in EMDEs', IEA, June 2023 at URL

Figure 73: 5-year return vs 5-year volatility of clean energy and fossil fuel equities by type, 2018-23



Source: Bloomberg LP, BloombergNEF, Urgewald. Note: Bubble size reflects current market cap. Data as of September 30, 2023.

Appendix B. How this research relates to commonly referenced frameworks

There is a significant depth of literature regarding EMDE capital mobilization for low-carbon energy. We have sought, wherever possible, to widely review, incorporate and reconcile the literature findings to the frameworks and analyses presented in this report. This section outline how we have approached this in three major areas – capital investment and financial flows tracking, enabling environment frameworks, and the cost of capital and risk-adjusted returns analyses.

B.1. Capital investment and financial flows tracking

Existing research provides a range of estimates based on different methodologies. The OECD report is primarily focused on how much OECD countries' money has been spent mobilizing private capital – trying to answer the question of whether the $100 billion target has been met. In doing so it focuses primarily on financing.

Songwe and Stern's opus draws on OECD and other third-party research to present an overarching picture of the challenge and potential solutions.

The IEA focuses almost entirely on capital investment – ie, investment into physical assets – though its 2023 report began to look at the question of financing and the investor's perspective, primarily through the lens of blended finance.

The BNEF report is focused primarily on the private sector's perspective on "private capital mobilization", and the relationship between capital investment and private-sector financing.

Table 4: Summary of selected reports on EMDE capital mobilization

Organization (year) Report	Scope				Findings ($bn) capital investment; financing				
	Years	Capital investment vs financing	Sectors	Countries	2019	2020	2021	2022	2023
OECD (2022) Aggregate Trends of Climate Finance Provided and Mobilized by Developed Countries in 2013-2020	2013-2020	**Limited financing** (Bilateral public; multilateral public; export credits; mobilized private)	Climate: Energy, transport, agriculture, water supply, banking and financial, industry	Non-OECD countries	$80bn	$83 bn	*$92-97 bn	*$101bn-106 bn	N/A
Songwe and Stern (2022) Finance for climate action: scaling up investment for climate and development	2019-2020	**Capital investment/ limited financing** (sovereign, project debt, blended finance)	Climate finance mobilized by developed countries. Aligned to Sustainable Development Goals.	Developing countries	$87bn	$91 bn	N/A	N/A	N/A
IEA (2022) Financing clean energy transitions in emerging and developing economies	2016-2021	**Capital investment**	Renewable energy, nuclear, battery storage, energy efficiency, electricity networks	IEA EMDE list	N/A	$78 bn	$78bn	N/A	N/A
IEA (2023) World Energy Investment	2016-2022	**Capital investment**	Supply – renewables only	IEA EMDE list	$88bn	$91 bn	$98bn	$109bn	*$114 bn

IEA-IFC (2023) Scaling Up Private Finance for Clean Energy in EMDE	2018-2022	**Capital investment/ limited financing** (blended finance)	Low-emissions power: renewable power, nuclear, grids and storage	IEA EMDE list + China	$440bn	$462bn	$469bn	$543bn	n/a
BNEF (2022) Mobilizing Capital into EMDEs	2014-2021	**Asset investment**	Renewable energy, nuclear, electrified heat, electrified transport, hydrogen, carbon capture and storage.	IEA EMDE list	$72bn	$67 bn	$67bn	N/A	N/A
BNEF (2023) Mobilizing Capital in and to EMDEs (this report)	2014-2022	**Capital investment; full spectrum financing** (sovereign, corporate, project)	Capital investment: Renewable energy, nuclear, batteries and small-scale solar; financing all low carbon per ESBR	IEA EMDE list	$77bn	$78 bn	$77bn; $55bn	$85bn; $61bn	N/A

Source: BloombergNEF. Note: BNEF 2023 difference to 2022 is due to small scale solar, and difference to IEA is due to grids and large hydro. IEA 2023 does not have a country breakdown. ESBR = Energy Supply Banking Ratio, for more detail see 'Financing the Transition: Energy Supply Investment and Bank Financing Activity', February 28, 2023 at URL.

Throughout this report, we present countries in line with the IEA classification of advanced economies and EMDEs. We present sectoral analysis in line with BNEF's Energy Supply Investment Ratios, except for deepdives on low-carbon and fossil-fuel asset finance which, because of data availability, have certain differences.

Table 5: Country groups

Region group	Markets included
World	All
Advanced economies	OECD regional grouping and Bulgaria, Croatia, Cyprus, Malta, Romania
Emerging markets and developing economies	All other countries not included in the advanced economies regional grouping, excluding China
China	Mainland China and Hong Kong
Exception: IEA historical energy supply investment includes Mexico, Chile, Colombia and Costa Rica as advanced economies.	

Source: BloombergNEF, IEA.

Table 6: Sectoral groupings

Sectoral analysis	Fossil fuel	Low carbon
Global energy supply investment / global energy supply financing	Includes the upstream, midstream and downstream value chains of oil, natural gas and coal production and processing, as well as unabated fossil-based electricity supply	Renewable energy (utility scale and small-scale solar), nuclear, capture and storage, energy storage, hydrogen, large hydro, transmission and distribution, fossil-fuel-based electricity generation with abatement.
Low-carbon energy supply investment	N/A	Renewable energy (utility scale and small-scale solar), nuclear, carbon capture and storage, energy storage, hydrogen. Not included (due to data limitations): large hydro, transmission and distribution, fossil-fuel-based electricity generation with abatement.

Source: BloombergNEF, IEA.

B.2. Enabling environment frameworks

To establish an overarching enabling environment framework, we reviewed commonly referenced literature, identifying and parsing the key challenges and proposed solutions in each.

These were then mapped onto the IMF Financial Programming Framework, which identifies the specific levers that economies can affect, and the degree to which they are within or outside an economy's control.

The high-level groupings of this framework are:

- External: factors external to the economy and that the economy alone cannot easily control.
- Intrinsic: factors that are intrinsic to the economy and that the economy cannot change, or that can be changed but only over time.
- Economic policies and collective actions
  - Fiscal policy and national strategy
  - Monetary and exchange rate policy
  - Sectoral policies

A full bibliography of the literature reviewed is available on request.

B.3. Cost of capital and risk adjusted returns analyses

Purpose and scope

The cost of capital of renewable energy is one of the key factors for investors and lenders when assessing the viability of providing capital for a project.

Theory and empirical evidence suggest that projects based in emerging markets and developing economies (EMDEs) face higher financing costs than those in advanced economies. That risk perception is present for more than renewable energy projects and, as such, EMDEs often have to borrow in hard currency to mitigate those risks.

The reasons behind these observations are multifactorial, but generally can be explained by the higher perceived risks associated with projects based on the investment environment and specific asset or project that requires investment.

The investment environment pertains to macroeconomic risk factors, such as currency risk and trust in the government, and microeconomic risk factors like the creditworthiness of the borrowing company and probability of receiving steady cashflow from specific energy assets.

This work seeks to study a subset of EMDEs (as defined by the IEA and World Bank) and investigate the potential contribution of each of the aforementioned risk factors to the cost of borrowing for a renewable energy assets.

The charts are illustrative only and should be interpreted as such. They provide an indication of the most prominent risk premiums likely faced by renewable project developers who seek to raise financing for an asset.

We choose to focus on the cost of debt as it is a more consistent, tangible and measurable metric of the cost of capital than the cost of equity.

Methodology

The methodology of the cost of debt illustration is a build-up model, borrowing from classical financial literature (Pastor Stambaugh etc.), as well as literature specific to the topic from organizations like the International Renewable Energy Association (IRENA) and the CPI.

We start with a global risk-free rate and add on perceived risk premiums pertaining to the local government, the borrowing company, the technology being financed and the local currency. The result is a benchmark for the borrowing cost that a developer could face if they wanted to raise capital in the local currency.

Cost of debt (local currency) = (global risk-free rate + sovereign risk premium + implied currency risk + corporate risk premium + tech-specific risk)

- **Global risk-free rate** = US 10-year Treasury yield
- **Sovereign risk premium** = government 10-year yield in US dollars – global risk-free rate
- **Currency risk premium** = government 10-year yield in local currency – government 10-year yield in US dollars
- **Corporate risk premium** = large country-specific utility 10-year yield in US dollars – government 10-year yield in US dollars
- **Project-specific risk** = if the borrowing currency is US dollars, then it is the difference between the country-specific rate of borrowing for the largest non-hydro renewable technology by generation and the US dollar corporate borrowing rate. If the currency is local, then there is assumed to be a currency risk premium embedded, and therefore the currency risk premium as calculated above is taken off the US dollar tech risk premium.

Table 7: Instruments and data sources

Country	Risk-free rate	Sovereign debt (hard currency)	Sovereign debt (local currency)	Corporate debt (hard currency)	Project cost of debt
Argentina	US Treasury Actives Curve (YCGT0025 Index)	USD Argentina Sovereign Curve (YCGT0756 Index)	ARS Argentina Sovereign Curve (FC10ARGE Index)	Pampa Energia SA 10 Year, 2017 (AM2017649)	BNEF LCOE data viewer
Brazil	US Treasury Actives Curve (YCGT0025 Index)	USD Brazil Sovereign Curve (YCGT0211 Index)	BRL Brazil Sovereign Curve (YCGT0393 Index)	Central Electricas Brasileiras S.A. (Electrobas) 10 year, 2030 (BBG00RLT4FN0)	BNEF LCOE data viewer
Egypt	US Treasury Actives Curve (YCGT0025 Index)	USD Arab Republic Of Egypt BVAL Yield Curve (BVIS1282 Index)	EGP Egypt Government Bond BVAL Yield Curve (BVIS1282 Index)	Energean Plc 10 year, 2027 (BBG013CSVW84)	CPI, 2023
India	US Treasury Actives Curve (YCGT0025 Index)	MY Indian USD govts Fitted Curve (YCFC41UR Index)	INR India Sovereign Curve (YCGT0180 Index)	Adani electricity Mumbai 10 Year 2031 (BBG011RTX1H6)	BNEF LCOE data viewer
South Africa	US Treasury Actives Curve (YCGT0025 Index)	USD Republic Of South Africa BVAL Curve (BVIS1142 Index)	ZAR South African Sovereign Curve (YCGT0090 Index)	Eskom Holdings SOC Ltd 10 year, 2028 (BBG00LL9FKT8)	BNEF LCOE data viewer
Vietnam	US Treasury Actives Curve (YCGT0025 Index)	No data	Vietnam Sovereign Curve (YCGT0380 Index)	Mong Duong Financial Holdings 10 year, 2029 (BBG00PV1N2T6)	BNEF LCOE data viewer

Source: Bloomberg LP, BloombergNEF, IRENA. Note: Bloomberg ID or Financial Instrument Global Identifier in brackets after name of instrument. The government debt instruments used for Vietnam are the USD and PHP denominated sovereign bonds issued by the Philippines. These have been used to proxy the currency spread experienced in the absence of sufficient USD denominated Vietnamese government bonds. The Bloomberg ID for the VND denominated Vietnam government bond yield curve is YCGT0380 Index.

In the risk adjusted returns section, the size and performance of different countries energy linked publicly traded equity markets were tracked. Hypothetical county and technology level portfolios were created to achieve this. The universe of companies was informed by BloombergNEF's Clean Energy Exposure Ratings (CEERs) for low-carbon energy companies and Urgewald's Global Coal Exit List (GCEL) and Global Oil and Gas Exit List (GOGEL) for fossil fuel companies. The analysis only considered firms where at least 50% of their 2022 revenue was derived from clean energy sources or at least 50% was derived from fossil fuel sources. Where BloombergNEF or Urgewald data indicated a revenue split by technology, a company would be assigned a country and majority technology portfolio grouping, otherwise it would become a constituent part of an unspecified low-carbon or fossil fuel portfolio. For example, Tesla is a constituent of "*United States Advanced Transportation Majority",* Nextera is a constituent of *"United States Wind Minority" ("minority"* indicates that while more than half of the company's revenue was sourced from clean energy in total, the largest technology revenue driver formed less than 50% of the revenue. Such companies typically have more diverse business operations).

Market capitalization is used to give each portfolio a drifting weighting. Returns are measured as annual total returns over five years to 30 September 2023. Total returns account for capital gains and assumes that cashflows (e.g. dividends) are reinvested at contemporaneous market prices. Volatility is measured as the annualised standard deviation of the daily returns. The size of the bubbles in Figure 72 and Figure 73 represent the market capitalisation of each portfolio as of 30 September 2023.

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