Beyond de-risking:

An assessment of blended finance for climate transition

How to cite this paper: Atiyas I.: "Beyond de-risking: an assessment of blended finance for climate transition", Finance for Development Lab. Policy Note. Link
Keywords: Climate finance, Aid, Development
JEL Codes: F35, G23, O19, Q54

By Izak Atiyas

Policy Note 26

July 2025

Table of contents

Executive Summary 4

Introduction 6

1. The carbon budget, climate investment flows, and blended finance: the current situation 7

2. Global experience with Private Public Partnerships (PPPs) 12

3. Economic and technical challenges of decarbonization in the power sector 15

3.1. The peculiarities of renewable generation 15

3.2. If renewables are competitive, why do countries continue to invest in fossil fuel-based generation? 17

3.3. Transmission challenges 19

3.4. Climate transition in countries with heavy dependence on coal or other stranded costs 20

3.5. Challenges posed by poor countries currently at low levels of emissions 22

3.6. The role of the cost of capital 23

3.7. The structure of the electricity industry and the issue of public ownership 25

3.8. What about public lending? 25

4. A quick review of recent examples and initiatives 26

4.1. An initiative for electricity access in sub-Saharan Africa – Mission 300 26

4.2. Recent notable renewables projects in EMDEs 27

Conclusion: Beyond de-risking 28

References 30

Annex: Total emissions according to projections by the IEA 34

About Finance for Development Lab

The Finance for Development Lab is an independent and non-partisan economics think tank dedicated to building a fairer and more effective international financial system. Acting as a hub for policy discussions, the Lab partners with think tanks, researchers, and other key stakeholders across the Global South to generate constructive and innovative policy proposals.

The Lab is housed at the CEPREMAP, a leading French research institute located within the Paris School of Economics. Its work is directed by the Steering Committee, a group of about fifteen experts and institutions in Africa, Latin America, and Asia. Its founding members are the following institutions, in addition to a group of individual experts.

While steering committee members discuss and shape our research, reports from FDL only represent their authors' views.

Steering Committee Institutions

Readers are encouraged to use and disseminate material from this publication, but not for commercial use. FDL requests due acknowledgement for any citation, and a link to the original resource on the FDL website when cited online. The views, thoughts and opinions expressed in this paper are those of the author(s) and do not necessarily represent the views of FDL or its partners.

About the Author:

Izak Atiyas is an economist specializing in competition and regulation, economic development and climate change. He was an associate professor of economics at Sabancı University, in Istanbul, between 1998 and 2019. His recent research and consulting focus on private finance for the energy transition and digitalization, especially in low-income countries.

Acknowledgment: I thank, without implicating, Ishac Diwan, Mark Dutz and Martin Kessler and participants at the FDL lunch seminar for very helpful comments.

Executive Summary

The world is significantly behind in meeting the Paris Agreement targets. Emissions continue to rise, and global investments in the climate transition are not on track, as shown by a rapidly shrinking carbon budget. The share of emerging market and developing economies (EMDEs) in actual climate investments remains very low, even though these countries are expected to contribute a major portion of emissions in the coming decades.

The key strategy to raising the necessary financing for climate investments in EMDEs was to leverage private financial resources through blended instruments. It was hoped that using public resources as a catalyst to lower the risks of EMDE climate projects would attract significant private investment. However, this strategy has not been successful so far. In 2022, less than half of climate investments in EMDEs came from private sources, and the use of blended instruments remained very low.

There are several important challenges that climate finance for EMDEs needs to address:

- **Even though the cost of renewable energy has declined significantly over the past few decades, there are still notable differences across regions.** Additionally, common indicators like Levelized Cost of Energy (LCOE) do not account for additional costs related to large-scale decarbonization, particularly regarding transmission, storage, and other flexibility sources such as increased interconnection and demand response. In some cases, countries may prefer to keep transmission under public ownership to enhance the flexibility of investment responses to the rapidly expanding renewables sector. This preference further restricts the potential role of private financial resources.
- **Expanding private investment into renewables in the near future is likely to require government support** in many jurisdictions, at least in the form of instruments to reduce volatility in earnings. Lessons of history, including experiences with Public-Private Partnerships, strongly indicate that such instruments inevitably generate costs for governments under unforeseen circumstances, which are bound to occur. These costs also demand fiscal resources.
- **In environments heavily dependent on coal or where fossil fuel generation remains a financially attractive option, public resources are needed** to address stranded costs, social and regional transition costs, as well as the opportunity costs of forgoing the fossil fuel option. The value of the fossil fuel option tends to be high where the fuel is locally available or where vested interests benefit from using that option. The ongoing increase in coal generation investments over recent years, despite falling renewable costs, suggests that the value of that option could be significant. Additionally, recent research indicates that in many coal-dependent countries, the overall benefit of phasing out coal and switching to renewables may actually be negative, while the benefits to wealthy countries of the resulting avoided emissions are substantial. This implies that more financial support from affluent nations benefiting from these transitions might be necessary.

These challenges suggest that for large-scale decarbonization to happen, governments will need to take on a much larger role than so far envisaged. In terms of finance, decarbonization requires public funding not only to lower various risks and make projects more appealing to private investors but also to make complementary investments. These include those needed to boost system flexibility and to cover stranded costs, opportunity costs, and social costs of the transition.

In most countries, decarbonization requires more than just individual projects; it needs a system-wide approach. Governments must lead by designing mechanisms for coordination, dialogue, and participation, and develop transition plans. These plans should address how the costs and benefits of the transition will be shared among key stakeholders. They should also clearly outline when and how fossil fuel plants will be phased out (where relevant), how and when renewable energy plants will be introduced, and when complementary investments will be undertaken. Recent initiatives like Just Energy Transition Partnerships and broader efforts to establish country platforms are promising steps forward. However, to be effective, they have to increase in scale, reduce excessive dependance on debt, and mobilize more grants.

Introduction

The world is significantly behind in meeting the Paris Agreement targets. Emissions keep rising, and global climate transition investments remain delayed. Most investments occur in wealthy countries, while the share from emerging markets and developing economies (EMDEs) remains very low, even though they are expected to account for an important part of emissions in the next few decades.

The key strategy to raise the necessary financing for climate investments in EMDEs was to tap into private financial resources through the use of blended instruments. It was hoped that using public resources as a lever to reduce the risks of EMDE climate investments would result in attracting large amounts of private financing. So far, this approach has not been successful. The purpose of this paper is to explore why this has been the case and to discuss key challenges that financing schemes would need to address to overcome the barriers to climate investments.

The key takeaways of this paper are summarized as follows:

- **Although the cost of renewables has declined significantly over the last two to three decades, there are still significant variations across regions.** High costs of capital, high levels of required complementary investments—especially in transmission and storage—and, in some cases, domestic availability of fossil fuels limit the competitiveness of renewable investments compared to fossil fuel generation. Even when renewables are competitive, private investments need various instruments to reduce earnings volatility, which can create significant contingent liabilities for the state.

- **In some countries heavily reliant on coal, the unilateral net benefit of phasing out coal and switching to renewables might be negative,** while the resulting emissions reduction could provide substantial positive benefits for wealthy countries. Decarbonization under these circumstances may require additional support from wealthy countries that benefit from the emissions reductions.

- **Decarbonization requires a larger-than-expected role for the state**, both to address urgent externalities and coordination problems, and also in terms of financing, to undertake the necessary complementary investments as well as to address social and stranded costs of decarbonization.

- **Decarbonization at scale cannot happen on a project-by-project basis but requires a country- or system-wide approach.** Recent initiatives like Just Energy Transition Partnerships, and more broadly, efforts to create country platforms, promise to represent moves in the right direction. However, so far, they have shown limited scale, relied too heavily on debt, and used too few grants.

The paper is organized as follows: **Sections 1 and 2** provide an assessment of the current situation regarding emission levels, the remaining carbon budget, estimates of investments needed to meet the Paris Agreement targets, and the current available financing. **Section 3** discusses key challenges that must be addressed to increase supply and demand for climate financing. **Section 4** offers a conclusion.

1. The carbon budget, climate investment flows, and blended finance: the current situation

The objectives of the Paris Agreement are to hold "global average temperature increase to well below 2 °C above pre-industrial levels" and to pursue "efforts to limit the temperature increase to 1.5°C above pre-industrial levels." These objectives are becoming increasingly difficult to achieve. Reaching these goals requires major reductions in carbon dioxide emissions; however, emissions have continued to rise so far. Emissions from developed countries have been decreasing for some time (Figure 1), but this decline is more than offset by increases in emissions from developing **countries.**

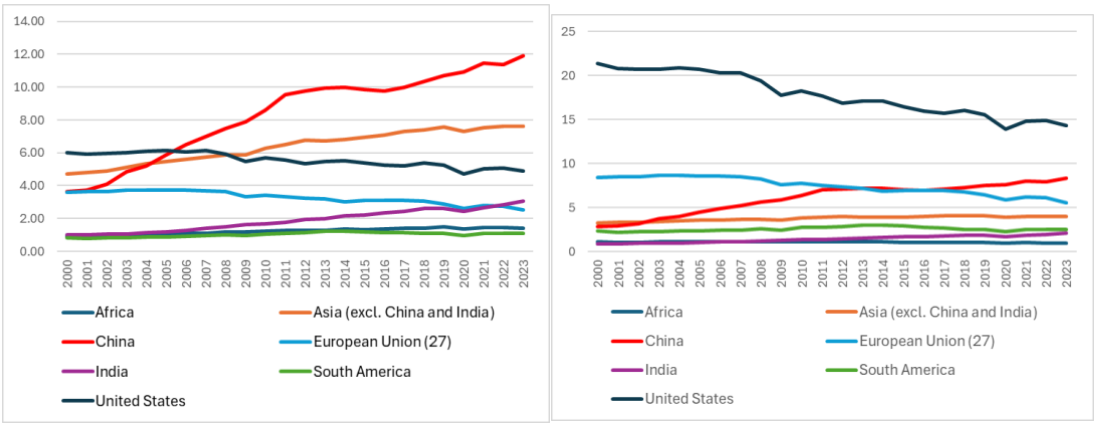
According to the 2024 Global Carbon Budget report, CO2 emissions from fossil fuels and cement increased by 0.8% in 2024, reaching a record 37.4 billion tons of CO2 (GtCO2). Including land-use emissions, the total has reached 41.6 GtCO2.[1] Per capita emissions from developing countries remain low compared to those from developed countries (Figure 1(b)), mainly because energy use and emissions are closely linked to income levels. With current trends, emerging markets and developing economies (EMDEs) are expected to comprise a significant portion of total emissions.[2] A key question for the future is whether economic growth in developing countries can be decoupled from emissions.

A common way to summarize the current state of affairs is the carbon budget, which is defined as the maximum CO_2 that can be emitted at the global level while remaining within certain temperature limits. The Carbon Budget Project estimates that as of January 2025, the remaining carbon budget for limiting global warming to 1.5°C (with a 50% probability), 1.7°C, and 2°C allows for emissions of 235, 585, and 1110 $GtCO_2$, respectively. If current emission levels continue, these amounts will be approximately reached in 6, 14, and 27 years, respectively.[3]

[1] Hausfather and Friedlingstein (2024)." Analysis: Global CO2 emissions will reach new high in 2024 despite slower growth" at https://www.carbonbrief.org/analysis-global-co2-emissions-will-reach-new-high-in-2024-despite-slower-growth/.
[2] One piece of support for this much-cited prediction can be found from the publicly available data on emissions scenarios prepared by the International Energy Agency. Under the "Announced Pledges Scenario", which is based on countries' existing and announced policies, total emissions of CO2 are reduced from 38 GT in 2023 to 12 GT in 2050. The emissions share of North America, Japan and Europe is reduced from 27% in 2023 to 7% and the share of a group of countries that can roughly be called as EMDEs (consisting of Central and South America, Africa, Middle East, Eurasia and Asia Pacific excluding China, Japan and India) increases from 29 to 60% (from 23 to 44% if one excludes the Middle East). See Annex 1 for details.
[3] https://globalcarbonbudget.org/key-targets/

Figure 1: Carbon emissions (a) and emissions per capita (b) for selected regions

(a) billion tons (b) tons per person



Source: Our World in Data, based on Carbon Budget Project.

The existence of a carbon budget has led to efforts to outline future emission pathways under various scenarios influenced by how much countries implement policies to reduce emissions. Usually, one key pathway involves the global energy sector achieving net zero CO2 emissions by 2050, with advanced economies reaching this goal earlier than others. In the IEA definition, this scenario also aligns with important energy-related Sustainable Development Goals (SDGs), especially universal energy access by 2030 and significant improvements in air quality. It is consistent with limiting global temperature rise to 1.5 °C (with at least a 50% chance), according to emission reductions assessed in the Intergovernmental Panel on Climate Change (IPCC)'s Sixth Assessment Report.

The global goal of reaching net-zero emissions by 2050 translates into large volumes of investments needed to meet these objectives. According to the classification proposed by the Independent High-Level Expert Group on Climate Finance (IHLEG), these include investments in clean energy transition, adaptation and resilience, loss and damage, natural capital, and just transition. Among these, the clean energy transition accounts for approximately three-quarters of the total. A widely recognized and accepted estimate of the required investments as of 2022, prepared by IHLEG, is shown in Table 1.

What the table shows is that current investment levels are very low compared to what is needed, and if the carbon budget is to be respected, these investments must increase rapidly. Any delays today will lead to even faster growth in required investments in the future. Although climate-related investments have increased significantly in recent years, most of this growth has occurred in advanced economies, with EMDEs (excluding China) seriously lagging behind (IHLEG 2024). Total annual climate investments need to increase from about $2 trillion in 2022 to $6.4 trillion in 2030 and to $7.5 trillion in 2035. Clean energy makes up about 60-75% of these investments. It is estimated that to stay on track with climate goals, clean energy investment in EMDEs other than China must increase almost fivefold from 2022 levels to reach $1.6 trillion per year by 2030, and then increase by another 30% to about $2.1 trillion per year by 2035. This rapid increase reflects both the slow growth of investments in EMDEs excluding China over the past few years and the fact that, as EMDEs expand, their energy demand will rise significantly. In contrast, clean energy investments in advanced economies need to grow by a factor of 2.5, from approximately $800-850 billion in 2022 to about $2 trillion in 2030, and then roughly stay at that level in 2035. China's clean energy investments also need to double, from around $500 billion in 2022 to $1.2 trillion in 2030 and 2035. The bottom line so far is that climate investments in

EMDEs have been very low and will need to increase rapidly in the next few decades if the carbon budget is to be respected.

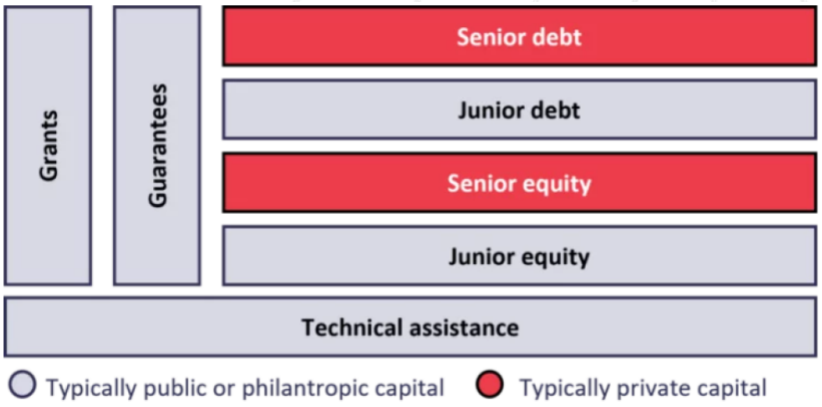
Table 1: Estimated annual investment needs to reach the goals of the Paris Agreement

	2022	2030	2035
Total climate investment needs	2150	6400	7500
Advanced	1100	2700	2800
China	550	1300	1400
EMDEs excluding China	500	2400	3300
Investment needs for clean energy	1620	4900	5300
Advanced economies	800	2100	2000
China	500	1200	1200
EMDEs excluding China	320	1600	2100

Note: based on IHLEG (2024) Figures 1.1 and 1.2. As explained in IHLEG (2024) the estimates are based on estimates provided by IEA (World Energy Outlook 2024) but also include "the costs of early phase-out of coal and other just transition related costs".

The common belief is that much of this investment should or would be raised from private resources, with blended finance playing a key role (IHLEG 2024). Blended finance refers to financial tools where public and philanthropic resources with concessionary elements are used as leverage to mobilize private financial resources. Concessionary elements may include below-market interest rates, various types of guarantees or risk insurance, complementary technical assistance facilities, or grants. The main goal is to improve the quality and/or financial viability and attractiveness of investments, addressing both risks related to investments in EMDE environments and skill shortages, to enhance project design, for example. A typical blended finance structure might look like the one in Figure 2. Junior positions in debt and equity would carry higher risks, perhaps by taking first losses compared to senior positions, thereby making senior instruments more attractive.

Figure 2: Typical instruments used in blended finance



Source: Randall and Lankes (2022)

To understand this quest to mobilize private resources, it helps to consider what sort of policy environment is needed to encourage private investment in clean energy and discourage private

investors from engaging in activities that lead to carbon emissions. Emissions are essentially a negative externality. The textbook remedy for a negative externality is a tax. In the case of emissions, a carbon tax is widely recognized as a key policy tool. Imposing a tax on carbon emissions could incentivize private decision-makers to internalize the externality, leading to outcomes that are more socially optimal. Therefore, a carbon tax is seen as an essential part of the policy mix to combat climate change and reduce emissions (Blanchard et al 2022). However, carbon taxes often face political resistance. Currently, they cover only a small portion of global emission sources—about 24% as of 2023, according to the World Bank (2024). This limited coverage means other measures, such as subsidies, standards, quantity restrictions, or outright bans, must be used more extensively compared to a situation where comprehensive carbon taxes are available.[4] It is important to underline that efforts to raise private financial resources for climate investments are made in an environment where a key policy instrument is not available. This means to raise private finance one has to think about how to best use these alternative instruments. It was previously noted that climate investments are seriously behind schedule and will need to ramp up considerably over the next 2-3 decades. It would be useful to gain further insights about the private and public components of these investments so far. Table 3 presents the latest data compiled by the Climate Policy Initiative (CPI) on climate-related investment flows. The table shows that as of 2022, total climate investments reached about $ 1.5 trillion. Of this, only $ 205 billion was invested in EMDEs. Less than half of this amount was raised from private sources. The share of private funding was even lower- less than 10%- in the least developed countries (LDCs). Additionally, in the case of LDCs and sub-Saharan Africa, nearly all public finance came from international sources, primarily Development Finance Institutions (DFIs).[5]

Table 2: Climate investment flows (CPI, billion USD)

	Global		EMDEs (excl. China)		LDC		Sub Saharan Africa	
	2021	2022	2021	2022	2021	2022	2021	2022
Total	**1151.6**	**1460.0**	**163.5**	**205.0**	**28.0**	**38.6**	**30.1**	**43.8**
Private	574.2	726.7	80.6	95.5	5.4	3.2	4.7	7.0
Domestic	507.5	673.9	64.0	77.9	3.2	1.5	1.9	2.4
International	66.7	52.8	16.6	17.6	2.2	1.7	2.8	4.6
Public	555.0	721.6	78.7	107.4	22.6	35.4	23.7	36.3
Domestic	419.2	544.9	8.2	13.8	0.3	0.5	0.9	0.9
International	135.8	176.6	70.5	93.6	22.2	34.9	22.8	35.5
Unknown	22.4	11.8	4.2	2.1	0.0	0.0	1.7	0.5

Source: CPI (2024). LDC: Least Developed Countries

Next, we look at total blended finance that has been raised for climate change purposes. The main source of statistics for blended finance is Convergence. Table 4 shows that the total volume of blended finance investments have been a very small fraction of climate-related investment flows.

[4] The need for these instruments may decline, for example, as clean energy technologies become cheaper. For the power industry, for example, this may occur when renewables projects become more competitive relative to fossil fuel projects, an issue addressed below.
[5] CPI Global Landscape of Climate Finance 2023, Methodology.

Table 3: Climate blended finance investment (Bil. USD)

	2021	2022	2023
Total climate blended finance investment	12.2	8.3	18.3
Mitigation	8.6	6.4	10.5
Adaptation	2	0.3	1.2
Cross-cutting (hybrid)	1.6	1.6	6.6

Source: Convergence (2024)

Hence, the data shows that i) climate-related investments in EMDEs are significantly below what is needed for net-zero transitions, ii) half of the required investments in EMDEs come from public sources, iii) in least developed countries, the private sector's share is much smaller—less than 10%—and iv) so far, the share of blended finance has been negligible.

Finally, it is important to understand how much leverage blended financial instruments generate, that is, for every unit of concessional funds how much private finance is raised. This is particularly difficult to estimate, if anything because establishing the counterfactual is almost impossible: the crucial question is how much additional money is raised, and assessing whether more or less money would have been raised without the concessional element is not possible. With these caveats, some estimates are available. Attridge and Engend (2019)[6] calculate that "Each $1 of MDB [Multilateral Development Bank] and DFI [Development Finance Institution] invested mobilizes on average $0.75 of private finance for developing countries". They find that, on average, for every $1 of MDB resources invested, private finance mobilized amounts to just $0.37 in LICs, $1.06 in lower-middle-income countries, and $0.65 in upper-middle-income countries. Leverage ratios are slightly higher in the social sectors and lowest in infrastructure. They conclude that "expectations that blended finance can bridge the SDG financing gap are unrealistic: 'billions to billions' is more plausible than 'billions to trillions'." In a recent web post, Convergence suggested a slightly higher ratio: Out of 340 deals studied, Convergence reports that for every dollar invested, a total of $4 in commercial capital was raised, but only $1.8 of private money, with the rest of the commercial capital coming from "MDBs/DFIs and philanthropic investors".[7] One gets a similar sense from IFC (2023), which reports that in 2021, the total volume of projects involving various blended concessional finance solutions for private sector operations was about $13.4 billion. Of this amount, private sector finance leveraged for projects supported by blended concessional finance was only about $4.6 billion. Concessional commitments were approximately $1.9 billion. The projects had about $5.3 billion of DFI own account commercial financing (p. 8). Overall, leverage ratios associated with blended finance are not high.[8]

The main point of this section so far is that relying on private financial resources, in general, and blended finance, in particular, has not resulted in the much-anticipated rapid increase in climate investments in EMDEs. There may be several reasons why blended finance has not lived up to its promise. In principle, the reasons may lie on the supply side, the demand side, or both. On the supply side, it may be that insufficient efforts have been made to sufficiently "de-risk" climate projects,

[6] The authors collect data from 11 MDBs and DFIs as inputs of Official Development Finance. To calculate private finance that has been raised by these inputs, they rely on OECD data.
[7] Andrew Apampa "How much does a dollar of concessional capital mobilize?" 21 Feb. 2023 at https://www.convergence.finance/news/4cC8kVJXvOFZDVxGQ6HLNH/view
[8] In a study prepared for the European parliament, Bayliss et. al. (2020) review the available evidence and conclude that "While it has generated additional investment finance, amounts raised have been relatively small compared with the size of the financing gap they are supposed to plug" (p. ix).

making them less attractive to private investors. On the demand side, given that demand for financial resources is a derived demand, countries might hesitate to pursue rapid decarbonization. This hesitation could stem from various reasons, such as climate transition being a complex process that requires complementary actions (and therefore financing) on several fronts simultaneously. Or it could be that relying on private finance for the climate transition is not realistic to start with. The rest of this paper will examine these possibilities by focusing on some of the details of the climate transition process. The focus is on decarbonization in the power industry. While responses depend on each country's circumstances, two main themes emerge: i) in many situations, the demand side is especially critical, and ii) the climate transition requires a much greater involvement from the public sector—as regulator and rule maker—and also critically in terms of financial resources than most donors active in the field have recognized.

2. Global experience with Private Public Partnerships (PPPs)

The idea of mobilizing private resources to finance public services is, of course, nothing new. The wave of privatizations that began in the 1980s was soon followed by the concept of designing and implementing Public-Private Partnerships (PPPs) to address significant infrastructure gaps in developing countries. PPPs came in various forms but under a typical PPP arrangement, the government contracts with a project company (sometimes a special vehicle company, especially for large projects), which often takes responsibility for building and operating the project until the end of the lifetime of the assets involved (Build Operate projects) and sometimes transfer the facilities back to the government at the end of the project period (typically a Build Operate Transfer project). PPPs were seen as a viable solution to what was perceived as massive investment needs in EMDE infrastructure.[9] An assessment of the PPP experience may offer valuable lessons about blended finance today.

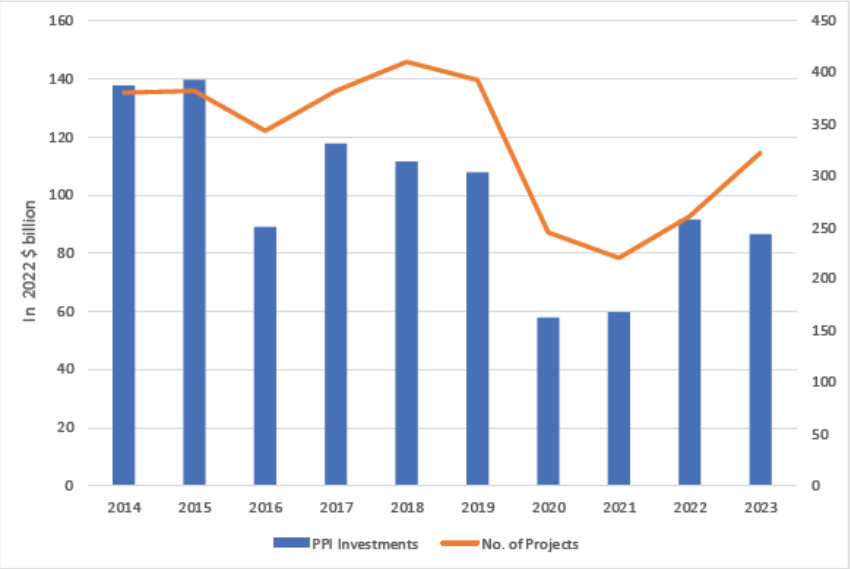
The World Bank PPI database reports that annual PPP investments ranged between $60 billion and $140 billion over the last decade, averaging around $88 billion in 2022-23. This represents only 0.2% of the GDP of all low- and middle-income countries (Figure 1 and World Bank, 2023). The total volume of projects in sub-Saharan Africa in 2023 was $3.5 billion (World Bank 2023, p. 18). The total for sub-Saharan Africa during the 10-year period from 2014 to 2023 was about $48 billion.[10] These numbers are relatively low compared to the estimated infrastructure requirements of sub-Saharan Africa.[11]

[9] In 2013, for example, McKinsey Global Institute (MGI) estimated that infrastructure needs until 2030 would amount to $57 trillion, with 40-50% of this amount accounted for by emerging economies (McKinsey Global Institute, 2013; Arezki et. al. 2016). In 2016 MGI provided an update, estimating that through 2030 the world would need to spend $3.2 trillion annually on infrastructure, with emerging economies accounting for 60% of that need (MGI 2016). At the then current trends MGI reported that a gap of about 11% (or $350 billion a year) would come about. The gap would be triple if the additional investment required to meet the new UN Sustainable Development Goals were to be included.

[10] Calculated from https://ppi.worldbank.org/en/snapshots/region/sub-saharan-africa.

[11] To compare: A 2005 report by the Commission for Africa suggested that Africa's infrastructure financing needs would be $39 billion per year, or about $20 billion more than (then) current spending (Kenny 2024). "In 2019, the World Bank estimated that meeting the infrastructure-related Sustainable Development Goals in sub-Saharan Africa would take spending equal to about 10% of the region's GDP each year from 2015 to 2030. Current market GNI in the region is about $2 trillion, suggesting annual needs of about $200 billion. In 2022, estimates underpinning the High-Level Expert Group on Climate Finance suggested that Africa required "an additional $325 billion per year by 2025 to achieve transformational spending on human capital, nature and sustainable infrastructure." Kenny (2024)

Figure 3: Private Participation in Infrastructure Projects 2014-2023



Source: World Bank 2023, Figure 1.

A better indicator of the role of PPPs is their share in total infrastructure investments in EMDEs. The World Bank PPI data set does not provide data for all infrastructure investments. A World Bank study published in 2017 offers some insights. The study, titled "Who Sponsors Infrastructure Projects," used the World Bank PPI data set but supplemented it with a specially created data set of public projects, i.e. projects where the majority of investors are an SOE or a government entity. According to that study, in 2017, the combined share of SOEs and public entities in total infrastructure investment (amounting to $0.5 billion) was 83%, while the private sector's share (i.e. share of investment volume of projects that can be counted as private sector, namely PPI projects) was 17% (World Bank 2017). Even among PPI projects, more than half of the financing came from non-private sources—30% from Development Finance Institutions and 25% from public banks and public equity—while private sources (commercial banks and private equity) financed 45% of PPI investments. The highest private investment share was in Latin America at 40%, whereas in sub-Saharan Africa, the share of private projects was only 5%. According to the study, 50%of investments were in the energy sector. Within that, the private sector share was 21%. Within projects on electricity generation, 48% was undertaken by SOEs, 26% was financed public entities and 26% by private investors. In distribution, the share of private projects was only 26% and in transmission, only 3%. Within private generation, 57% was in renewables.[12]

The evidence presented above generally shows quite low levels of private financial resources allocated to infrastructure investments in EMDEs. This conclusion is also consistent with data presented by the Infrastructure Consortium for Africa (ICA). According to ICA, total infrastructure investment in Africa ranged between $80-100 bn in 2018-2020. The private sector's share was between 11% and 23%.[13]

[12] Another possible source of share of private in total infrastructure investments is MGI (2016), which shows that in a sample of countries that consists of Brazil, Russia, India, China, Mexico, and Turkey, between the years 2010-2014 the share of PPP spending in total infrastructure investments varied between 5.5-8.9% (an average of 7.5%).
[13] https://www.icafrica.org/en/topics-programmes/key-achievements-in-the-financing-of-african-infrastructure-in-2019-2020/

The most important conclusion about PPPs is that they failed significantly to deliver the promised mobilization of private sector finance for infrastructure in EMDEs. There were several reasons for this including:[14]

1. **PPPs require a relatively strong legal and regulatory framework that provides sufficient assurance to investors.** At the same time, they require significant capabilities in the host country for designing the legal framework, project planning, and project execution, along with overall oversight. Many countries, especially poorer ones, lack these capabilities. Partly because of this, the share of low-income countries in total PPI projects in the World Bank data set is very low (1.4% between 2010-2023).[15]
2. **PPPs were used as a means to involve the private sector in the provision of public services and as an alternative to public ownership and its inefficiencies.** Often, these inefficiencies were driven by political economy factors. For example, in many countries, political considerations led governments to subsidize urban energy use, resulting in below-cost tariffs. In many countries energy companies served as tools for employment patronage. While PPPs didn't eliminate these pressures, they offered governments a tool that, at least partially, shielded some parts of the industry from political pressures, at least to some extent. However, these same pressures also limited governments' willingness to use these instruments, thereby limiting the willingness to launch PPP projects in the first place. In fact, one might argue that governments which attempted to address these political economy constraints—perhaps by reforming public management—would have reduced the need for PPPs, especially in naturally monopolistic sectors.
3. **Pricing for often non-competitive public services and foreign exchange risk has always been hard to manage, and PPPs are no different.** Pricing schemes that seemed fair initially could result in windfall gains or losses when unexpected events, such as large relative price or foreign exchange shocks, occurred, leading the public to question the legitimacy of these projects. [16]
4. **It is well documented that many PPP contracts have been subject to costly renegotiations** even in countries with relatively well developed legal and regulatory environments (Guasch 2004).
5. **PPPs can also be exploited by both governments and their cronies**. On one hand, PPPs were attractive to governments because they could build politically popular infrastructure with less pressure on current budgets. At the same time, in environments where the legal and regulatory environment lacked transparency and accountability, subsidies or guarantees from governments could be concealed from the public, accumulated as non-transparent contingent liabilities that could later surface when they could no longer be hidden. When PPPs were awarded with limited competition or where pricing arrangements were opaque, they easily became channels for rent transfers to politically connected business groups. In some cases, inadequate technical capacity within government agencies coupled with non-competitive procedures resulted in contracts that allowed private operators to extract high volumes of rents.[17]

Despite these challenges, it should be emphasized that the energy sector has been one of the key industries where PPPs have been relatively successfully mobilized. Between 2010 and 2023, according to World Bank PPI data, the energy industry's share of total investment was about 50%,

[14] For detailed discussions, see Leigland (2024), Kenny (2024)
[15] One can also note that PPP investments were concentrated in a few countries. The share of top 4 countries (Brazil, India, China and Türkiye) was almost 60%.
[16] In the case of Turkey, which accounted for almost 7% of all PPI projects listed in the World Bank data set, electricity BOTs granted during the 1990 included take-or-pay clauses backed by Treasury guarantees. These created significant levels of contingent liabilities that were realized when demand turned out to be lower than anticipated. At one point, the World Bank was quoted as estimating that the guarantees under existing contracts could reach $8-10 bn by 2010 (van Rickeghem, 2004, p. 9).
[17] Doberman et al (2024) describe how in Pakistan, some electricity PPAs granted through non-competitive procedures allowed IPPs to earn high rents by inflating costs and thereby exploiting the cost-plus nature of the PPAs.

followed by transport at 42%, and water and sewage a distant third with 4%. Most of that investment was in generation. This is likely because, in many countries, irrespective of the extent of regulatory reform, the degree of competition, or the extent of public dominance, it is relatively easy to attract private sector investment as Independent Power Producers (IPPs) through power purchase agreements (PPAs), with or without take-or-pay clauses, granted through direct negotiations or through a competitive process such as an auction.[18] As will be discussed below, although IPPs in renewables remain a popular mode of entry by the private sector in EMDEs, the net-zero transition involves additional complexities that go beyond the usual challenges addressed in IPP contracts.

3. Economic and technical challenges of decarbonization in the power sector

3.1. The peculiarities of renewable generation

Renewable energy generated from wind and solar has several well-known features that set it apart from power production based on fossil fuels. First, it has high fixed costs and nearly zero marginal costs. Second, it is intermittent because output depends on weather conditions (which is why it is often called "variable" or "non-dispatchable"). These two characteristics have shaped the way they have entered electricity systems. In particular, the most common approach has been using mechanisms that reduce or even eliminate the volatility of earnings. Such mechanisms also include subsidies to offset low levels of carbon prices and expectations that learning-by-doing would lead to reductions in costs over **time.**

Governments have used various support instruments, such as feed-in tariffs, feed-in premiums, portfolio restrictions, and green certificates, to promote the development of the renewables industry worldwide.[19] According to Statista, by 2016 a total of 83 countries were implementing feed-in-tariffs or feed-in-premiums.[20] The original feed-in tariffs often involved long-term contracts with administratively set fixed purchase prices and guaranteed access to the grid. Initially, these policies included a significant subsidy component. Over time, they faced criticism for isolating generators completely from market prices. This led to various changes with more market-oriented features, such as making remuneration more responsive to market prices (like in feed-in premiums) and setting prices through competitive auctions.[21] In countries with wholesale electricity markets, contracts for differences (CfDs) have become one of the main instruments used to attract investment in renewables

[18] In fact, a recent review of power sector reform by Foster and Rana (2020) found that the establishment of a regulatory body or allowing IPPs were the most widespread mode of private sector participation in the power industry in developing countries (dubbed "a la carte reform" by the authors) and other crucial elements of the reform model, such as unbundling or establishment of wholesale markets was much less frequent.
[19] A feed-in-tariff is a long-term contract that pays a fixed price per volume of energy to the renewables supplier over the duration of the contract. A feed-in-premium pays a fixed premium plus the wholesale price. A portfolio restriction is a requirement imposed typically on distribution companies that a percentage of the energy they sell to final consumers must be procured from renewables suppliers. A green certificate is a tradable asset which proves that a certain electricity was produced from renewable resources.
[20] https://www.statista.com/statistics/830641/countries-with-feed-in-tariff-adoptions-of-renewable-energy/
[21] Under a feed-in-premium regime the price of electricity sold is determined by adding a premium to the market price, perhaps with floors and ceilings.

by protecting investors from intermittency risk and volatility in wholesale prices where these exist.[22] Recent reforms in the EU also promote PPAs between generators and large private consumers. Like feed-in tariffs and CfDs, PPAs provide stable revenues for renewables. In fact, as mentioned above, in countries where electricity industry reforms have not fully aligned with the standard model, PPAs that guarantee stable prices and revenues are the primary tools used to attract private investment.

While renewable generation has received various types of government support in the past, the distinguishing feature of the energy transition is its scale: In the past, governments supported a relatively small segment of the electricity generation industry. As the share of renewables increases, the climate transition involves governments acting as guarantors or purchasers of almost the whole system. The problem is that ex-post, instruments used to reduce uncertainty—such as PPAs or CfDs—can result in losses or revenues for governments. For example, under a CfD, if market prices turn out to be low or if there is an excess supply of renewable energy, ex-post, this creates losses for the government.[23] Governments need to be prepared to manage these costs and come up with mechanisms to distribute them fairly among consumers, the government, and future generations (Heusaff and Zachmann 2024).

Also, increasing the share of renewables would require taking additional measures to reduce mismatches between supply and demand. Investments in batteries and storage allow electricity to be stored for use when renewable supply is low. Increased demand responsiveness would help consumers increase demand during low prices and decrease it during high prices. Greater connectivity may enable better complementarity between solar (which is high during the day) and wind (which, in some regions, is stronger at night). Coordinating the pace of electrification in sectors like transport and housing would also help reduce demand-supply mismatches (ibid).

The cost structure of renewables, characterized by very high fixed costs and zero variable costs, has implications that extend beyond intermittency and volatile revenues. In countries where wholesale prices are set through competitive markets, sustained increases in renewable shares result in fossil fuels being pushed out of the merit order.[24] Because wholesale prices are usually set by the marginal plant with the highest bid, this, in turn, lowers wholesale prices and makes it increasingly difficult for renewable generators to stay profitable in environments with a high share of renewables (the so-called "cannibalization effect"). Empirical studies show that the cannibalization effect may be significant (e.g., Kozlovas et al. 2024, Prol et al. 2024). Support mechanisms such as feed-in tariffs or CfDs help protect renewable operators' revenues from the cannibalization effect. The impact of this effect can be reduced by measures like batteries and storage (which would allow shifting electricity supply to when prices are higher), demand management, and increased (including cross-border) trading interconnection.[25] Without such measures, approaches that guarantee prices may be very costly because of the increasing gap between the market price and the guaranteed price (Prol et al 2020).

[22] Under a standard CfD, the generator is paid by the counterparty (often a public entity) the difference between the strike price of the contract and the wholesale price when the wholesale price is lower than the strike price, and vice versa. The strike prices are most often determined by auctions.
[23] Conversely, when prices are high, CfD's creates revenues for governments. The legal framework in the EU requires any surplus to be distributed to consumers. By contrast, how losses should be handled is not explicitly stated in the legislation (Heusaff and Zachman 2024).
[24] Competitive wholesale electricity markets often work on the basis of bids to supply and purchase electricity. The merit order is a ranking of bids to supply electricity from lowest price offers to the highest accepted price. As a result of increases in the share of renewables, some fossil fuel generators that have higher costs can no longer serve the market because their offer prices become too high. The situation is made worse dur to the fact that, for example, all solar plants would like to sell output at similar times of the day.
[25] For the possible effect of batteries on cannibalization see also J. Wallace "The Vibe is Wrong" June 24 2024, at https://thechinalab.substack.com/p/the-vibe-is-wrong

Supporting the expansion of renewables and managing emerging risks are ongoing efforts. In some countries (Spain is a well-known example), feed-in tariffs have initially caused significant fiscal problems.[26] Experiences have led to modifications and improvements over time. There is a current effort to improve CfDs to provide more incentives for investment and operational decisions that are more "grid-friendly",[27] and to reduce possible distortions in output decisions. [28] Furthermore, as renewables become more dominant in the electricity system, it becomes necessary to implement additional measures that enhance flexibility, such as storage, interconnectivity, and demand response. All these points emphasize that decarbonizing the power sector is inherently complex, will not evolve solely through market forces, and will require significant involvement from relevant stakeholders, including the government.[29] While entry based on long-term contracts makes private investment in renewables reminiscent of the IPP model used in PPP projects, it is the dominance of renewables envisioned in net zero transitions that introduces additional complications.

3.2. If renewables are competitive, why do countries continue to invest in fossil fuel-based generation?

Historically, subsidies have played an important role in deploying renewables, as discussed above. However, there is a growing perception that renewables are quickly becoming competitive and might be deployed without subsidies. How accurate is this perception?

The most popular metric used to measure the competitiveness of renewable energy relative to fossil fuels is the Levelized Cost of Energy (LCOE). The LCOE can be viewed as the average or constant price a plant must sell its output for so that its lifetime discounted revenues equal total costs. However, there has been a significant decrease in the cost of renewable generation over the last decade and a half, as reflected by LCOE. For example, IRENA (2024 p. 19) reports that "The global weighted average LCOE of newly-commissioned utility-scale solar PV projects declined from USD 0.460/kWh to USD 0.044/kWh between 2010 and 2023 – a decrease of 90%". Consequently, IRENA (2024) states that while in 2010 utility-scale PV projects were 414% more expensive than the lowest available fossil fuel costs, by 2022 they were 56% cheaper (p.16). Such dramatic declines in LCOE have often led observers to conclude that renewables could be deployed without support and market forces would be sufficient.[30]

However, the LCOE alone only partially reflects the attractiveness or competitiveness of renewables relative to fossil fuel electricity. The LCOE is a plant-level measure and does not consider the entire electricity system. Since renewables are intermittent energy sources, they add extra costs to the system to ensure reliability. As the share of renewables grows, additional storage requirements will arise. There may be times of excess electricity supply (when sun and wind are abundant), which could lead to curtailment, necessitating storage or increased grid interconnections to prevent waste. As the

[26] In the case of Spain, generous FIT schemes led to fast increases in renewables capacity and a situation of excess supply when demand declined due to the financial crisis of 2008. See, for example, del-Rio and Mir-Artigues (2014). A recent example of unintended consequences of support schemes is the case of Chile, a country that is highly regarded for its governance capacity and a leader in renewables in Latin America. There, private companies that were granted "advanced" forms of CfD are experiencing financial distress (Ferreiro and Gonzales 2025).
[27] For example, with free entry, investors have a tendency to choose locations where production costs are low but transmissions costs may be excessively high.
[28] Under a conventional CfD generators have strong incentives to maximize output under all conditions, even when even when prices are negative. So there are efforts to reduce the dependence of payments to current levels of output.
[29] Some observers (e.g. Green, 2023, and Finon, 2023) argue that the recent reform in the EU, where auction-based CfDs are used to shield renewables from risk is in the direction of "single buyer" or "centralized trader" model.
[30] For example: "Between 2010 and 2022, solar and wind power became cost-competitive with fossil fuels even without financial support" at https://www.irena.org/News/pressreleases/2023/Aug/Renewables-Competitiveness-Accelerates-Despite-Cost-Inflation

country switches from fossil fuel to renewables, the transmission system may need "rewiring" because the new sources of energy have locations different from those that are being phased out. Typically, these additional costs are not included in the calculation of LCOE.[31]

Depending on the arrangement, some of these costs may be borne by the investor, and many could fall on the public sector. Regardless of the arrangement, the key point is that these costs must be considered when comparing different technologies. Therefore, when deciding whether to invest in renewables or fossil fuels, governments need to evaluate not only plant-level costs but also system-wide and even economy-wide costs benefits. [32]

Even when renewables' LCOE is lower than fossil fuels at the plant level, there are several factors that might still lead countries to continue investing in fossil fuels. Whether fuel (e.g., coal or gas) is available domestically could play a crucial role in deciding the energy mix moving forward.

There is also the question of economic interests. Owners of fossil fuels or fossil fuel-based electricity plants have an interest in resisting or delaying decarbonization because it remains profitable for them. Given the negative externality, the lack of carbon taxes significantly contributes to maintaining the profitability of owning fossil fuel or related electricity plants. Without a carbon tax, decreasing profitability would require regulation, such as intentionally redirecting electricity generation through quantity restrictions. Depending on the political landscape, it may also be necessary to compensate fossil fuel owners.

It is no wonder, then, that even though the costs of renewables have declined significantly over the last decade, countries still invest in fossil fuel technologies. Several important examples include: In 2024, China's construction of coal-fired power plants reached the highest in a decade, even though China is a global leader in the construction of renewables capacity as well. Interestingly, reports have indicated that the drive for coal plants was pushed by coal mining companies and the desire of local authorities to develop local base load generation in response to high growth in electricity demand and segmented national markets due to transmission constraints. [33] Senegal has declared its intention to build a new power plant using gas from local fields to provide electricity to half a million households.[34] Zambia, which depends mainly on hydroelectric power for electricity, is reportedly considering new coal plants as a response to deep cuts in generation resulting from record droughts.[35] The latest IEA report on coal (IEA 2024a) states: *"While coal demand in advanced economies continues to shrink, this decline is expected to be offset by growth in a few emerging and developing economies, such as India, Indonesia and Viet Nam, where the additional energy demand associated with economic growth is set to*

[31] IEA has provided estimates of LCOE that includes the cost of batteries. These estimates suggest that in India today solar PV plus batteries is competitive with new coal-fired power, and that in the next couple years, will become competitive with new coal in China. See https://www.iea.org/reports/batteries-and-secure-energy-transitions/executive-summary.

[32] Forecasts about future competitiveness of renewables also underline possible transmission constraints. For example, Nijsse (2023) suggests that "global irreversible solar tipping point may have passed where solar energy gradually comes to dominate global electricity markets, without any further climate policies", but that grid resilience remains as a key vulnerability. They suggest that allocation of storage costs to the grid and charged directly to consumers "incentivises more renewables diffusion than requiring renewables to carry the full burden of storage needs." They also mention availability of finance and political tensions especially with respect to use of land and water as possible constraints.

[33] Carbon Brief, January 2025 "China's construction of new coal-power plants 'reached 10-year high' in 2024" at https://www.carbonbrief.org/chinas-construction-of-new-coal-power-plants-reached-10-year-high-in-2024/. Transmission constraints are mentioned in Financial Times, February 2025 "China's construction of coal-fired power plants reaches highest in a decade" at https://www.ft.com/content/4658e336-930f-49db-abc9-0036ee0ea777

[34] "Senegal: A Strategic Gas Pipeline to Monetize Resources from the GTA Project" 28 January 2025, at https://energynews.pro/en/senegal-a-strategic-gas-pipeline-to-monetize-resources-from-the-gta-project/

[35] "Zambia Weighs $900 million Coal-Power Plan as Drought hits Hydro", November 22, 2024 at https://www.bloomberg.com/news/articles/2024-11-22/zambia-weighs-900-million-coal-power-plan-as-drought-hits-hydro; also "Zambia Approves New Coal Power Plant as Drought Saps Hydropower" 24 October 2024 at https://www.sustainable-carbon.org/zambia-approves-new-coal-power-plant-as-drought-saps-hydropower/

be met with a variety of sources, including coal. Despite increasing renewable electricity generation, India is expected to see the largest increase in coal use in the coming years, driven by consumption from the power sector and industry."[36]

What these recent examples underline is that the remarkable decline in renewable energy costs has not eliminated the attractiveness of fossil fuel-based electricity, and renewable energy investments will continue to require various types of support in the near future. Indeed, the IEA (2024b) states:

"Although renewable energy technologies are increasingly becoming more cost-competitive, policies remain key for driving investment and enabling deployment. Almost 84% of global renewable utility-scale capacity growth in 2024-2030 is expected to be stimulated by policy schemes, a share similar to last year's forecast. Policy-driven deployment refers to capacity for which a government policy is the primary driver for the investment decision, for example, a policy that affects remuneration for power or reduces tax liability or introduces a purchasing obligation to meet government targets. The two most prominent policy schemes are administratively set tariffs and premiums, which make up almost two-thirds of all policy-driven capacity additions, and competitive auctions, accounting for more than one-fifth. … Conversely, market-driven deployment is expected to account for 15% of global utility-scale renewable capacity growth, slightly higher compared with last year's forecast, driven mostly by the increasing share of green certificate use in China." (IEA Renewables 2024b, p 67.)

3.3. Transmission challenges

The transmission system is a vital component in efforts to mobilize private investment for the climate transition. In many jurisdictions, the transmission network is becoming a critical factor limiting the rollout of renewable energy. Several reasons explain this. First, while renewables are replacing fossil fuels in power generation, a degree of "rewiring" the system is necessary because renewables are likely to be located at different locations from current generation sites. Second, as the share of renewables grows, connecting different parts of the system becomes increasingly important.[37] Going forward, further increases in renewable energy will challenge energy security and demand greater flexibility in the transmission network. The IEA forecasts that this will require a rebalancing of investments toward grid and storage.[38]

Private ownership or PPP models may be less attractive in transmission relative to generation. Transmission is a natural monopoly. Many countries, even those that have made significant advances in implementing the textbook model of privatization and regulatory reform in the electricity sector, have preferred to retain public control over the transmission system. One reason for this is that entities that control transmission may abuse their market power to reduce competition in other parts of the system. This tension can potentially be resolved by a strict form of unbundling where the owners of transmission are not allowed to own assets in other parts of the electricity market. On the other hand, unbundling makes the management of the whole system more difficult. Beyond this competition problem, there are also significant strategic reasons to retain public control of transmission, especially

[36] https://www.iea.org/reports/coal-2024/executive-summary

[37] "The more you interconnect, the more even if the sun isn't shining and the wind isn't blowing in your part of Europe, it will be doing it somewhere else and therefore you'll reduce the need for batteries or hydrogen storage or all the other ways that we balance the system". Financial Times March 3, 2025."Martin Wolf talks to Adair Turner: Can the world decarbonize fast enough?" at https://www.ft.com/content/79ed32fc-7524-401b-bc58-c37c5265e1e8

[38] "At the moment, for every dollar spent on renewable power, 60 cents are spent on grids and storage. By the 2040s, this reaches parity in all scenarios" IEA 2024a, p. 20. The report also underlines the fact that increases in extreme weather events create additional challenges for system security, increasing the importance of system resilience.

during a process of rapid transition. The rapid expansion of renewables is likely to introduce significant unforeseen contingencies with respect to the transmission system. Under typical PPP-like contracts, these unforeseen contingencies, not covered by the contract, would require renegotiations and create opportunities for hold-up and costly bargaining, as has been prevalent in the PPP contracts of the last several decades.[39] Governments may prefer to keep transmission under public control or seek arrangements in which control over strategic decisions can be maintained, simply to avoid these problems and expedite investment decisions as new renewable capacities are added to the system.[40]

An alternative model, where the public sector relinquishes less control over the transmission grid, is the Independent Power Transmission (IPT) model. In this model, the operator is granted rights and obligations on specific transmission lines through a tendered contract. Under this model, the winning party builds and operates the specific transmission line but does not have authority or responsibility for the rest of the network or new investments (World Bank 2017b). The challenge posed by relying too heavily on the IPT model is that the country must conduct frequent tenders, which is costly. Additionally, the model will not function effectively when the utility experiences financial viability issues.

An important alternative to expanding the traditional transmission system, especially for reaching underserved populations in overburdened urban grids, those living in remote areas, and fragile and conflict-affected environments, is to rely instead on renewable mini-grids. Mini grids consist of small power generators, storage systems, and users that are interconnected through a distribution line to constitute an independent system. They are considered more efficient alternatives to the main grid and solar home systems in remote (that is, far away from the main grid) communities with high population density and demand (Esmap 2019). As will be seen below, they constitute an important component of a recent effort to increase access to electricity in sub-Saharan Africa.

3.4. Climate transition in countries with heavy dependence on coal or other stranded costs

Climate transition in countries that rely heavily on coal poses additional complications. There is a fundamental credibility issue: on the one hand, massive private sector investments in renewables face a significant demand risk if fossil fuel generation assets are not phased out and new investments in fossil fuel generation are not prevented. Phasing out existing fossil fuel assets (e.g., coal generation plants) may entail expenditures on worker relocation, retraining, other social costs associated with plant closures, as well as reimbursing the owners of stranded assets (coal plants and/or mines) or contracts (e.g., PPAs with coal power plants).[41] At the same time, governments may be reluctant to

[39] In some jurisdictions incumbent private (or privatized) regulated utilities that own fossil fuel generation assets may actually use their power over the transmission system to hinder the transition efforts of governments. See, for example: Dye-Furstenberg (2024).

[40] In this respect, the UK, the leader of privatization of energy in the 1990s, and which has adopted an ambitious decarbonization program, presents a recent interesting example: In 2024 the government bought the Electricity System Operator from the National Grid and established a public company, the National Electricity System Operator. Press reports emphasized: " The government hopes that by bringing together the separate units involved in planning Great Britain's electricity and gas networks under one publicly owned company, the system operator can adopt a more strategic approach to achieving a net zero energy system by 2030."The Guardian, 13 .09.2024 "UK government to buy electricity system operator from National Grid for £630m" at https://www.theguardian.com/business/2024/sep/13/uk-government-to-buy-electricity-system-operator-from-national-grid-for-630m. A major motivation was to reduce the long queues that have appeared in the connections of new renewables projects to the grid. "Government Transfers National Grid ESO to Public Ownership, Rebranding as NESO," 30.09.2024 at https://www.powersystemsuk.co.uk/government-transfers-national-grid-eso-to-public-ownership-rebranding-as-neso/. It has also been reported that renewables projects "stuck in grid connection" is worth £200 bn. "The UK Energy Grid's Transition to Renewable Energy" at https://www.businesswisesolutions.co.uk/2025/02/03/uk-grids-integrate-renewable-energy/

[41] Pakistan presents a vivid example: The PPAs granted a decade or two ago, in the middle of severe energy shortages, resulted in excess capacity and high costs of electricity due to clauses that require the government to make payments even when the electricity is not used due to lack of demand. The government has been trying to renegotiate these contracts. See, for example The Diplomat, October 11 2024

phase out fossil fuel assets or give up new investments into fossil fuel generation, because of perceived risks about energy security in an environment of rapidly increasing energy demand, unless they are assured that the necessary renewables generation will be forthcoming (along with measures to address intermittency, etc., as discussed above). The phase-out and phase-in have to be addressed simultaneously, and, given the carbon budget, in a relatively short period of time.

These observations have two important implications for decarbonization. First, decarbonization may need a basic coordination mechanism, such as a "decarbonization plan," to regulate both entry and exit in a coordinated manner. Second, renewable investments of the scale consistent with net zero targets may require assurances that resources will be available to finance stranded and social costs associated with early retirement of fossil fuel assets, so that the "decarbonization plan" covers not only phasing in and out of generation assets but also a credible and acceptable plan to address the social costs. Taken together, decarbonization in these environments cannot be achieved by projects that are independent of each other. A system-wide approach is necessary (Adrian, Bolton, and Kleinnijenhuis 2022; Bolton, Kleinnijenhuis, and Zettelmeyer 2024; Bolton and Kleinnijenhuis 2024).

But this is not all. Recent empirical work suggests that for some of the large coal-dependent countries, the unilateral benefit of phasing out coal assets (calculated as avoided emissions multiplied by the country-level social cost of carbon) is substantially lower than the cost of replacing them with renewables (including the social costs of transition). The phasing out of coal and the consequent reduction in global emissions, however, create significant benefits for appropriate coalitions of rich countries (e.g., the G7 plus EU27, with or without the US), reflecting the large positive externalities of avoided emissions. In fact, calculations in Bolton. et. al (2024) suggest that rich countries of the world derive large net benefits even if they completely finance the decarbonization in these countries. The important point, however, is that the "coal transition" (i.e., phasing out coal and replacing it with renewables) in these countries is unlikely to happen unless external finance at scale is available. Moreover, a significant portion of that financing must be in the form of grants.

There have been recent efforts to design and implement "Just Energy Transition Partnerships" (JETPs), which ostensibly entail all of the elements described above.[42] While these are important steps in the right direction, Bolton et. al. (2024) identify, among others, the following problems with existing JETPs: The targeted emissions reductions identified in the JETPs are based on the most recent nationally determined contributions announced by the countries, but these are lower than the levels necessary to reach the targets of the Paris Agreement. As a result, the financing requirements are also lower than those estimated based on achieving emissions reductions in line with the Paris Agreement.[43] Secondly, the grant components are very low. Financing packages have mainly consisted of concessional loans and guarantees to support investments in renewables, while there has been a

"Pakistan Renegotiates Costly Contracts With 5 Private Power Producers" at https://thediplomat.com/2024/10/pakistan-renegotiates-costly-contracts-with-5-private-power-producers/. Some of these efforts have apparently drawn criticism from multilateral development institutions: Reuters February 26 2025 "World Bank unit and other lenders criticize Pakistan's energy negotiations" at https://www.reuters.com/business/energy/world-bank-unit-other-lenders-criticise-pakistans-energy-negotiations-2025-02-26/. Another current example of fossil fuel PPAs acting as stranded costs and raising the cost of transition is Jordan. See Quilliam and Obeid (2023). Interestingly, in both cases, a relatively supportive legal framework for renewables have encouraged widespread installation of solar panels, further deteriorating the financial situation of incumbent utilities. For the case of Pakistan, see Bloomberg 22.1.2024 "Surprise Solar Boom in Pakistan Helps Millions, But Harms Grid" at https://www.bloomberg.com/news/articles/2024-11-22/surprise-solar-boom-in-pakistan-helps-millions-but-harms-grid; for Jordan, see ibid.

[42] JETPs have been announced for Indonesia, Senegal, South Africa and Vietnam.

[43] The gaps are quite large. For example, for the power industry, the estimated investment need by 2030 for South Africa in the JETP is $69 bn. whereas Adrian et al 2022 estimate it to be $566 bn. For Indonesia, the figures are $97 vs $265 bn. (Bolton et. al. 2024, Table 4).

lack of grants or subsidies allocated to cover the stranded value of coal assets and to provide compensation for coal communities retraining.[44]

In many countries, the coal transition presents a challenge that extends beyond the specific issues linked to renewables. These cases are not about a lack of de-risking but rather about potential reluctance to decarbonize—or choosing to do so at one's own pace, such as without early retirement of coal plants—because the net benefits of doing so unilaterally are negative. Without proper incentives, there is no demand for blended or alternative forms of financing.

It seems that the current business models of MDBs can support the "system-wide" approaches required by JETP-like comprehensive programs. However, the need for substantial grant elements as appropriate incentives complicates this, as current MDB approaches cannot typically handle such arrangements unless, in the case of the World Bank, the country qualifies for IDA funds. Therefore, supporting the transition in these complex scenarios requires direct assistance from (coalitions of) wealthy countries or changes in the way MDBs operate business.[45]

JETPs are increasingly seen as parts or specific examples of "country platforms", which are described as mechanisms established under the leadership and ownership of host developing countries to mobilize domestic and international financial resources to achieve climate and development objectives (Bendossa et. al. 2025). Such platforms are designed to reduce the fragmentation of financial resources, mobilize them towards climate and development goals, and move beyond a project-by-project approach. They rely on a strategic vision geared towards structural transformation, which is strongly supported by the country's political commitment. The platforms would also serve as mechanisms to ensure coordination and cohesion among responsible agencies within the host government.

3.5. Challenges posed by poor countries currently at low levels of emissions

The main objective in these cases is to incentivize these countries to meet their rapidly growing energy demand with clean energy and discourage them from relying on fossil fuels. [46]

For countries with fossil fuel resources, the tradeoff will be between investing in them for growth, industrialization, and export earnings versus investing in renewables. One key dimension is the global progress with decarbonization. If the rest of the world makes significant progress towards net zero, demand for their fossil fuels will decline, and low-income countries that have invested in fossil fuels will be stuck with low export earnings. If progress is slow, or export earnings are not a major objective (as opposed to, say, rising domestic demand and industrialization), the most important tradeoff will be the relative cost of renewables.

Regarding the relative cost of renewables, the primary issue is that low-income countries have a higher cost of capital, which would tilt the scale towards fossil fuels, all else being equal (Sterl et al., 2023). As a result, they would require significant additional incentives to stay away from fossil fuels.

---

[44] For example, in the case of South Africa, the share of grants is about 4% of the total (GIGA 2024). For Indonesia, the share is 3% (Bolton et. al. 2024, p. 18).

[45] See Bolton and Kleinnijenhuis (2024) for some suggestions on how to change MDB business models.

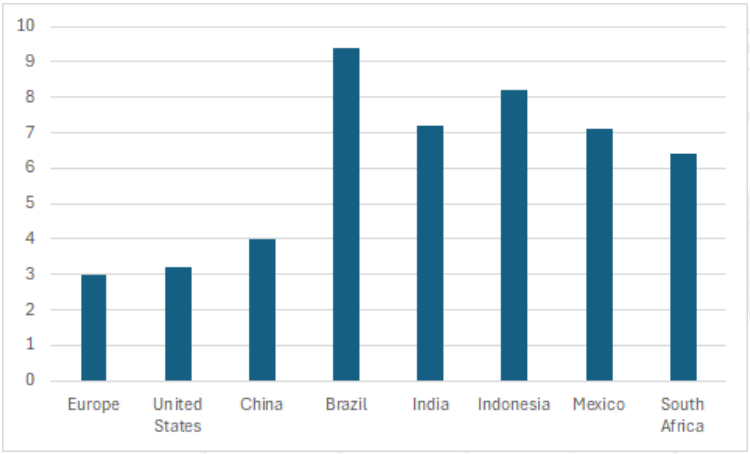
[46] We are assuming here that are valid social welfare reasons to tilt their choices towards renewables. There may be two dimensions: positive externalities for the rest of the world, and domestically based benefits. Regarding the former, the assumption is that even though their contribution to total emissions today is very low, they will reach substantial (binding with respect to the carbon budget) levels as they grow. At this point it is not clear that this assumption is correct and the literature does not seem to provide a definitive conclusion. This is an issue that deserves future research. With regards to domestically based benefits, an important consideration that could justify a tilt towards renewables is pollution.

There are two additional considerations that influence the tradeoff between fossil fuels and renewables. The first is that renewables may create additional benefits for clean industrialization. Assuming advanced economies do make significant progress towards decarbonization, and schemes such as the European Union's Carbon Border Adjustment Mechanism (CBAM) become effective in preventing carbon leakage and reduce gaps between the cost of domestic industries facing carbon pricing and imports, investing in renewables would make industrial products in poor countries become competitive in the face of CBM-like schemes. Second, in cases where fossil fuels are not available domestically and would need to be imported, investing in renewables would result in significant savings in foreign currency.

3.6. The role of the cost of capital

A key characteristic of renewable energy investments, compared to fossil fuel generation, is that they have high upfront fixed costs and almost zero variable costs. This makes renewables investments highly sensitive to the cost of capital, and consequently to the interest rate. More concretely, given fossil fuel prices, an increase in interest rates and the consequent rise in the cost of capital reduce the financial appeal of renewable energy investments relative to investments in fossil fuel generation, particularly in countries with higher risk spreads (Youcefi 2022). According to data compiled by the IEA, the cost of capital in EMDEs is more than twice to three times as high as that in rich countries (Figure 4). As such, high interest rates and the consequent increases in the cost of capital act as major impediments to renewable investments in EMDEs.

Figure 4: Cost of Capital of Utility-Scale Solar PV in selected countries (2021)



Source: IEA Cost of Capital Observatory, at https://www.iea.org/reports/cost-of-capital-observatory/tools-and-analysis#abstract

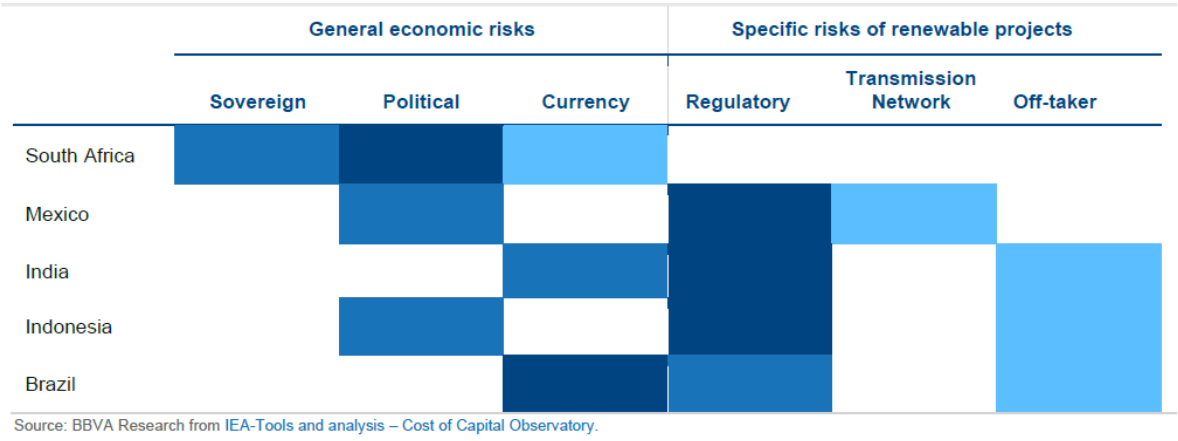
The IEA categorizes key factors that explain the divergence in the cost of capital between EMDEs and wealthy countries into two groups: general economic risks and specific risks of renewable projects. General economic risks include, among others, political risks (political or social instability), sovereign risk (risk of public debt becoming unsustainable), and currency risks. Among specific risks, the most prominent are regulatory risk (changes in the rules), off-taker risk (risks related to the payment of

power purchased by off-takers), and transmission risk (ability to access transmission in a predictable manner) (IEA 2023, 2024c).[47]

The relative weight of these factors is difficult to assess and will depend on country circumstances. The IEA's own assessment of Senegal and Kenya reveals that off-taker and associated currency risks are the top factors explaining the high costs of capital (IEA, 2025). Regulatory risk is also counted as one of the main risks, even though both countries rank high in the African Development Bank's evaluations (African Development Bank 2022).

Generally, the main recommendations to reduce the cost of capital include a clear vision and planning for the future of the industry, including a plan for decarbonization, strengthening regulatory frameworks in a manner consistent with the vision, resolving the financial difficulties of the off-takers, as well as increased use of guarantees and concessional financing. Which one of the levers is more important again depends on the country's circumstances. For example, BBVA's (2024) assessment, based on information provided by the IEA, is that general economic risks, especially political risks, are more important in South Africa, and regulatory and off-taker risks are more important for India, Indonesia, and Brazil (Figure 5).

Figure 5: Top risks to be addressed to lower the cost of capital



Source: BBVA (2024)

It is clear that high capital costs are a serious impediment to renewable energy investments and act as an important factor that reduces the competitiveness of renewables. It was these kinds of risks that blended finance instruments were hoped to resolve. At the same time, evidence also suggests that it is not the sole or even main barrier to decarbonization. Some of the countries listed above, such as India and South Africa, have been quite successful in attracting renewable energy projects, despite reportedly high capital costs. These observations suggest that other factors described above, including stranded and social costs as well as coordination problems, must be acting as significant barriers as well.

[47] Not explicitly mentioned is in the IEA list is the risk of expropriation (perhaps subsumed under regulatory risk). The risk of expropriation is especially relevant in the case of renewables, and possibly higher than fossil fuel-based generation of similar capacity, because of renewables cost structure, namely high fixed and almost zero marginal costs. To what extent expropriation risk creates a disadvantage for renewables is a question for further research.

3.7. The structure of the electricity industry and the issue of public ownership

The global power industry has undergone a significant transformation over the last three to four decades. In many countries, the model of a vertically integrated publicly owned utility has been restructured. Many countries have undergone the full textbook model of reform, unbundling the natural monopolistic elements, establishing a wholesale market, and allowing private entry. Some countries have gone further and privatized state-owned assets in generation as well as transmission and distribution. Many countries adopted only part of the textbook model, allowed entry into generation through IPPs, but retained public control over (at least parts) of the rest of the system, ending up with various forms of the so—called single buyer model. Some countries (especially small countries and poor countries) have maintained the vertically integrated utility model, predominantly under public ownership.

In principle, transitioning from a vertically integrated to a single buyer model through PPAs is relatively straightforward. As discussed above, this so-called "a la carte reform" has been the most widespread means through which the private sector has participated in energy investments in EMDEs (Foster and Rana, 2020). It is likely that in the medium term, many countries will establish or retain the single buyer model. As a result, attracting private capital to the power industry is less an issue of ownership of the power industry and more an issue of its governance and financial health. The emphasis should shift (and it appears to have been shifting, see below) from privatization to rehabilitation, so that buyers can become credible off-takers and accommodate private entry through long-term contracts. Rehabilitation efforts must be accompanied by increased transparency and regulatory certainty.

3.8. What about public lending?

So far, the discussion has relied on the presumption that private capital needs to play a major role in financing the climate transition in EMDEs, and has examined what sort of challenges blended finance faces to achieve these objectives. The validity of this presumption, however, is not obvious. Recent assessments of rates of return on private capital in infrastructure projects are quite high (ranging between 8 and 37%, as reported by Kenny (2022), and much higher for sub-Saharan Africa). This is simply a restatement of the fact that the cost of capital is very high, especially in poor countries. Given the widespread poverty and affordability challenges (see below), it may be that it is simply not realistic to expect most green mitigation projects in EMDEs to meet these return thresholds, or that capital costs will be meaningfully reduced by improving governance. Even then, the leverage ratios reported above are not encouraging.

By contrast, MDBs can borrow from private markets at much lower rates. In addition to that, MDBs have the leverage and capacity to address the various policy reform, governance, and technical capacity issues that are clearly crucial for progress towards net zero in many EMDEs. Moreover, MDB funds have high leverage; the World Bank has been able to support total loans of $223 billion out of a capital of $18 billion, resulting in a leverage ratio of 1:12 (Kenny and Morris, 2021). The problem is that the current levels of capital of MDBs are not sufficient to raise the resources necessary to finance the climate transition of EMDEs. Therefore, meeting the needed scales would require capital increases in MDBs. In addition, as discussed above, current MDB instruments restrict the amount of grants they can channel to EMDEs, so more grant finance is essential.

4. A quick review of recent examples and initiatives

4.1. An initiative for electricity access in sub-Saharan Africa – Mission 300

More than 600 million people in Africa lack access to electricity. The level of electricity access, especially in rural areas, is significantly lower than in countries with similar (low) levels of income in other regions (Atiyas and Dutz, 2025, Table 8.3). While the emphasis so far has been on supply-side factors, recent analysis has shown that demand-side factors play an even more important role in explaining the lack of access. Blimpo et al. (2019) emphasize that the proportion of households living near the grid but not connected is very high. Low uptake reflects a low willingness or ability to pay, and, along with low usage, often results in insufficient revenues to cover costs. So, affordability is a key concern and is ultimately linked to very low incomes and widespread poverty.

Mission 300 is a partnership between the World Bank and the African Development Bank (AfDB), as well as several philanthropic organizations, including the Global Energy Alliance for People and Planet (GEAPP), Sustainable Energy for All (SEforALL), and The Rockefeller Foundation. The objective is to provide electricity access to a total of 300 million people (250 m. by the World Bank and 50 m. by the AfDB). The World Bank has committed 30 bn. of IDA resources until 2030, "while using innovative tools to mobilize private sector investments… Many development partners and development finance institutions (DFIs) are also supporting Mission 300 projects through co-financing and technical assistance."[48] An article at the AfDB website mentions a total of $90 billion from MDBs, the private sector, and philanthropic contributions.[49]

In a meeting in Dar Es Salaam, Tanzania, in January 2025, twelve sub-Saharan African countries have declared "country compacts" that provide commitments in 5 key areas: a) Rehabilitate and expand energy infrastructure at competitive costs; (b) work towards financial viability of utilities; (c) incentivize private sector participation; (d) embrace distributed renewable energy (DRE) and clean cooking solutions for affordable last mile access; and (e) increased regional integration. Rather than a centralized new initiative, Mission 300 seems to be a combination of ongoing projects and new initiatives. The emphasis is on rehabilitating existing infrastructure, enhancing the financial viability of public utility companies, and introducing new generation, including through mini-grids and off-grid **solutions.**

Some of the initiatives and ongoing projects are under the purview of public sector companies. For example, the "Regional Emergency Solar Power Intervention Project (RESPITE)" has the objective of rapidly increasing grid-connected renewable energy capacity, the requisite grid upgrades, and strengthening regional integration in the participating countries, which include Chad, Liberia, Sierra Leone, and Togo. The project consists of $156 m. IDA credit and $155m IDA grant.[50] The recipients are **state-owned electricity companies.**

Similarly, the Senegal Energy Access Scale-up Project aims to build and rehabilitate 4,000 km of power lines, also to be implemented by the state-owned electricity company, SENELEC. The project entails $150 million of IDA resources and aims to bring electricity to 200,000 households, including 40,000 vulnerable, low-income households, through a new affordable "Lifeline Connection Policy." This

[48] https://www.worldbank.org/en/programs/energizing-africa/overview
[49] https://www.afdb.org/en/news-and-events/geapp-rockefeller-foundation-seforall-advance-world-bank-afdb-mission-electrify-300-million-africa-74304
[50] https://projects.worldbank.org/en/projects-operations/project-detail/P179267

policy utilizes load-limited connection kits with standardized and pre-financed wiring systems. The expectation is that by providing pre-financed wiring with zero connection fees, and pre-paid meters and consumption limiters, illegal usage will be curtailed.[51]

Another example is the Nigeria "Distributed Access through Renewable Energy Scale-up (DARES)" project which is financed by an International Development Association (IDA) credit of $750 million and will leverage over $1 billion of private capital and significant parallel financing from development partners, including $100 million from the GEAPP and $200 million from Japan International Cooperation Agency. The objective is to provide access to 17.5 million unserved or underserved Nigerians through mini-grids or stand-alone solar installations. The project intends to use minimum subsidy tenders and performance-based grants to attract private sector investments.

The Mission-300 initiative certainly looks ambitious. It entails a variety of approaches, including rehabilitating and expanding main grids as well as investing in mini-grids. It targets private sector investments, but also invests in the public sector. Importantly, it focuses on rehabilitating state-owned utilities rather than exclusively attempting to privatize them. Rehabilitating public utilities has the benefit of addressing off-taker risks, which are deemed a key driver of the cost of capital for renewables. At the same time, it remains to be seen whether the various components will be able to resolve the fundamental affordability problem faced by many households.

4.2. Recent notable renewables projects in EMDEs

A quick review of recent large renewable projects in the Middle East, Africa and Southeast Asia reveals that most have used PPP-like approaches consisting of FITs (often administratively set, but in some jurisdictions determined by auctions), PPAs granted by public utility companies (e.g., in Egypt) and more rarely, PPAs issued by private corporations to procure their energy needs through renewables. The brief review strongly suggests that the traditional instrument used to attract private investors, most notably PPAs issued by public entities, is still highly popular and represents the dominant form of entry by private capital.

A notable development is the emergence of new green multinationals, particularly in the Middle East. One example is the Saudi company ACWA Power, which is 50% owned by the country's Public Investment Fund. ACWA is developing solar power plants in Azerbaijan, Ethiopia, Iraq, and Uzbekistan (Young 2023). Another example is Masdar, an energy company fully owned by the United Arab Emirates. In 2022, it announced that it would spearhead renewable energy projects in Angola, Azerbaijan, Kyrgyzstan, Romania, Tanzania, and Uganda (ibid.). In 2023, Masdar signed agreements with Angola, Uganda, and Zambia to develop renewable energy projects with a total capacity of 5 GW.[52]

Most of these projects rely on long-term contracts, which are typically issued by state-owned electricity companies. For example, a recently approved project in Egypt is a collaboration between Masdar, Infinity Power, an Africa-focused independent subsidiary of Masdar, and Hassan Allam Utilities, a private Egyptian company. The project entails 2 PPAs with the Egyptian Electricity Transmission Company (EETC) for solar energy projects with a combined capacity of 1.2 gigawatts (GW) and 720 megawatt-hours (MWh) of Battery Energy Storage Systems (BESS).[53] In another example,

[51] https://documents1.worldbank.org/curated/en/163581623855248829/pdf/Concept-Project-Information-Document-PID-Senegal-Energy-Access-Scale-Up-Project-P176620.pdf
[52] https://masdar.ae/en/news/newsroom/masdar-to-develop-5-gw-of-renewable-energy-projects
[53] https://solarquarter.com/2024/11/25/masdar-infinity-power-and-hassan-allam-utilities-power-up-with-1-2gw-solar-projects-in-egypt/

Infinity Power is engaged in developing 4 GW of renewable capacity in Cameroon, under a Memorandum of Understanding with the West Cameroon Regional Council, which entails solar, wind, battery storage, and biomass.[54]

An example of a PPA with a private client is the Anglo-American Renewable Energy Project in South Africa. In this project, three companies associated with Anglo American, a mining group, have committed to 20-year off-take agreements with Envusa Energy, which itself is a joint venture between Anglo American and the French company EDF.

Among several important projects in Southeast Asia, a notable one is the following:[55] The Dau Tieng Solar Power Plant in Tay Ninh, Vietnam, with a capacity of 500 MW, became operational in 2019 and supplies power to Vietnam Electricity under a 20-year purchase agreement at USD 0.093/kWh. In Indonesia, a notable project is the Cirata Floating Solar Power Plant, with a capacity of 192 MWp, which is a floating solar project implemented by Masdar. In the Philippines, one can cite the Solar Philippines Concepcion Solar PV Park, a 150 MW facility supplying electricity to Manila Electric under a 20-year agreement at USD 0.058/kWh.

Conclusion: Beyond de-risking

The various challenges examined in this paper suggest that relying on the private sector to finance climate transition in EMDEs necessitates an extensive engagement of the public sector in various forms, both domestically and internationally, encompassing both governance capacity and public finance. They also suggest that depending on country circumstances, barriers may exist both on the supply side, whereby investors can perceive climate projects as too risky or not offering enough returns, but also on the demand side, where countries, or fossil fuel interests within countries, are not willing to give up the fossil fuel options, or do not find it in their interest to unilaterally finance stranded costs. In countries with a heavy dependence on coal and/or high stranded costs, the demand-side **factors are expected to be more binding.**

A global carbon tax, accompanied by appropriate mechanisms for redistribution to compensate the losers, would have helped resolve many of the demand-side barriers. In the absence of a carbon tax, addressing some demand-side factors requires international public support to discourage EMDEs from fossil fuel investments and encourage decarbonization. Apart from countries with very low-income levels (which qualify for grants from MDBs), the tools available to MDBs do not seem suitable for providing the grant components needed to reach these goals, unless, in the case of the World Bank, the country qualifies for IDA funds. Without changes in how MDBs operate, a coordinated effort by a coalition of willing countries appears to be necessary.

MDB tools might be more suitable to dissuade countries with very low energy consumption (and thus low emissions) from investing in fossil fuels and incentivize them to rely on renewables to meet rapidly growing energy demand. These countries face barriers on both the supply side of finance—such as very high costs of capital—and the demand side, where low demand for renewables financing exists

[54] https://solarquarter.com/2024/07/15/infinity-power-signs-mou-with-cameroon-west-regional-council-to-develop-4gw-of-renewable-energy/
[55] https://construction-property.com/southeast-asias-largest-solar-projects-lead-global-renewable-energy-growth/

precisely because high capital costs make renewables less attractive. Additionally, these are also countries where poverty and a lack of affordability serve as major barriers to expanding access to electricity.[56]

Once countries are willing to pursue decarbonization, the focus shifts to making renewables appealing for private investment. A key responsibility for EMDE governments is to establish a clear and credible decarbonization plan. This involves, where relevant, plans to phase out fossil fuel-based generation and strategies to guide investments in renewables. Regarding the latter, it is likely that governments will also need to play a leading role in identifying locations, expediting permits, and planning for the necessary increase in flexibility, including grid expansion, engaging demand response, boosting storage, and possibly improving domestic and cross-border connectivity. Without these complementary investments, plans to expand renewables will lack credibility and will therefore be unable to attract private capital.

The public sector also plays a crucial role in developing tools to hedge risks stemming from the intermittent nature of renewables. Global trends indicate that some form of long-term contracts are essential and will remain necessary to support renewable investments. Recent examples of successful renewable projects in EMDEs all feature some sort of long-term agreements, some (but not all) of which have been awarded through competitive auctions. The shift away from administratively set prices toward more competitive mechanisms is welcome. However, it is always possible that these contracts may create contingent liabilities for the government and ultimately incur some fiscal costs. Governments need to be prepared to bear these costs and establish fair mechanisms to distribute them among the main current and future stakeholders.

Reducing risk through long-term contracts is important, but not enough. Building new transmission lines and increasing transmission flexibility with investments in storage and demand response are essential complementary efforts needed alongside more renewable deployment. Rapid progress in these areas will require additional public funding, which could then allow greater reliance on private finance.

[56] As stated by Blimpo at.al. 2019 "the fundamental problem is poverty and lack of economic opportunities rather than power".

References

Adrian, Tobias and Bolton, Patrick and Kleinnijenhuis, Alissa M. (2022), The Great Carbon Arbitrage. IMF Working Paper No. 2022/107,

African Development Bank (2022) Electricity Regulatory Index for Africa 2022, at https://africa-energy-portal.org/reports/electricity-regulatory-index-africa-2022-eri

Atiyas, I . and M. Dutz Digitalization, Ch 8 in Goh, C. (ed. 2025), 21st Century Africa: Governance and Growth, at https://openknowledge.worldbank.org/entities/publication/03bdf5e3-daba-404a-a638-25c5511c2376

Arezki, R., P. Bolton, S. Peters, f. Samama, J. Stiglitz 2017, From global savings glut to financing infrastructure, Economic Policy, April, 221-261

Attridge, S. and L. Engen (2019) Blended finance in the poorest countries: The need for a better approach, Overseas Development Institute.

Kate Bayliss, K.,B. Bonizzi, O. Dimakou, C. Laskaridis, F. Sial (2020), "The use of development funds for de-risking private investment: how effective is it in delivering development results?" Study prepaed for the European parliament at https://www.europarl.europa.eu/RegData/etudes/STUD/2020/603486/EXPO_STU(2020)603486_EN.pdf

BBVA (2024) Global | Cost of Capital, Renewables and Cleantech, at https://www.bbvaresearch.com/en/publicaciones/global-cost-of-capital-renewables-and-cleantech/

Bendossa, B., A. Cavallini, S. Kammourieh and M. Kessler (2025), "Planning and Implementing the Climate and Development Transformation: Country Platforms as Enablers"Finance for Developmen Lab, Policy Note 23, at https://findevlab.org/planning-and-implementing-the-climate-and-development-transformation-country-platforms-as-enablers/

Blanchard, O. C. Collier and J. Tirole (2022), The Portfolio of Economic Policies Needed to Fight Climate Change, PIIE Working Paper 22-18.

Blimpo, Moussa P.; Cosgrove-Davies, Malcolm, 2019, Electricity Access in Sub-Saharan Africa: Uptake, Reliability, and Complementary Factors for Economic Impact.

Bolton, P., A. M. Kleinnijenhuis and J. Zettelmeyer (2024), The economic case for climate finance at scale, Bruegel Policy Brief, at https://www.bruegel.org/policy-brief/economic-case-climate-finance-scale

Bolton, P. and ., A. M. Kleinnijenhuis (2024) COP29, The Economic Case for a New Common Quantified Goal of Climate Finance (NCQG) at Scale, NCQG Policy Brief at http://e-axes.org/wp-content/uploads/2024/11/COP29-PB_11_20_2024a-1.pdf

CPI (2024) Global Landscape of Climate Finance 2024, at https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2024/,

data download at https://www.climatepolicyinitiative.org/wp-content/uploads/2024/11/GLCF-2024-Data-Download.xlsx

Convergence (2024). State of Blended Finance 2024, Climate edition

Del-Rio, P. and P. Mir-Artigues (2014) "A Cautionary Tale: Spain's Solar PV Investment Bubble", International Institute for Sustainable development at https://www.iisd.org/gsi/taxonomy/term/429

Doberman, T., F. Hayat and S. Srivastav (2024), "Contracts and Corruption: Evidence from Pakistan's Power Sector" at https://drive.google.com/file/d/1tA1u4_4lChTMm04yWor0VoaBSrTGclvL/view

Dye-Furstenberg (2024), "Electric Utilities' Broken Economic Incentives Are Obstructing the Green Transition", The Roosevelt Institute, at https://rooseveltinstitute.org/blog/electric-utilities-broken-economic-incentives-are-obstructing-the-green-transition/

Esmap (2029), Mini Grids for Half A Billion People: Market Outlook and Handbook for Decision Makers, at https://openknowledge.worldbank.org/entities/publication/ee3960d4-0d83-5d7f-baca-a5f425a66c77

Ferreiro, J. A. and E. S. Gonzales (2025), "Turmoil in the Chilean electricity sector: A failed attempt at using advanced contracts for differences to support the energy transition?" Utilities Policy 93 (2025) 101882.

Finon, D. (2023), The central trader model: a solution to strengthen the low-carbon transition and to protect consumers in the European Union, Forum, May 2023 Issue 136.

Foster, V. and A. Rana (2020) Rethinking Power Sector Reform in the Developing World, The World Bank.

German Institute for Global ad Area Studies (2024), Why Just Energy Transition Partnerships Are Not Enough, at https://www.giga-hamburg.de/en/publications/giga-focus/why-just-energy-transition-partnerships-are-not-enough

Green, R. (2023), Contracting for renewable energy: return of the single buyer?, Forum, May 2023 Issue 136.

Guasch , L. (2004), Granting and Renegotiating Infrastructure Concessions – Doing It Right, The World Bank.

Heusaff, C. and G. Zachmann (2024), The changing dynamics of European electricity markets and the supply-demand mismatch risk, Bruegel Policy Brief Issue 14/24.

International Energy Agency (2025), Financing costs represent a critical barrier to scaling up clean power projects, at https://www.iea.org/commentaries/how-a-high-cost-of-capital-is-holding-back-energy-development-in-kenya-and-senegal

International Energy Agency (2024a), World economic Outlook 2024.

International Energy Agency (2024b), Renewables 2024.

International Energy Agency (2024c), Reducing the Cost of Capital.

International Energy Agency (2023), Cost of Capital Observatory, Tools and Analysis at https://www.iea.org/reports/cost-of-capital-observatory/tools-and-analysis

International Energy Agency (2020), Projected Costs of Generating Electricity 2020 edition.

IFC (2023) DFI Working Group on Blended Concessional Finance for Private Sector Projects, Joint Report, march 2023 update.

IRENA (2024), Renewable Power Generation Costs in 2023.

Kenny, C. (2024), "The Private Sector and Development: Cataloguing A Quarter Century of Mobilization Unscaled", at https://www.cgdev.org/blog/private-sector-and-development-cataloguing-quarter-century-mobilization-unscaled

Kenny, C. (2022), The Simple Math of Development Finance, at https://www.cgdev.org/publication/simple-math-development-finance

Kenny, C. and S. Morris (2021), Bad versus Better Ways to Leverage Private Investment in the Global Fight for 1.5 Degrees, at https://www.cgdev.org/blog/bad-versus-better-ways-leverage-private-investment-global-fight-15-degrees

Kozlovas, P.; Gudzius, S.; Jonaitis, A.; Konstantinaviciute, I.; Bobinaite, V.; Gudziute, S.; Giedraitis, G. (2024) Price Cannibalization Effect on Long-Term Electricity Prices and Profitability of Renewables in the Baltic States. Sustainability 2024, 16, 6562. https://doi.org/10.3390/su16156562

Kroger, M. and D. Newbery (2024), Renewable electricity contracts: lessons from European experience, No 24 Febrero 2024.

Leigland, J. (2024), The Rise and Fall of Public–Private Partnerships - Finance, Infrastructure and Developing Countries, Edward Elgar.

McKinsey Global Institute (2013), Infrastructure Productivity: How to Save $1 Trillion a Year, at https://www.mckinsey.com/capabilities/operations/our-insights/infrastructure-productivity

McKinsey Global Institute 2016, Bridging Global Infrastructure Gaps , at https://www.mckinsey.com/capabilities/operations/our-insights/bridging-global-infrastructure-gaps

Prol, J. L., K.W. Steininger, D. Zilberman (2020), "The cannibalization effect of wind and solar in the California wholesale electricity market", Energy Economics 85 Article 104552.

Quilliam, N. and J. Obeid (2023), "How to unlock the potential of Jordan's renewable energy sector" Chatham House at https://kalam.chathamhouse.org/articles/how-to-unlock-the-potential-of-jordans-renewable-energy-sector/

Randall and Lankes (2022), How can 'blended finance' help fund climate action and development goals?, at https://www.lse.ac.uk/granthaminstitute/explainers/how-can-blended-finance-help-fund-climate-action-and-development-goals/

World Bank (2024), State and Trends of Carbon Pricing 2024.

World Bank (2023), Private Participation in Infrastructure Annual Report 2023.

World Bank (2017), Who Sponsors Infrastructure Projects? Disentangling public and private contributions, at https://ppi.worldbank.org/content/dam/PPI/documents/SPIReport_2017_small_interactive.pdf

Youcefi, D. (2022), The financial costs of the green transition in developing countries, Fiinance for Development Lab, at https://findevlab.org/financing-costs-of-green-transition-in-developing-countries/.

Young, K. (2023), "The Gulf Goes Green Can the Fossil Fuel Giants Lead the Energy Transition?" Foreign Affairs, at https://www.foreignaffairs.com/persian-gulf/gulf-goes-green-fossil-fuel-energy-transition

Annex: Total emissions according to projections by the IEA

The World Energy Outlook (2024) prepared by the IEA provides estimates of regional CO2 emissions until 2050 under two separate scenarios (Annex Table 1). The Stated Policies Scenario (STEPS) is a projection of the global energy system's future based on existing and announced policies. It serves as a baseline scenario, showing the likely trajectory of energy systems if current policy commitments are fully implemented. By contrast, the Announced Pledges Scenario (APS) illustrates the extent to which announced ambitions and targets can deliver the emissions reductions needed to achieve net-zero emissions by 2050. As stated by the IEA, "it includes all recent major national announcements as of the end of August 2024, both 2030 targets and longer-term net zero or carbon neutrality pledges, regardless of whether these announcements have been anchored in legislation or in updated Nationally Determined Contributions". [57] Note that the PAS does not guarantee and significantly falls short of reaching emissions reductions necessary to limit the global temperature rise to 1.5 °C (with at least a 50% probability).

Annex Table 1: Total CO2 emissions (Mt CO2)

		Stated Policies			Announced Pledges		
	2023	2030	2035	2050	2030	2035	2050
North America +Europe+ Japan	10 122	8 438	7 123	4 917	6 976	4 556	773
China	12 636	11 598	9 607	6 356	10 523	6 951	1 745
India	2 902	3 458	3 497	3 184	3 172	2 685	1 509
Africa	1 420	1 472	1 543	1 971	1 329	1 288	1 233
Middle East	2 197	2 326	2 423	2 814	2 185	2 166	1 878
Central and South America + Africa + Middle East + Eurasia + Asia Pasific excluding Japan, China and India	10 850	11 284	11 614	12 667	10 262	9 504	6 976
Total	37 723	36 170	33 285	28 636	32 056	24 678	11 711
North America +Europe+ Japan	26.8	23.3	21.4	17.2	21.8	18.5	6.6
China	33.5	32.1	28.9	22.2	32.8	28.2	14.9
India	7.7	9.6	10.5	11.1	9.9	10.9	12.9
Africa	3.8	4.1	4.6	6.9	4.1	5.2	10.5
Middle East	5.8	6.4	7.3	9.8	6.8	8.8	16.0
Central and South America + Africa + Middle East + Eurasia + Asia Pasific excluding Japan, China and India	28.8	31.2	34.9	44.2	32.0	38.5	59.6

*Includes industrial process and flaring emissions.

Source: IEA World Economic Outlook 2024, Table A.29

As shown in the table, under the APS, global emissions are reduced from 37.7 Gt in 2023 to 11.7 GT in 2050. Major reductions are achieved in the country group North America + Europe + Japan (comprising "advanced countries, with a few exceptions such as Australia), from about 19% in 2023 to 6.6% in 2050. China's emissions have decreased from 34% to 15% of the total. India's share increases from 7.7 to 12.9%, and Africa's (in the IEA groupings, Africa includes North Africa and sub-Saharan Africa) share from 3.8 to 10.5%. The last row in the table shows the emissions share of an (albeit imperfect) measure of EMDEs (comprising central and South America, Middle East, Eurasia and Asia Pacific excluding Japan, China and India), increasing from about 29 to almost 60% (23 to 44% if one excludes the Middle East).

[57] https://www.iea.org/reports/global-energy-and-climate-model/announced-pledges-scenario-aps

Contact | **Finance for Development Lab**
communications@findevlab.org
www.findevlab.org