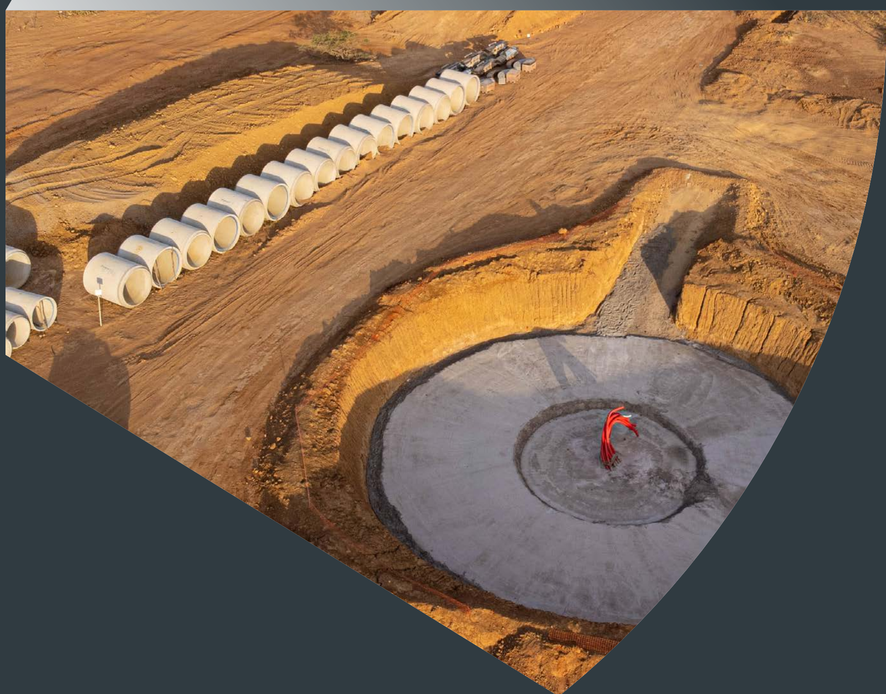
SEI Stockholm Environment Institute

Risk mitigation and transfer for renewable energy investments

A conceptual review



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Contents

Acronyms

ADB	Asian Development Bank
AfDB	African Development Bank
ATI	African Trade Insurance Agency
CAPM	Capital Asset Pricing Model
CSP	Concentrating Solar Power
DFI	Development Finance Institution
EU	European Union
FDI	Foreign Direct Investment
FfD	Financing for Development
FiT	Feed-in Tariff
GDP	Gross Domestic Product
HCY	Hard Currency
IEA	International Energy Agency
IMF	International Monetary Fund
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
KfW	KfW Development Bank
LCOE	Levelized Cost of Electricity
LCY	Local Currency
MDB	Multilateral Development Bank
MIGA	Multilateral Investment Guarantee Agency
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
PPA	Power Purchase Agreement
PRI	Political Risk Insurance
PV	Solar Photovoltaic
RES4Africa	Renewable Energy Solutions for Africa Foundation
RLSF	Regional Liquidity Support Facility
RMT	Risk Mitigation and Transfer
SSA	Sub-Saharan Africa
UN	United Nations
UNDP	United Nations Development Programme
WACC	Weighted Average Cost of Capital
WBG	World Bank Group

Abstract

The trillions of dollars needed to achieve global climate goals are more than an abstract number. They need to be channeled through viable projects that result in desirable outcomes, such as renewable energy infrastructure in developing countries. The complexity and barriers faced in the project development and finance process are often underestimated. The perception of risk is an important barrier to private investment in developing countries, hence one of the most relevant interventions is to reduce or transfer risk faced by investors. Renewable energy has benefited from this approach, yet its progress has been slow in some regions, such as Sub-Saharan Africa (SSA). In this paper, we look at risk-related interventions in renewable energy investments, particularly from the perspective of developers. To do that, we first review the literature and concepts related to the role of risk, the cost of capital, the project development process, and the investment selection process. The paper further explores the types and relevance of risks faced by renewable energy investors. Finally, the paper examines the use of risk mitigation and transfer (RMT) instruments in private utility-scale renewable energy investments and presents evidence of the effectiveness of RMT in practice.

1. Introduction

The goal of this report is to provide a better understanding of the role of risk in climate mitigation investments from the project-level perspective. This includes aspects such as the project development process, the prevailing logic of investing in real assets and the role of risk from the viewpoint of developers.

There are high expectations around private finance contributions to sustainability in developing countries (IMF, 2022; OECD, 2022a; UN, 2022). Given a limited availability of public funds, particularly in the current sovereign debt crisis, development finance institutions (DFIs) are expected to focus on leveraging private finance into profit-seeking sustainable development activities, including climate infrastructure (IMF, 2022). In 2015, the UN adopted the Addis Ababa Action Agenda (UNGA, 2015) focused on the Financing for Development (FfD) concept. A key element in the FfD concept is attracting additional private finance into infrastructure or other sustainable development projects through risk mitigation and transfer (RMT).

Another relevant concept is blended finance – currently understood as a structuring approach that uses public or philanthropic capital to attract private investment into sustainable development. The tools of blended finance include, among others: providing access to below-market-cost (concessional) finance for the capital structure of projects; credit enhancement through guarantees and insurance under concessional terms; and grant-funded technical assistance and project preparation to increase viability (Convergence, 2022). Blended finance seeks to reduce risk for private profit-seeking investors, and is thus particularly suitable for climate mitigation investments that can generate commercial revenues, such as renewable energy (OECD, 2022b).

DFIs have placed a greater focus on blended finance in recent years. For example, the World Bank adopted the Maximizing Finance for Development framework whereby it seeks to use the cascade approach, preferring to mobilize private enterprise and finance over using scarce public resources. The WB aims to use its own capabilities to structure projects and manipulate their risk-return profiles to make them attractive to private actors such as institutional investors, commercial banks and project developers. This would allow for a replication of the well-functioning process of project financing, development and implementation in high-income markets, with public funds only used as a backstop. Other DFIs, including the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD), the Asian Development Bank (ADB), and the African Development Bank (AfDB), have placed greater emphasis on private finance mobilization in their strategic plans.

There are numerous barriers, however, to the FfD approach and to deploying climate infrastructure investments, including renewable energy, at the magnitude and speed required to address global climate and local development challenges. Many of the countries or regions targeted by the FfD approach suffer from chronic low investments in all sectors, not just in climate infrastructure (Hausmann et al., 2005). Within economies that generally see a low level of private investment, the FfD approach proposes to direct local and especially foreign capital at scale toward sustainable development. This is a complex task as not only do such countries need to attract additional investment across the board, but they are required to also steer markets into the direction of sustainability. At the micro level, firms[1] are expected to be earning an adequate risk-adjusted return while contributing to sustainability through, for example, investments in access to energy, climate action, or biodiversity.

There are numerous high-level global initiatives that focus on increasing, catalyzing, crowding-in, promoting, aggregating and de-risking private investments for sustainability. These include, for example, UNDPs SDG Investment Platform, the Global Investors for Sustainable Development Alliance, the Net-Zero Asset Owners Alliance and many others. Yet progress continues to be limited; in 2021, it is estimated that the private finance mobilized for sustainable development through blended finance was USD 40 billion, around 1% of what is needed (Convergence, 2022).

In international circles, the debate around climate finance, particularly for mitigation, tends to focus on the allocation of ever-increasing sums, with the implicit assumption that the availability of these sums will directly translate into climate results. However, the process to develop and implement each climate project is complex, iterative and time-consuming, and the number of such projects required to absorb the billions allocated in climate finance is staggering. Projects, whether private or public, must meet certain economic feasibility and viability criteria, as well as the requirements of the various actors involved, including banks, investors, suppliers and offtakers. The International Energy Agency (IEA) estimates that Africa as a whole would need around USD 125 billion per year in clean energy investments each year until 2030 to reach its energy and climate goals, including the addition of nearly 130 gigawatts (GW) of installed capacity for solar photovoltaic (PV). (IEA, 2022a). For an approximate average project size of 50 megawatts (MW), this would amount to more than 2600 projects in the next seven years, or slightly more than one new project entering into operation each day from now until 2030. This illustrates why understanding and supporting the project development and finance processes is key for scaling up renewables.

This review emphasizes the project level perspective, including aspects such as the project development process, the prevailing logic of investing in real assets, and the role of risk from the viewpoint of developers. The FfD approach relies on the process of project development and finance, which has evolved over time and currently delivers adequate outcomes, especially in high-income countries. This process is discussed at length in the following chapters of this review. The aim of the FfD approach is to minimally intervene in the existing process to solve the crucial pain-points and thus make more projects meet the selection criteria of private investors in developing countries. This can include wide programs, such as strengthening the rule of law or contract enforcement, which may take decades to bear fruit, but also narrow interventions such as technical assistance or blended finance that enable specific projects, with a shorter-term perspective. One of the most relevant class of interventions is RMT. By either reducing the probability of adverse events that can affect the value of an investment or reducing the severity of the consequences should such events occur, RMT provides comfort to investors to allocate capital to regions where risk is perceived to be high.

1 In this paper, the word *firm* refers to legal entities that take in capital, invest in assets and through their operations of production and sales of goods or services aim to generate profits after satisfying all other legitimate claims from stakeholders, including lenders, clients, suppliers, communities and states.

To illustrate the approach, the sector chosen for this review is utility-scale renewable energy[2] – one of the most intuitive and successful climate sectors, where the FfD approach and, more specifically RMT, have been applied. For example, 88% of financing invested into blended climate projects globally were directed to renewable energy between 2019 and 2021 (Convergence, 2022).

The regional focus for this review is SSA. SSA is home to the greatest number of people with inadequate access to electricity – an estimated 590 million in 2021 (IEA, 2022a). Of the 20 High Impact Countries for progress in energy access, as defined by Sustainable Energy for All, 15 are in SSA (SEforALL, 2023). While adding more utility-scale renewable energy connected to the grid does not directly translate into greater access to energy for the population, the positive impact is clear in terms of economic growth, diversification of energy sources and avoidance of fossil-based capacity. Moreover, many countries in SSA rely on hydroelectricity and the increasingly frequent severe draughts create acute shortages that require emergency purchase of mostly fossil-based generation at high prices. Greater utility-scale renewable energy deployment would eliminate or reduce the magnitude of this problem.

The abundant renewable energy resources (wind, solar, hydro or geothermal), economic and population growth add to the case of accelerating renewable energy deployment in SSA. As the world is aiming for net zero while pursuing SDG 7 (access to energy for all), ensuring that SSA does not embark on a fossil-based growth path becomes a matter of global relevance. In this context, existing investment flows have been limited. From 2000 to 2020, only about USD 40 billion have been invested in renewable energy in SSA, amounting to less than 1.5% of the total sum at the global level (IRENA & AfDB, 2022) while the region accounts for almost 15% of the global population. On the other hand, SSA has been the destination of 41%, the highest percentage of all regions, of climate blended finance between 2019 and 2021 (Convergence, 2022). While low in absolute amounts, private climate finance in SSA uses blended structuring particularly to address the issue of higher perceived risk. This makes SSA highly relevant in the RMT space particularly in renewable energy.

The rest of the report will proceed as follows. The first section will briefly review the notion of investment risk, particularly in developing countries and the related concept of cost of capital. This will be followed by a review of the developer's perspective in selecting, financing and implementing a renewable energy project, closely following basic corporate finance theory. Finally, the main categories of risks in renewable energy will be discussed, together with the most relevant programs and instruments meant for mitigating or transferring them to other parties.

2 Renewable energy here will mean utility-scale wind and PV (higher than 10 MW), however, the vast majority of projects in the chosen region are PV.

2. Risk and return in developing countries and the cost of capital

To attract private (i.e. profit-seeking) investment, there need to be project opportunities that provide adequate returns for a given level of risk. While private actors are continuously scouting for such project opportunities, there are many reasons why investment may not materialize. For all investors, the perception of risk is a significant barrier (NZAOA, 2021).

The higher perceived risk of investing in a certain technology or region translates into a higher required return from debt or equity investors to compensate for the higher probability of events with negative impact on the project investment value. What is defined as return from one side of the financing decision is, in effect, a cost for the other side. The cost of capital has been shown to be higher in developing countries, where risks are perceived to be higher (Damodaran, 2021).

In the case of firms in the financial sector, the level of tolerable risk is regulated and represents one of their fundamental features. For example, banks went through a significant review process after the 2008 crisis, as excessive risk-taking was seen as the main cause. The Basel III framework provides for more stringent rules and requirements on loss-absorbing capital, liquidity, leverage and more cautious definitions for market and counterparty risks, and securitization (BIS, 2017).

While the caution that lenders take in appraising projects may be frustrating to developers and all stakeholders who demand more investments on the ground, there are also regulatory limits to what lenders can do, stemming from the experience of excessive risk-taking. After all, private financial institutions are managing deposits and investments that ultimately originate from individuals who expect security and returns from their capital to have confidence in the system.

The relationship between risk and return is well documented (Brealy et al., 2018). Firms receive capital from the financial markets and, through their operations, must select projects that generate returns higher than the cost of capital. Capital is provided by debt and equity investors who forgo other uses for it, and thus want to be compensated. Higher risks are almost automatically associated with higher expected returns, as exemplified by the long-term difference in returns between highly rated (safe, lower return) government bonds and (riskier, potentially higher return) stocks in different sectors.

According to portfolio theory, risk can be diversified away by including a greater number of investments with uncorrelated returns. When that is achieved, the investor is exposed only to systematic risk, which affects all economic activity and cannot be diversified away. Hence, rational investors prefer portfolios with the highest level of return and the lowest amount of systematic risk. To attract capital to economic activities in countries perceived as highly risky, higher expected returns will therefore be needed. Moreover, with less developed financial markets and the absence of a track record to calculate even the diversifiable company risk, many of the risk management tools are less applicable.

From this perspective, developing countries are at a disadvantage, as they are traditionally associated with higher systematic risk due to differences in political landscape, strength of legal institutions and economic structure (Damodaran, 2021). Many developing countries are perceived to have weaker institutions, rule of law and property rights, and thus risky for doing business. They also tend to have less developed financial markets to channel capital into economic activities and lower amounts of accumulated domestic capital. As such, they rely more on foreign capital, whether from private investors or DFIs. In many cases, the structure of their economies is less diverse, which leaves them more vulnerable to shocks, such as in commodity markets which rapidly translate to other sectors. They also typically have unstable exchange rates, exposing foreign businesses to currency fluctuations or even limits to convertibility.

In addition, with global markets becoming increasingly correlated, particularly during economic downturns, country risk appears not to be diversifiable (Damodaran, 2021). This may help explain the reality of risk premiums that are observed in developing countries compared to developed countries, even for diversified investors.

The cost of capital

Higher perceived risk commands higher expected returns for investors to compensate for the potential downside. Return for the investors is a cost for the project, namely the cost of capital.

The cost of capital is understood as the minimum required expected return by an investor in exchange for the decision to commit capital to one project and forgo its other uses. It is based on its two main components, debt and equity, given their different inherent features. Debt investors, whether through loans or bonds, require the firm or project to pay back a fixed sum, composed of principal and interest and have priority in the payout order to equity investors. In addition, interest payments are tax deductible. Equity, on the other hand, has greater downside risk, given the lower ranking in the payout order, but also has an unlimited upside potential compared to debt. However, dividend payments are not typically tax deductible. All in all, the cost of debt tends to be lower than the cost of equity because the risk is lower (Brealy et al., 2018). The Weighted Average Cost of Capital (WACC) combines the equity and debt components in proportion to their weight.

$$WACC = \frac{E}{E+D} * R_E + \frac{D}{E+D} * R_D * (1 - T)$$

Where E is the amount of equity, R_E is the cost of equity, D is the amount of debt, R_D is the cost of debt and T is the tax rate.

The cost of debt is the interest rate demanded by lenders, generally composed as the risk-free rate (theoretical rate of return on an asset with zero risk) plus margin based on various consideration including inflation expectations and the creditworthiness of the borrower.

The cost of equity is less intuitive as it involves estimating the minimum required return for an investor to commit their capital to one project instead of the next best alternative. As an approximation, the Capital Asset Pricing Model (CAPM) is used. Based on CAPM, the return on equity is determined as the risk-free rate plus an equity risk premium adjusted by a correlation coefficient beta. The latter determines the correlation between an individual return and the market return, gauging the extent to which the individual return mirrors the rest of the market. Two crucial caveats to the CAPM are that its validity relies on a number of forceful assumptions and that it is based entirely on the past, which may or may not be informative for the future.

The ratio of debt to equity is also relevant, as debt typically has lower cost and favorable tax treatment of interest payments, limited by the creditworthiness of the borrowing entity.

The cost of capital in renewable energy

The cost of capital is relevant for any investment and sector, but it is particularly relevant for renewable energy because of its financial profile. Renewable energy projects are highly capital intensive, as the initial investment constitutes most of their lifetime costs, with no fuel costs and relatively minor operation and maintenance costs. Given this, the cost of capital has an outsized importance in determining the lifetime cost of the project, as well as the levelized cost of electricity (LCOE). In other words, higher WACC results in a disproportionately higher LCOE for renewable energy than for other fuel-consuming energy technologies. For example, the cost of capital for PV has been shown to have a greater influence on LCOE than solar irradiation (Ondraczek et al., 2015).

Schmidt (2014) argues that the cost of capital is one of the biggest barriers to renewable energy deployment in developing countries and proposes a research agenda including a global database on financing costs and their drivers, especially in developing countries, and the impact, effectiveness and efficiency of policy and financial de-risking. While recent literature did contribute to this agenda (Agutu et al., 2022; Dobrotkova et al., 2018; Donovan & Corbishley, 2016; Michoud & Hafner, 2021; Muñoz Cabré et al., 2020; Polzin et al., 2019; Steckel & Jakob, 2018; Steffen, 2020; Sweerts et al., 2019), the efficiency, effectiveness and impact of de-risking have not been adequately addressed. This is mainly due to data limitations. The cost of capital faced by firms is generally not disclosed as it is considered commercially sensitive.

Since the relationship with risk is at the core of its definition, the cost of capital is higher in countries and regions perceived as riskier. Adding to this problem, investors tend to have a home bias, meaning they feel safer deploying capital in their home jurisdiction. To incentivize them to do otherwise requires even higher returns, which is equivalent to a higher cost of capital (Ameli et al., 2021).

Another implication for risk is the reliance on project finance. Renewable energy in developing countries is well suited for project finance structures, which allow for separating and allocating risks to different parties (Baker & Benoit, 2022). A project company is set up by equity sponsors and the majority of financing (typically between 65% and 75%) comes from non-recourse long-term debt. Hence, lenders become the key decision makers on project viability. Since debt repayment relies wholly on the cash flows of the project, lenders are understandably diligent in assessing and protecting themselves against any risks to those cash flows throughout the repayment period. In certain contexts, project finance structures may lead to higher cost of capital, while the rare cases of projects financed on corporate balance sheets may reduce the cost of capital (Dobrotkova et al., 2018). The choice of project finance tends to come from the higher perceived risk.

The relevance of the cost of capital for renewable energy investments also affects decarbonization scenarios. There is evidence that such scenarios are less precise when they assume uniform cost of capital for different regions (Agutu et al., 2022; Ameli et al., 2021; Sweerts et al., 2019). One estimate for WACC values for 46 countries in Africa based on a stylized model found the range is between 8 and 32%. These differences translate directly into higher costs for the projects and to fewer projects being feasible, directly impacting decarbonization and electrification models.

Ondraczek et al. (2015) compiled a list comprising the economy-wide cost of capital in 160 countries, based on assumed debt to equity ratios, publicly available interest rates and equity risk premiums. While not up to date, the compilation provides an illustrative example of the differences between high-income countries and those in SSA. The range is between 4-5% in the UK, Canada or Sweden to 29% in Madagascar, 32% in DRC and one outlier at 254.9%, Zimbabwe, a country that was facing a difficult public finance situation at the time.

There have been attempts to reverse engineer actual cost of capital numbers for renewable energy projects in SSA. The matter is complicated by the presence of various RMT instruments and concessional finance deals. Dobrotkova et al. (2018) created a database of PV auction winners to investigate the sustainability or viability of low LCOE projects in developing countries. They tried to recreate the main drivers behind the financial models of the winning bids: investment costs, capital costs, solar irradiation, opex, taxes and others. They used publicly available information to estimate the confidential data such as financing terms. They also checked their results with experts, regulators, consultants and market participants. The resulting capital costs vary, but the SSA examples are lower than what is assumed at country level, which may confirm the effect of the RMT instruments or programs.

Developing countries face significantly higher cost of capital than richer countries, but even within categories there seem to be large differences between similar countries, suggesting the estimations are imprecise. Steffen (2020) conducts a global systematic review of various methodologies and their results in estimating the cost of capital for renewable energy investments – utility-scale PV, onshore and offshore wind. The results confirm the scarcity of data and the difficulty of accessing commercially sensitive data on project finance structures, where disclosure is not mandatory. However, based on the various estimations, Steffen (2020) concludes that PV has the lowest cost of capital amongst renewable energy technologies, followed by onshore and offshore wind.

Adding to the body of evidence, IEA (2021b) reiterates the importance of the cost of capital in the LCOE of renewable energy. It shows that both economy-wide interest rates and equity risk premiums have been decreasing since 2016 – likely no longer valid in the high inflation/high interest rates environment of 2022-2023. The report also estimates project-level WACC ranges for four geographies: Europe, USA, China and India. The ranges are clearly higher in India than the other four geographies and for projects exposed to merchant risk compared to the ones with long-term offtake contracts. This further illustrates the unequivocal relationship with risk.

IRENA (2022) in its yearly Power Generation Costs report describes a new methodology around WACC, with the 2022 edition being the first where WACCs are differentiated by country and technology. While many SSA countries are missing, one can easily observe that most cases of WACC underestimation are in developing countries, while for most rich countries WACCs were overestimated.

The IEA also launched the Cost of Capital Observatory in 2022 (IEA, 2022b). The project aims to create and update a database of project-level WACC data throughout the world. It is widely believed that greater transparency regarding the cost of capital can inform both policymakers and investors in deploying more renewable energy especially in developing countries. The Observatory uses a structured interview sent to finance professionals and developers around the world to both estimate the WACC and gather information on its most important determinants. Based on the first iteration of the survey, the most relevant drivers of higher WACCs are political, offtaker, land rights, currency and transmission risks. As for actual values for WACC, the Observatory only publishes data on five emerging economies: Brazil, India, Indonesia, Mexico and South Africa. For a 100 MW PV plant the median nominal after-tax local currency WACC ranges from 9.75% in India and Mexico to 13% in Brazil. All are slightly increased in 2021 compared to 2019.

To further confirm the relevance of the cost of capital, Ameli et al. (2021) model the impact of different WACCs on decarbonization pathways in developing countries. They identify a climate investment trap in which the high cost of capital leads to reduced investment which exacerbates the climate problems, affecting GDP and financial markets, which increases the cost of capital. They also provided evidence for home bias in allocation of capital and identify shortcomings in sustainable finance frameworks that leave out developing countries. UNEP et al. (2018) finds that climate change is already contributing to increased cost of capital in a group of 20 vulnerable countries, with the average cost of debt up 117 basis points. In other words, the cost of capital is a barrier to climate investments, while climate vulnerability increases the cost of capital.

3. The developer's perspective and the relevance of risk

To understand more concretely the relevance of risk and the cost of capital in project development, a short discussion of the theory and practice of investment selection can be helpful.

Firms receive capital from financial markets in order to purchase real assets that may generate returns in excess of the cost of that capital. The firm may choose to reinvest those returns, but ultimately distributes them as dividends back to investors.

Financial markets, among other functions, connect the private capital of individuals to investment opportunities. Individuals seek a return on their deposits, bonds and equity (stocks) investments through interest rates, dividends, pensions and other means.

Investors typically have alternative destinations for their capital, and are thus faced with an opportunity cost. To be attractive, a firm must offer investors an expected return that is higher than the next best alternative.

The optimum way to finance the firm's operations with debt and / or equity is called the financing decision. The selection of projects as destination for the raised capital is called the investment decision.

Investment selection at firm level

The firm scouts for investment opportunities (e.g. new production facilities in new markets) and performs a valuation exercise to understand whether they are value creating (i.e. whether they generate expected returns higher than the cost of capital).

To do so, the firm estimates, based on the best available information for the entire useful life of the project:

- Revenues - the quantity and price of products sold (based on market demand estimations)
- Cost - capital and operational costs (based on projections)
- Discount rate[3] - the opportunity cost of capital, which is equivalent to the return on the next best comparable alternative investment

Applying the Net Present Value (NPV) rule, the firm would only select investment if NPV>0.

$$NPV = -C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_T}{(1+r)^T}$$

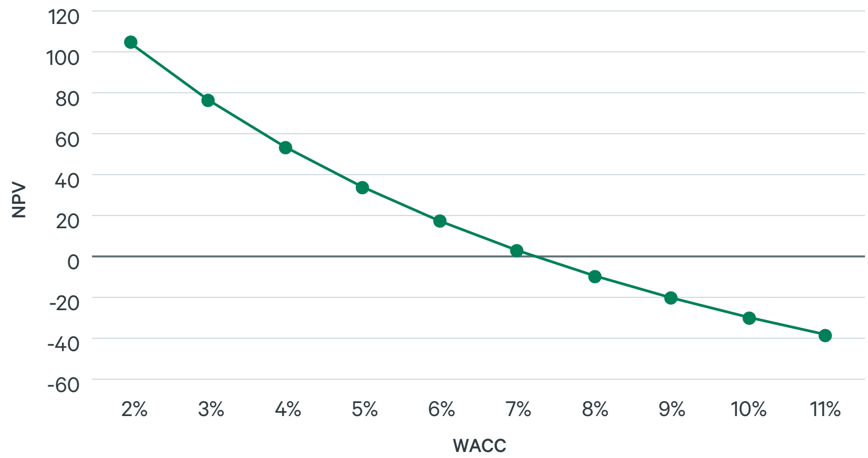
As can be seen, the NPV is higher as the free cash flow (C_n) is higher and the discount rate (r) is lower.

The firm is using the capital of investors (through various intermediaries like banks or pension funds) to provide an expected return in excess of any alternative investment with similar risk. For example, if a project's return is lower than what an individual would get by keeping their capital in safe government bonds, the project should naturally not be selected.

3 While there are other uses of the term "discount rate", here it refers to the financial discount rate understood as the opportunity cost of capital.

To estimate the discount rate, most firms use the WACC formula, discussed earlier. Thus, NPV is the crucial metric for investment selection and it depends on the WACC (see Figure 1). In turn, the latter depends on perceived risk. Taken together, this means that higher perceived risk translates into lower NPV, other things being equal, which can translate into the project no longer being seen as value-creating.

Figure 1. Illustrative NPV as a function of WACC



Project selection in renewable energy[4]

For renewable energy, particularly in mature markets, the investment selection process follows the same stages described above. The process usually starts with an equity sponsor/developer identifying land with good prospects of being developed into a renewable energy plant – good solar irradiation or wind speed and proximity to interconnection options. When potential options are identified,[5] developers perform due diligence (at a cost) on the opportunity, assessing land suitability for construction, detailed resource measurement, interconnection possibilities, eligibility for various incentives, and local or regulatory acceptance. If the analysis is positive, the project graduates to the advanced development phase, which involves further costs. Even at this stage the project may or may not end up being built, and often the project development costs are never recovered. In parallel, the developer looks for potential offtakers by submitting bids to various renewable energy auctions (corporate or utilities) or engaging in direct negotiations.

The next step is to further test the assumptions from due diligence and create the "investment package". To build this package, the developer collects information on the revenue and cost estimations for building, running and financing the project throughout its lifetime. The financing decision and investment decisions are analyzed in parallel.

Based on all the input collected and verified, the financial model of the project is built, containing detailed estimates on revenues, costs and the discount rate.

This model, together with the wider investment package containing all relevant information is then presented in the developer's internal investment committee, where all assumptions and projections get stress tested. In the end, a decision is made by the internal investment committee on whether to pursue the investment or not; if positive, the project moves to the construction phase.

In most SSA contexts many of the stages of the process are identical, but there are some crucial additional milestones. DFIs and governments are typically involved throughout, which is meant to get investors more comfortable with the potential investment destination. Such public entities

4 There is significant variation in what actors perform the various steps and in what order. In SSA, the government, the utility or DFIs may perform some early development work,

5 In some cases, the land is identified as part of a public procurement process.

often contribute to selecting sites, as well as performing or subsidizing feasibility studies, interconnection studies and environmental, social and other assessments. Further, the selection of IPPs tends to come as a result of an auction or a direct negotiation with the government or the national utility, which serves as the offtaker in most cases. Typically, the terms of the cooperation between the government and the investors are specified in an Implementation Agreement, which includes the concessions, regulatory conditions and a termination clause backed by a sovereign guarantee. Finally, due to the reliance on project finance structures, the crucial milestone in the development process is the financial close – when lenders have performed their due diligence process, have agreed to all negotiated terms and signed the loan agreements.

The process seems linear and straightforward but is more of an iterative game. The negotiations within the firm and the knowledge gathering from outside are complex processes that involve people with different agendas and incentives. The numbers that seem to define an objective reality are, to a significant extent, the result of subjective perception and personal incentives. When estimating the future, a range of possibilities is considered for the most consequential variables: revenue, cost and risk. Deciding on a value within that range often implies subjectivity.

What is certain is that most firms receiving most capital follow this process using these tools and the WACC, CAPM and NPV rules, and are likely to continue to do so for the time being. What can change is how they decide on the inputs to the financial model; while revenues and equipment costs are important, a crucial point will continue to be the discount rate. Manipulating the latter is one of the main instruments of the FfD approach – by reducing and transferring risk, the cost of capital is reduced, and more projects become NPV-positive, and thus feasible.

Renewable energy investments in SSA

The investment selection process can be applied while looking at the pace of investments in renewable energy in SSA. SSA has attracted an almost negligible share of the global renewable energy investments from 2015 to 2020 (IEA, 2021a). The reasons are certainly numerous and complex, but we will focus only on the immediate, material reasons that become relevant in the investment selection process.

Renewable energy as an industry is in many ways similar to real estate. If a decent return and manageable risk are yielded from the combination of land, infrastructure and, in the case of renewable energy, wind/solar resource on one hand, and customers willing to pay on the other, then construction starts and is completed within 1–2 years with a less challenging operational phase due to no fuel needs.

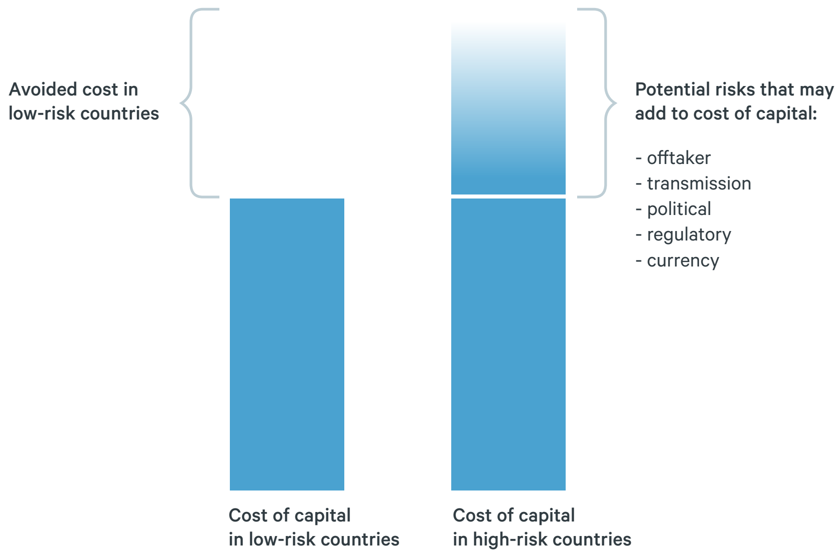
The most relevant elements for renewable energy are thus land, resources and interconnection. The most crucial element is an offtaker willing and able to pay a price that covers costs and yields a profit. While renewable resources are not scarce in SSA, suitable land and, above all, interconnection and offtake deals can be.

Since significant and trustworthy offtake opportunities are rare and interconnection is an issue, there are fewer small developers searching for opportunities on the ground. When credible offtake becomes available, like in the case of South Africa, an entire sector of small businesses emerges and scouts for projects to develop and sell.

Even when the basic conditions for developing a project are met, the issue of risk rises to the forefront. As discussed earlier, the projects meet the selection criteria by narrow margins and any change in revenue or cost throughout the project life may suddenly turn it from value-creating to value-destroying. Most of the project costs come in the construction phase and the useful life [of a plant] tends to be long (20–25 years). Recovering the costs and making the return depends on the offtaker making the agreed payments during the lifetime of the project.

Committing capital to a renewable energy plant involves several risks, and these perceived risks contribute to the higher cost of capital (discount rate). While not always numerically represented, they add up and make investors require compensation for choosing a project/firm/country perceived to be riskier than alternatives (Figure 2).

Figure 2. Illustrative cost of capital in low-risk and high-risk countries



Even in OECD countries, some of these risks have materialized with dire consequences for the value of projects, but they are seen as much higher in probability in many SSA countries.

4. Types of risks for renewable energy and their relevance in SSA

The issue of risk and risk management is fundamental for renewable energy investments (CEPA, 2014; IRENA, 2016; RES4Africa, 2019, 2020; Waissbein et al., 2013; Muñoz Cabré et al., 2020). There are several categories of risks and all are relevant for investors, with some more salient in certain regions than others. Some risks have a long history of mitigation products offered by the private sector, while for others, DFIs are the only actors capable of bearing them.

Waissbein et al. (2013) identify 9 risk categories:

Power market risk stems from the configuration of the market and its regulations, limitations to power trading, PPAs or other instruments as well as lack of predictability of demand. These risks are fundamental for the credibility of the revenue stream and the value of the project.

Counterparty risk implies that the project may not receive payments as set in the PPA terms. This risk is higher in countries where utilities serving as offtaker for the power suffer from poor financial health. Utilities whose tariffs are not cost reflective or lack management independence and professionalism tend to be associated with greater counterparty risk. Many utilities in SSA find themselves in this situation.

Grid and transmission risk implies restrictions to grid connection, congestion, limited capacity or inadequate system operations and balancing capabilities to integrate additional intermittent power. Where utilities are financially constrained, as in many countries in SSA, grid expansion and integration constitute significant barriers. The incidence of this risk is related to one of the fundamental requirements on which any project depends and over which they tend to have little control: the ability to evacuate the power generated and transport it to users.

Political risk includes several types of adverse events that can affect the value of an investment, such as violence, war or regime change, lack of government capacity or weak rule of law, but also changes in laws, breaches of contract by the sovereign entity, expropriation, restrictions on capital or currency convertibility.

Currency and macroeconomic risk materializes through exchange rate volatility, high inflation and interest rates, affecting the value of the project before completion or during operations. For most projects in SSA, equipment needs to be imported using hard currency (HCY); financing is also in HCY, while revenues are in local currency (LCY). This mismatch creates significant risks for the offtaker and, ultimately, for the project if the offtaker becomes distressed.

Permitting risk translates into possible delays and redundancies in the process of receiving all the necessary authorizations, licenses and permits from various authorities. Long permitting processes add to the development cost and may even hinder the development process from starting in the first place.

Social acceptance risk is inherent to infrastructure projects that have significant local impacts on land and landscapes for long periods of time. In countries where land rights may be under complex arrangements, as is the case in SSA, such risks can be exacerbated.

Resource and technology risk is faced by developers who may be confronted with a lack of credible information on resource measurement or insufficient suppliers on the ground for all the equipment and services required to design and build the plant. As these services have been standardized over time, these risks are now adequately handled by developers or private suppliers.

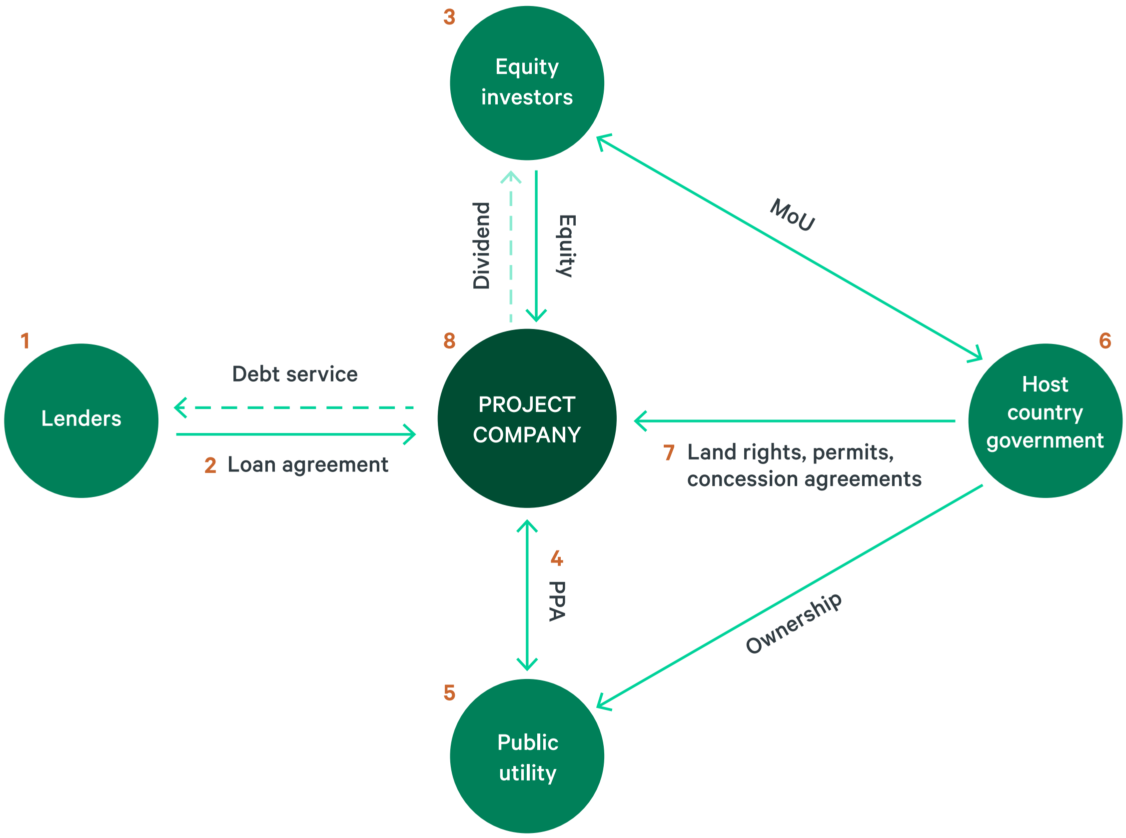
Financial sector risk is significant in countries where financial markets are still developing. Local capital may be insufficient or local financial institutions may lack the experience and the instruments to finance renewable energy projects. In some countries in SSA, the capital-intensive character of renewable energy investments prevents local banks from participating.

IRENA (2016) also identifies 9 key investment risks, many of which are similar to the ones featured in Waissbein et al. (2013). The differences come from i) adding resource risk, applicable to geothermal projects, ii) replacing financial sector risk with refinancing risk – the difficulty to refinance loans during the plant operations, stemming from maturity mismatch between the project useful life and the loan term; iii) including the permitting risk under policy/regulatory risks and iv) featuring a separate category for liquidity risk stemming from the timing of cash receipts and payments.

RES4Africa (2020) takes a more granular approach and identifies 28 risks, grouped along 5 dimensions: (1) legal framework enabling investments, (2) risks affecting revenues, (3) risks affecting costs, (4) risks affecting financial structuring and (5) environmental/social issues. It includes all stages of development, from setting up the legal entity to securing land rights and designing, building and operating the plant in a financially and socially sustainable manner. The additional risks mentioned include curtailment risks, logistics, security and safety risks, skills availability and force majeure risks. This detailed approach illustrates the real-life experience of a project developer and the numerous risks faced at each stage of the development process.

A schematic representation of risks faced by renewable energy developers, typical for most projects in SSA, is presented above (see Figure 3). It shows the contracts between the project company and various stakeholders and between some of the stakeholders. The project company collects equity from sponsors and loans from lenders, and relies on the government for land rights, permits and interconnection, and on the offtaker to provide regular payments for the electricity. All these contracts entail risks and for each, some stakeholders are better equipped than others to bear them. There are several ways in which development partners can contribute to making projects viable and they are also presented in Figure 3.

Figure 3. Typical project finance structure in Sub-Saharan Africa



Potential engagement by development partners

1 Concessional lending
2 First loss / guarantees / tenor extension
3 Equity investors / project preparation grants / viability gap grant
4 Payment guarantees, subsidized currency hedging
5 Technical assistance / grants / PPA templates
6 Technical assistance (rate design, regulation, competitive procurement) / indemnity agreement
7 Environmental and social assessment
8 Viability gap grants, political risk insurance

5. Risk mitigation for private utility-scale renewable energy investments

Recent literature identifies risk mitigation and related reductions in cost of capital as a major policy objective for the global energy transition (Komendantova et al., 2019; Matthäus & Mehling, 2020; Muñoz Cabré et al., 2020; Polzin et al., 2019; Steckel & Jakob, 2018; Taghizadeh-Hesary & Yoshino, 2020; Tiyou, 2021). RMT instruments aim to reduce or transfer some of the most relevant risks and thus make investors more comfortable with committing their capital in a certain country or project (see Figure 4). The approach divides risk mitigation into two strands, even though they tend to be significantly related: policy risk and financial risk.

Figure 4. Risk Mitigation and Transfer

Several terms are being used interchangeably in the literature, despite having slightly different meanings. Two widely used terms are *de-risking* and *risk mitigation*. While some interventions do aim at reducing perceived risk, most instruments are in effect transferring risks to other parties rather than reducing them. Other sources use the term *risk transfer,* which may capture more accurately the reality of such instruments. Interventions related to risk tend to aim for either or both: i) reducing perceived risk (i.e reducing the probability of adverse events occurring, such as by strengthening the management of the utility or reducing the cost of doing business) or ii) limiting the consequences of such events, should they occur, by transferring risk to other parties (i.e. compensating the project when the utility fails to make a payment). Another clarification worth making is that risk transfer instruments represent costs to the project. Similar to insurance, the various guarantees and facilities put a price on the protection they offer to lenders and investors. This price tends to be more competitive than the private sector because of the concessional nature of the sponsors of such instruments (DFIs). This report uses the term risk mitigation and transfer (RMT) introduced in Duma et al. (2023).

Reducing policy risk is achieved by a combination of friendly policies that address barriers to private renewable energy investments. These can be specific to the energy sector but can also include a wide variety of country level issues – government capacity, financial sector development and the cost of doing business. Any improvement to the latter can be considered policy de-risking. Many renewable energy-specific interventions are likely to fall under this category: reforming the public utility, strengthening transmission infrastructure or regulation, streamlined permitting or customized regulation for long-term PPAs. Thus, policy de-risking is aimed at reducing the probability that an adverse event occurs and affects the value of a project.

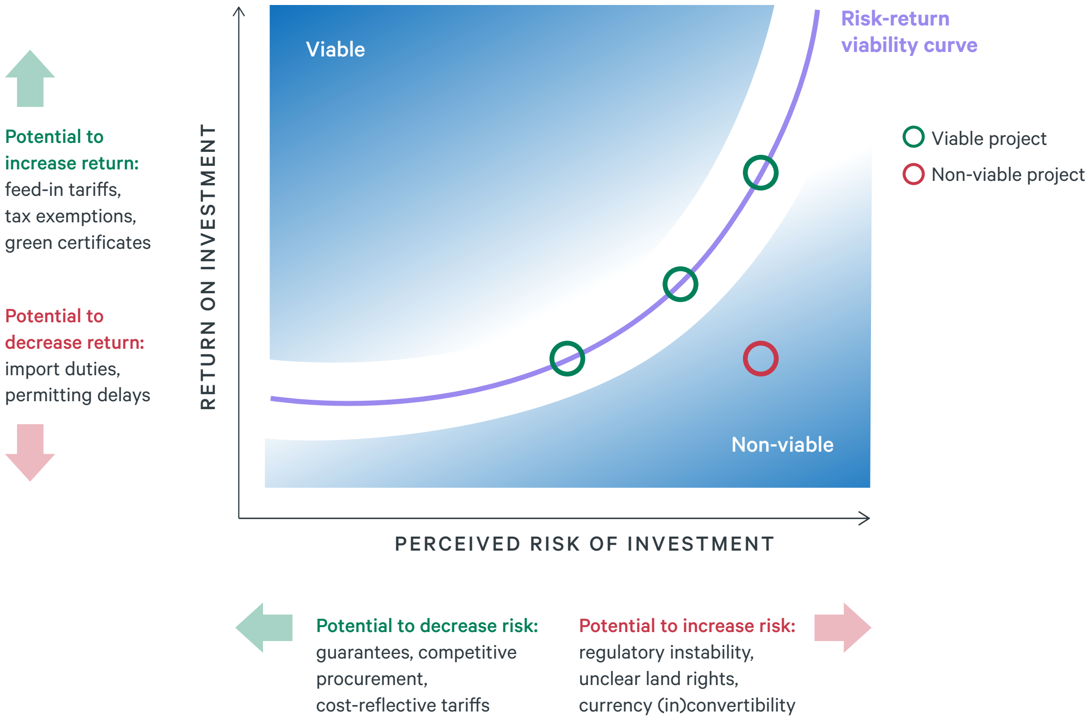
Financial de-risking, on the other hand, reduces the damage to the covered party in case the adverse event does occur. Thus, financial risk is not necessarily reduced *per se* but transferred, for a fee, to a third party, most often to a DFI.

Waissbein et al. (2013) propose a comprehensive approach for setting up a de-risking intervention in the renewable energy sector that starts with a cornerstone instrument – the one that sets the basic principles of renewable energy growth in a country. Based on experience, these are renewable energy auctions or FiT, PPAs with take or pay clauses and guaranteed access to the grid. All of them require legal and regulatory preparation and are the foundation upon which a renewable energy sector can be built. Such cornerstone instruments are meant to reduce both policy and financial risk.

This is complemented with the appropriate policy and financial de-risking instruments. Streamlined permitting, long term planning, utility reform, capacity building for the government, regulatory or financial sectors to deal with renewable energy requirements would all be concrete examples of policy de-risking. Financial de-risking (or risk mitigation) includes instruments like concessional lending, risk participation, guarantees and insurances.

These instruments have been used extensively in most if not all projects in SSA and can be seen as covering the risks that were not credibly addressed through policy de-risking. If a negative event materializes – unilateral changes to terms of a contract or the utility stops honoring their obligation – a third party covers part of the damage to the project. Having this coverage provides comfort to the equity and debt investors which can lower the cost of capital and move the project into the feasibility zone (Figure 5). These instruments will be discussed in detail.

Figure 5. Shifting the risk-reward profile of renewable energy projects



IRENA (2016) presents a framework for approaching risk that aims for the greatest scalability. It also starts with the adequate policy framework that can enable the emergence of a renewable energy industry in the country by attracting both investors and contractors for the required services. Project development then is best encouraged via concessional on-lending for project preparation and the availability of financial de-risking instruments. The next step for scale is to aim at creating investable projects for institutional investors (pensions, insurance, sovereign funds, endowments and foundations) that have limitations to their investment mandates. Through aggregation and securitization one can create financial products that meet the requirements of size, maturity, liquidity and risk-return profile of institutional investors. IRENA (2016) also identifies a portfolio of potential financial risk mitigation instruments that cover renewable energy investment risks , and most of these instruments have been used in a variety of projects throughout SSA and the world. Figure 6 presents a sample of investment risks and the RMT tools available to address them.

Figure 6. Selected risks and risk mitigation and transfer instruments

Tools / Risks	Off-taker	Transmission	Political	Regulatory	Currency
Sovereign guarantee	●		●	●	
Political risk insurance	●		●	●	●
Project-based guarantees (partial risk/credit/payment)	●	●	●	●	
Export credit guarantee	●	●	●	●	
Currency hedging instrument					●

Adapted from: IRENA, 2016

Sovereign guarantees represent the backing of the sovereign in the event of an unmet obligation by a government-controlled entity towards a third party. In renewable energy contexts, in many developing countries, the offtaker is a fully or partially state-owned utility, and usually enters into a long-term contract (15–25 years) with an IPP. These utilities tend to have poor credit ratings and investors demand sovereign guarantees as a condition for backing the project. Guarantees can cover other obligations than payment, including tax, currency convertibility and transfer, termination clauses and other elements under the control of the government (IRENA, 2020). Sovereign guarantees count toward public debt, which makes them more difficult or impossible to grant in the challenging post-Covid situation. In addition, experience with successful arbitrations has made governments more wary in issuing such guarantees. This can completely block renewable energy growth in some countries as lenders are not allowed to extend credit to projects backed by an entity with a poor credit rating without a sovereign guarantee, and the sovereign can no longer issue guarantees because of high levels of public debt and restrictions (from the IMF, for example). While they have been used in countless projects successfully, government guarantees have been criticized and other instruments and models are being tested with the aim of moving away from such guarantees.

Political risk insurance (PRI) covers cross-border public or private investors in the event of currency inconvertibility and restrictions, expropriation, war or civil unrest, and breach of contract. PRI generally does not require indemnity from the host government (but does require approval) and can cover both equity and debt investments up to, or sometimes even above, 90% of the total investment. They tend to be priced like an insurance, based on the specific project context, and can also be reinsured. MIGA, part of WBG, is one of the main providers of PRI but other MDBs also offer such products. PRI is widely available from private insurers as well. While effective in covering much larger losses, like any insurance, they do add to the costs of the projects, which may or may not push projects outside the feasibility zone.

Project-based guarantees, such as partial risk guarantees (PRG) and partial credit guarantees (PCG), were first introduced by the World Bank Group (WBG). They are obligations of payment by institutions of the WBG covering any event under the control of the government, including currency inconvertibility, expropriation, war, violence, non-payment and regulatory changes. One of the main differences from PRI is that they require indemnity from the host government, which adds another layer of protection and provides a powerful deterrent to harmful government actions.

PRG and PCG are similar in coverage but provide protection to different parties to the transaction. PRG provides cover to lenders who finance private projects in case of defaults caused by the government, while PCG provide cover to lenders in case of defaults of debt service by a government-owned or controlled entity. Since 2016, the WBG decided to increase flexibility for both products, which are now called loan guarantees (World Bank, 2016). They are offered by other MDBs such as the AfDB and the ADB. In reality, these instruments are rarely triggered because of the strong deterrent effect of MDBs and especially the WBG.

A third type of project-based guarantee of the WBG is the payment guarantee, which covers non-loan payment defaults by a government entity (for example PPA payments). This can be arranged directly or through a Letter of Credit (LC) issued by a private bank in favor of the project company. The latter can draw immediately from the LC in case of non-payment from the government and the private bank benefits from the guarantee. This, in effect, adds a liquidity guarantee component, ensuring the project company can continue making timely debt service payments even when PPA payments are delayed. For renewable energy project finance structures in developing countries where all revenues come from a single offtaker with poor credit rating, external liquidity facilities are often required by lenders as a condition for financial close. The IDA Payment Guarantee is an example of an instrument providing liquidity coverage. Another relevant instrument is the Regional Liquidity Support Facility (RLSF) of the Africa Trade Insurance Agency (ATI) and KfW. Backed by agreements between ATI and the host Government, RLSF provides the IPP with liquidity support covering a number of months of PPA payments. This, in turn, can offer comfort for lenders and help in reaching financial close. RLSF is also developing a Transparency Tool that aims to record the payment performance of utilities throughout the region in an effort to reduce the perception of non-payment risk.

Export credit guarantees are services offered by Export Credit Agencies to mitigate the risk of exporting to certain countries and cover a comprehensive range of events. They backstop the investors and their creditors in the event of default on debt service and thus can lower the cost of finance or improve tenors, just like other products. They tend to be highly customized and rely more on bilateral relations with host governments. The amount of export credit finance at global level is believed to be high, yet the products offered are less known. Since the production of renewable energy equipment tends to be concentrated in a relatively small number of countries, renewable energy projects often have a trade component, which may be covered by ECAs.

Currency hedging instruments protect investors from changes in exchange rate when there is a currency mismatch between revenue and debt payments. Such mismatch is prevalent for renewable energy projects, as financing needs are too high for domestic lending and projects require equipment purchases from abroad, while PPA payments come from the local utility. Often this risk is mitigated for the project by setting PPA terms in HCY but payable in LCY. In effect, the risk is thus transferred to the utilities since the price they pay increases as LCY devaluates against HCY. Currency devaluation tends to be associated with a generally deteriorating economic outlook, which means the utility is likely to face greater difficulties in collecting payments and increased costs can worsen their financial position. For some emerging markets, currency hedging instruments are available from commercial financial institutions, but many countries in SSA are excluded due to their fragile financial systems. Where they are available, the prices of hedging instruments can be too high and can make the project infeasible. TCX is a currency fund that provides swaps and forward contracts in countries where they are not commercially available, or they contribute to making them more competitive where they are. By purchasing such instruments, the buyer is protected against fluctuations in LCY. An alternative is direct lending in LCY from local financial institutions. GuarantCo provides guarantees that enable local financial institutions to lend to infrastructure projects in LCY.

6. RMT in practice: evidence

Renewable energy projects in SSA are not numerous when compared to other regions, and therefore the body of evidence on the effectiveness of RMT in their development process is limited. However, a number of contributions from the literature are looking at identifying the availability of RMT instruments and their role in bringing projects to financial close.

RES4Africa (2019) found more than 100 such instruments, with around 75 being qualified as active. The fragmentation is believed to be limiting the effectiveness of RMTs by adding to an already high level of complexity.

Frisari and Stadelmann (2015) examine the role of RMT in the case of two Concentrating Solar Power (CSP) projects in Morocco and India. They estimate the project-level financial details with and without the de-risking policies to gauge their impact. The government- and WBG-supported policies included price premiums, guaranteed offtake and concessional finance with extended maturities. They conclude that: 1) tariffs would have had to be much higher to generate the required equity returns of private IPPs without de-risking; 2) strong de-risking combined with well-organized tenders ensures that technology costs are revealed and thus avoid overcompensation; and 3) some risks, especially currency, are still inadequately mitigated.

Frisari and Micale (2015) discuss RMTs in the case of a large hydropower project in Uganda. They conclude that PRG and PRI made the largest ever private investment in Uganda possible. The PRG enabled commercial banks to lend at interest rates and maturities unavailable in the market otherwise, which reduced the electricity tariff significantly. Government ties with the WBG sent a confidence signal to investors, and the PRG and PRI reduced the potential cost of negative scenario by 70% (both its probability and its consequences). In addition, committing financial resources through guarantees requires no initial disbursement and sometimes no disbursements at all. As this case study shows, combining various de-risking instruments can lower transaction costs.

Komendantova et al. (2019) discuss the impact of de-risking CSP in MENA using a Computable General Equilibrium model and find that the effects are positive and strong on technology deployment but also on GDP and employment.

At the same time, guarantees are still underutilized as a tool for attracting private climate finance. IRENA (2016) conducted a survey of IFIs and investors and found that guarantees represents a small portion of the portfolio of IFIs. Some of the reasons mentioned are the lack of awareness, high costs and long processing times.

Conclusion

This paper has presented an overview of the fundamentals of risk and RMT for renewable energy investments, with a regional focus on SSA, including an exploration of concepts such as risk and return, the cost of capital, and types of risk and related RMT instruments for renewable energy projects. The paper emphasizes the project developer perspective to better understand how climate finance and RMT instruments can translate into actual projects on the ground.

This paper is designed to be the companion paper of Duma et al. (2023), which presents additional evidence on the project-level impacts of RMT in renewable energy projects in Malawi, Mozambique, Namibia and Zambia and provides reflections and recommendations.

Further evidence and recommendations on the role of RMTs, effectiveness and potential for improvement are being analyzed in 2023 for other regions of SSA and other developing countries.

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