SRMI Sustainable Renewables Risk Mitigation Initiative

IRENA International Renewable Energy Agency

RENEWABLE ENERGY AUCTIONS

DESIGN FOR RISK ALLOCATION

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The International Renewable Energy Agency (IRENA) serves as the principal platform for international co-operation, a centre of excellence, a repository of policy, technology, resource and financial knowledge, and a driver of action on the ground to advance the transformation of the global energy system. A global intergovernmental organisation established in 2011, IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security, and low-carbon economic growth and prosperity.

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About the Sustainable Renewables Risk Mitigation Initiative

Launched in 2018, the Sustainable Renewables Risk Mitigation Initiative is a multilateral partnership that aims to help emerging markets and developing countries develop their renewable energy sectors by attracting investments and promoting socio-economic benefits through targeted infrastructure. Partners include the Energy Sector Management Assistance Program at the World Bank, Agence française de développement, IRENA, the International Solar Alliance, Sustainable Energy for All, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, and GET.transform. More information can be found at esmap.org/srmi.

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GLOSSARY

The following definitions reflect the nomenclature used by IRENA and are strictly related to the renewable energy industry; definitions used by other organisations and publications may vary.

Auction: competitive bidding procurement process for electricity either from renewable energy alone or from both renewable energy and fossil fuels (competing against one another). The auctioned product can be either capacity (*e.g.* megawatts) or energy (*e.g.* megawatt hours).

Auction demand bands: Different categories within the total demand of an auction that require specific qualification requirements when submitting the bid (*e.g.* demand bands dedicated to specific technologies or project sizes).

Auctioned volume: The quantity of installed capacity (*e.g.* megawatts) or electricity generation (*e.g.* megawatt hours) that the auctioneer is aiming to contract through the auction.

Auctioneer: The entity responsible for setting up the auction and for receiving and ranking the bids.

Bid: A bidder's offer for the product awarded in the auction – most usually a power purchase agreement for the renewable energy generation or capacity.

Bidder: A physical or juridical entity that submits its offer in the auction process. Also referred to as a project developer, seller, or independent power producer.

Independent power producer: A private (or privately led) entity that develops, owns and operates generation facilities and sells electricity, usually under a long-term power purchase agreement with an offtaker. In auction schemes, the independent power producer is typically the bidder or project developer.

Levelised cost of electricity: The constant unit cost of electricity per kilowatt hour of a payment stream that has the same present value as the total cost of building and operating a power plant over its useful life, including a return on equity.

Offtaker: The purchaser of a project's electricity generation.

Partial risk guarantee: A guarantee instrument, often provided by multilateral development banks or development finance institutions, that covers specific risks related to government or offtaker performance (*e.g.* non-payment, breach of contract, currency transfer restrictions). Partial risk guarantees are designed to enhance creditworthiness and mobilise private capital.

Power purchase agreement: A legal contract between an electricity generator (the project developer) and a power purchaser (the government, a distribution company, or any other consumer).

Project developer: The physical or juridical entity that handles all the tasks for moving the project towards a successful completion. Also referred to as the seller, bidder or project company, since the developer is the one who bids in the auction.

Request for proposals: A formal procurement document issued by the auctioneer or contracting authority inviting bidders to submit comprehensive technical and financial proposals for a project or service. In renewable energy auctions, the request for proposals typically includes detailed project requirements, evaluation criteria and draft contractual documents (*e.g.* power purchase agreements) and requires bidders to propose both their solution and their price or tariff.

ABBREVIATIONS

BOO	build-own-operate
BOOT	build-own-operate-transfer
DFI	development finance institution
EDFI MC	Association of European Development Finance Institutions Management Company
EMDEs	emerging markets and developing economies
EPC	engineering, procurement and construction
EU	European Union
GET FiT	Global Energy Transfer Feed-in Tariff
IFC	International Finance Corporation
MDB	multilateral development bank
MIGA	Multilateral Investment Guarantee Agency
O&M	operations and maintenance
PCOA	put and call option agreement
PCS	preferred creditor status
PPA	power purchase agreement
PV	photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SEIA	socio-economic impact assessment
T&C	transfer and convertibility

EXECUTIVE SUMMARY

Auctions – or competitive procurement – are now the leading instrument for the deployment of renewable-based power globally, with estimates that they will drive almost 60% of gross capacity additions between 2025 and 2030 (IEA, 2025). This can be attributed to several key benefits. Auctions have been proven to reduce information asymmetry between government and market players via real price discovery. They also have the potential to incentivise innovation and cost reductions and, in the presence of competition, they minimise the cost of the support needed from the public sector to deploy renewable power. The flexibility in their design allows them to be tailored to particular contexts, challenges and policy objectives.

Countries seeking to grow their renewable energy capacity can draw on the experience of governments that have implemented auctions, although there is no one-size-fits-all model – each context requires its own design. Lessons can be drawn from the most common aspects of the auctions implemented in emerging markets and developing economies (EMDEs) excluding China. In these countries, auctions are often designed to shift risks away from private developers towards other stakeholders, most likely the offtaker (typically a state-owned utility) and the government. This generally entails requiring sovereign guarantees from the host country government, power purchase agreements denominated in hard currency[1], and award criteria based largely on the lowest bid price with no requirements for domestic sourcing of equipment or services, often with limited consideration of broader development goals such as local value creation or measures for the integration of variable renewable energy in the grid. These auctions work better when they receive support from development finance institutions, such as bilateral development finance institutions and multilateral development banks, which increases the confidence of foreign investors.

In the short term, such a model provides certainty to investors and developers on secure revenue streams and increases their willingness to participate in the market, increasing competition and resulting in lower prices. For the host country government, although renewable power will be purchased at a lower price, this model can be costly. Mitigating some of the most important risks to investors – offtake or currency risks through guarantees and hard currency contract denomination, for example – can be fiscally burdensome in the long run. In addition, a model that leads to the lowest price might perpetuate the same issues that EMDEs face with the way their resources are tapped, using imported equipment, finance and expertise, with minimal value retained in the economy. This is why, when designing auctions, it is important to understand the implications of mitigating the risks for developers and investors and allocating them to the host country government; in such cases, the risks would eventually be passed on to consumers or added to the accumulated debt.

For EMDEs that have comparatively higher risks and are just beginning to implement auctions, this model may be needed initially to attract investors, complete the first auction rounds and demonstrate successful project delivery. With time, and as the sector starts developing, objectives should go beyond simply realising projects at low prices. Policy makers therefore need to anticipate and plan for this gradual evolution from the outset.

In the long term, if the country continues to absorb all risks (especially currency and financial) and guarantee profit for investors at all costs, this can heighten fiscal pressures and, in some cases, contribute to debt distress. While such auctions have delivered competitively priced renewable energy and mobilised investment, they often operate within a financial architecture that constrains countries' ability to build sustainable energy

[1] *A currency that is not likely to depreciate suddenly or to fluctuate greatly in value such as the USD or EUR.*

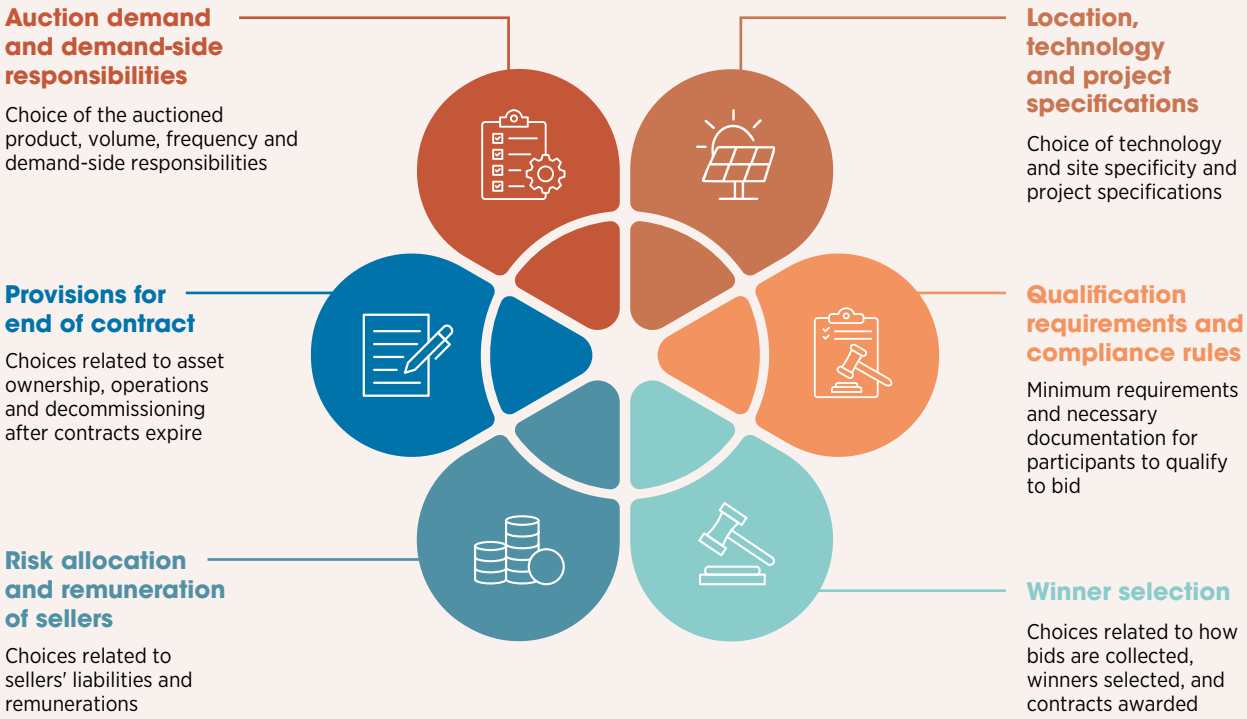
sectors and resilient local industries. This raises questions of fairness and long-term sustainability, as these structures can place disproportionate burdens on governments and citizens – potentially undermining the principles of a just transition.

At the same time, projects must be able to handle some of the risks and responsibilities associated with integrating variable renewable energy into the system. The infrastructure in EMDEs can be outdated or underdeveloped. Allocating the risk of working around these challenges to the power producers can yield effective results, while public resources can be freed up to be invested in upgrading the infrastructure.

With a broader structural vision for renewables, auctions can change over time to accommodate strategic objectives such as integrating variable renewables and supporting the development of a local renewable energy industry. In this way, host countries can lay the groundwork for building local value chains and capacities and therefore capture the socio-economic benefits, not just from rents but also from job creation and spillover effects on other sectors. These benefits underpin the view that renewable energy ambitions should not be narrowly limited to increasing installed capacities but should be seen as a catalyst for sustainable socio-economic development.

It is indeed possible to avoid overburdening host country governments and to even support broader development and socio-economic goals through the choices made in auction design. This will require policy makers to select auction parameters that align with the public interest, national objectives and prevailing macroeconomic conditions. Figure ES illustrates IRENA's updated framework for renewable energy auction design elements involved.[2]

Figure ES IRENA's renewable energy auction design framework



The choice made for each design element will have implications not just for auction outcomes in terms of the volumes and prices bid but also for the wider economy. For example, whether power purchase agreements are denominated in hard or local currency will have implications for project delivery, the level of support or incentive provided to develop a local value chain, the government's final spending on the project (especially in the longer run), and consumer affordability, depending on how the costs are passed on. As such, the trade-offs must be part of the decision when considering design elements for the following auction objectives: achieving competitive (as well as sustainable) bid prices, supporting consumer affordability, ensuring project timely realisation and delivery, preserving sustainable levels of public debt, and supporting the development of local value chains for renewable energy technologies.

This report serves as a guide for policy makers to navigate these trade-offs, enabling informed decisions that consider consequences both at the project level and at a systemic and macroeconomic scale. The report maps the risks that affect renewable energy investment and identifies the auction design elements that can influence those risks (Chapter 2), weighs the implications for which stakeholder bears the risk, and analyses the trade-offs associated with design choices (Chapter 3).

[2] *The updated framework features two new categories of design elements (location, technology and project specifications; and provisions for end of contract) that were previously classified under the initial four categories in the old framework first presented in (IRENA and CEM, 2015).*

Those responsible for auction design can choose to either balance multiple objectives at once or prioritise certain objectives, depending on the strategic goals and what is determined to be in the public interest. There is no standard auction design that can be easily applied to all countries. Contexts matter, and so do public priorities. A single design choice, however minor it may seem, can ripple across the entire framework, shaping outcomes far beyond price. Auction design ultimately requires systems thinking: understanding how one decision affects others and, importantly, how that decision may determine whether the government can manage its public finances, whether a household can afford power or whether a community will capture meaningful value.

For the benefits of renewable energy to be shared equitably, so too must the risks, costs and rewards be. Constantly guaranteeing highly protected returns to private actors while socialising liabilities can run counter to the broader ambition of aligning the energy transition with inclusive and sustainable development. What will be considered a "fair" allocation of risks will vary in every context but ultimately involves matching risks to the stakeholders best able to manage them and, ideally, reducing undue fiscal pressure on host governments while maintaining incentives for developers and investors.

Fundamentally, the prevailing auction design being implemented in EMDEs is closely linked to today's renewable energy finance landscape, where disparities abound. EMDEs – particularly those outside the G20 – still receive less than 10% of global energy transition investment, despite an overall record-high global investment, which rose 20% year-on-year in 2024 (IRENA and CPI, 2025).

Besides the gradual evolution of auction design for EMDEs, unlocking the full potential of the energy transition in these countries will require a fundamental reimagining of the role of public finance on a systemic level – a role that ensures the transition delivers not just sustainable energy but also inclusive prosperity. Part of achieving this will require, at the onset, improved access to affordable finance, debt instruments below market rates or concessional financing, and risk mitigation solutions that do not overburden EMDE governments (IRENA and CPI, 2025).

1. INTRODUCTION

Global investments in renewable energy reached a record USD 807 billion in 2024. This figure, however, is underpinned by stark disparities, with emerging markets and developing economies (EMDEs) (excluding those that are part of the G20) receiving less than 10% of these investments. Sub-Saharan Africa, despite its immense renewable energy potential and need for sustainable development, received less than 3% of investments. One factor behind these disparities is the prevailing reliance on profit-driven investments versus public or impact-driven investments (IRENA and CPI, 2025), the cost of which is heavily influenced by risk perception. While private investments are vital for closing investment gaps, such investments may not always align with the socio-economic imperatives of energy transitions. Bridging the financing gap for EMDEs requires a larger role for impact-driven investment, as well as strategies that ensure the long-term sustainability of a renewable energy sector that builds on local capacities, including domestic industries and finance, and creates value for local communities, the energy sector in general and the economy as a whole. The design of mechanisms for the competitive procurement of renewable power – or auctions – plays a considerable role in achieving such a scenario.

Auctions for utility-scale renewable energy projects have spread rapidly across the world in the last two decades.[3] Their uptake is due to the benefits auctions can provide: their ability to reduce information asymmetry between government and market players; their ability, via real price discovery, to incite competition and minimise the cost of support from the public sector for the deployment of renewable power; their potential to incentivise innovation and cost reductions; and the potential flexibility in their design, allowing them to be tailored to particular contexts, challenges and policy objectives. As such, auctions can be designed to allocate financial, operational and macro-level risks among the offtaker, the government, consumers, developers and investors in a way that can best address country- and project-level risks and limitations, in line with the optimal benefits to the country.

In contexts where renewable energy investments are perceived as high risk – most commonly due to considerable political, regulatory, offtake or currency risks – auctions have been typically designed in a way that allocates risks away from the bidders (usually private investors) to other stakeholders, such as the offtaker (often a government-owned utility) and the government, generally leading to competitive prices, especially when supported by development finance institutions (DFIs). A defining feature of several completed auctions in Africa and other developing regions has been the strong involvement of international development actors – particularly DFIs, including bilateral DFIs and multilateral development banks (MDBs). Their participation has enabled risk to be mitigated for investors and developers and allocated to governments and public offtakers, commonly via credit enhancement and loan or payment security measures, such as sovereign guarantees, letters of credit and guarantee mechanisms offered by international financial institutions (*e.g.* the Multilateral Investment Guarantee Agency (MIGA) and partial risk guarantee cover from the World Bank). These measures ensure investors receive stable, hard currency returns and are shielded from risks such as payment default or currency depreciation. While these auctions have helped to attract international lenders and developers and to deliver competitively priced renewable energy, they have often done so within a financial architecture that limits EMDEs' ability to develop sustainable renewable energy sectors and build resilient local industries. Under current norms, private actors bear minimal risk, backed by government guarantees (*e.g.* for currency risks), while the country shoulders the risks of depleting currency reserves, plunging deeper into debt distress and increasing its reliance on foreign finance, equipment and expertise.

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[3] *Competitive mechanisms are also used for off-grid solutions, and this topic is addressed in a dedicated IRENA publication (IRENA, Forthcominga).*

While this model of risk allocation has helped attract investment and deploy renewable energy capacity, at times at celebrated low prices, it raises important questions about fairness and long-term sustainability. Current structures can place significant financial burden on governments and, ultimately, their populations – which can undermine the principles of a just transition. The prevailing international economic system that underpins this approach is increasingly being questioned. There have been growing calls to reshape the global financial architecture – placing impact over volume, aligning public and private capital under mission-driven frameworks, and embedding accountability into every stage of investment.

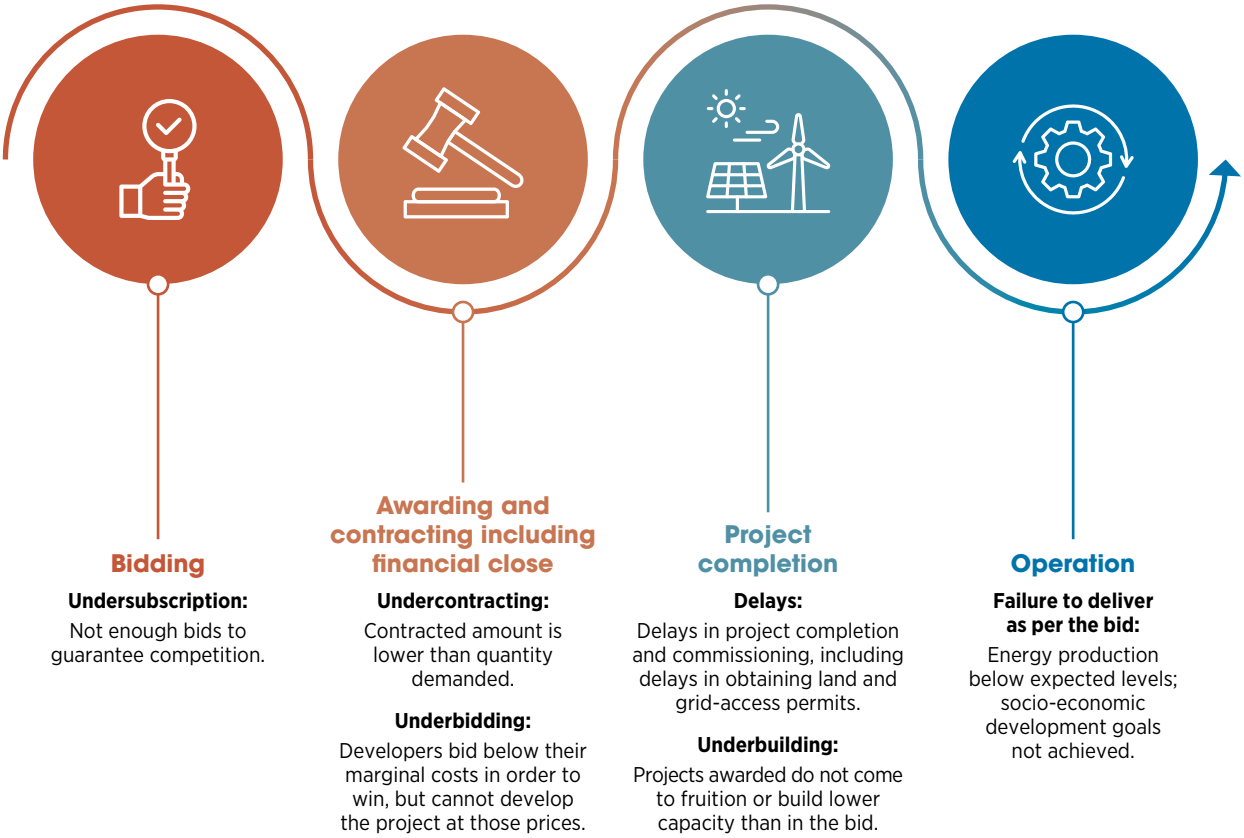
Unlocking the full potential of the energy transition in EMDEs will require a fundamental reimagining of the role of public finance – one that ensures the transition delivers not just sustainable energy but also inclusive prosperity. Achieving this will require, at the onset, improved access to affordable finance, debt instruments below market rates or concessional financing, and risk mitigation solutions that do not overburden EMDE governments (IRENA and CPI, 2025). For the benefits of renewable energy to be shared equitably, so too must the risks, costs and rewards be. Constantly guaranteeing highly protected returns to private actors while socialising liabilities can run counter to the broader ambition of aligning the energy transition with inclusive and sustainable development. What will be considered a "fair" allocation of risks will vary in every context but, ultimately, involves matching risks to the stakeholders best able to manage them and, ideally, reducing undue fiscal pressure on host governments while maintaining incentives for developers and investors.

This report begins by mapping the risks associated with renewable energy investments and highlighting the impact of typical risk allocation on broader outcomes (Chapter 2). Chapter 3 dives into each auction design element, highlighting the trade-offs to consider when seeking to balance multiple objectives, such as securing low prices, achieving high project realisation rates, limiting macroeconomic risks and debt burdens, and advancing broader development goals. Drawing from theoretical insights and empirical evidence from EMDEs in Sub-Saharan Africa and Latin America and from India, the report aims to support EMDEs in considering a more comprehensive approach to designing renewable energy auctions, with the aim of achieving not just competitively priced renewable energy projects and project realisation but also Sustainable Development Goal 7, debt sustainability, and renewable energy industry localisation in the long term.

2. RISKS RELEVANT TO RENEWABLE ENERGY AUCTIONS

Investors, project developers, offtakers and host country governments face a number of risks when it comes to developing renewable energy projects. If not adequately anticipated and allocated, these risks can impact the performance of the competitive procurement process – or auction – at each stage: bidding, awarding and contracting, construction, and operation (Figure 1). Underperformance can result in high power prices, project delays and, more broadly, failure to achieve certain objectives, whether those objectives are to improve energy security and affordability or to stimulate the economy by creating local value and jobs, reducing reliance on imports and boosting industry.

Figure 1 Risks of underperformance at each stage of the auction process



Source: (IRENA, 2019).

The challenge and goal are to appropriately allocate and mitigate these risks through the auction design, recognising that there are limitations to what a procurement process can do in the face of multiple macro-challenges: risks that are so deeply structural, persistent or exogenous that they cannot be allocated or

designed away. IRENA's 2019 auctions report (IRENA, 2019) highlighted that design elements to address underperformance during one stage can risk causing underperformance during another. A balanced approach to auction design that focuses on the overall objectives is therefore needed. For instance, relaxing bidding requirements can attract more bidders and mitigate the risk of undersubscription, increasing competition, but it may lead to the selection of unfeasible projects and underperformance during the stages of construction and operation.

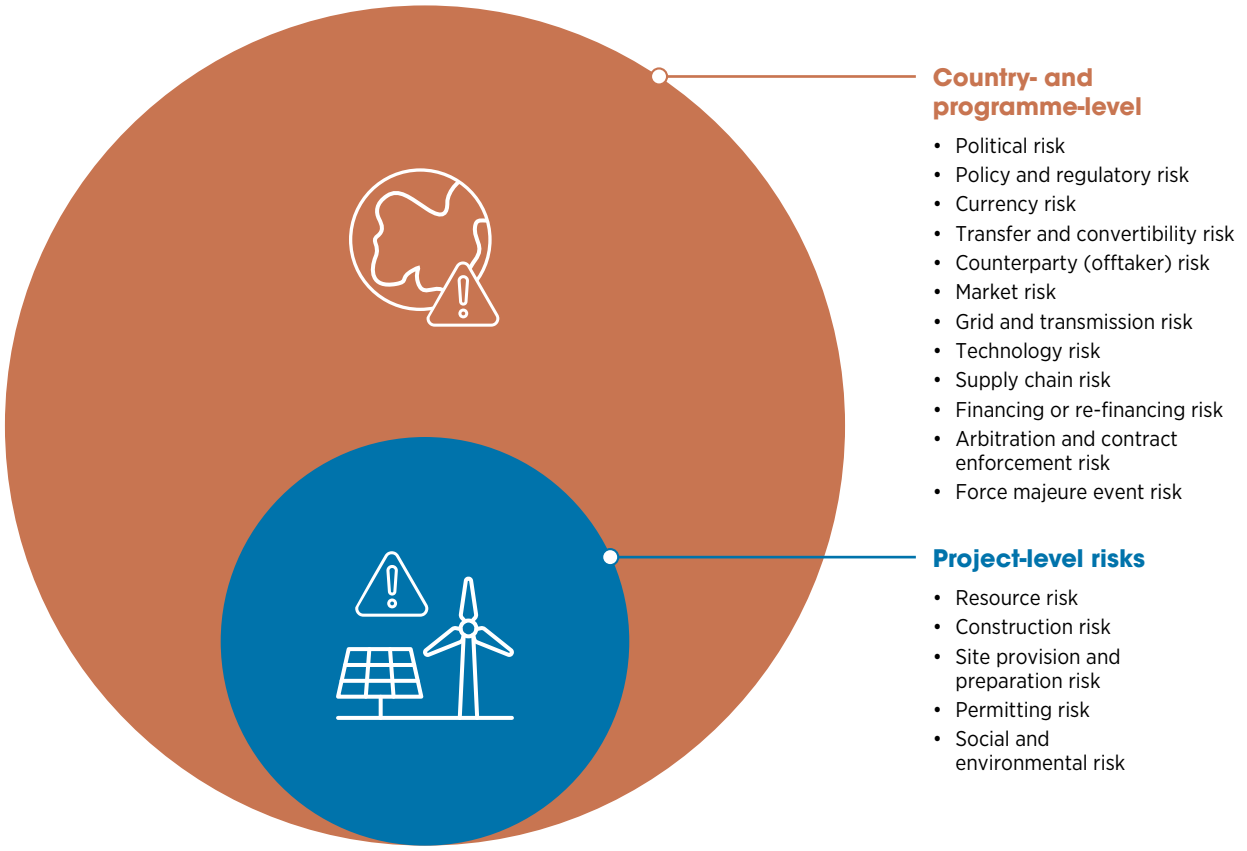
Likewise, auction design and risk mitigation instruments (*e.g.* sovereign guarantees) should account for underperformance at the broader socio-economic level, including the project adding to the country's debt burden, further limiting fiscal space, or not creating opportunities for socio-economic development.

Section 2.1 presents an overview of risks from the perspective of investors, predominantly profit-driven and foreign investors, and lays out existing risk allocation and mitigation options. Section 2.2 presents the impacts of typical risk allocation on broader issues such as increasing the level of indebtedness, falling behind on Sustainable Development Goal 7 (access, reliability and affordability), missing out on opportunities for local value creation, and other potential negative social and environmental impacts.

2.1 OVERVIEW OF INVESTOR RISKS

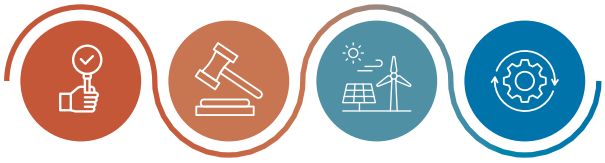
Figure 2 lists possible risks at the country and programme level and project level that must be taken into account and allocated between stakeholders in the context of renewable energy auctions.

Figure 2 Potential risks in renewable energy auctions and projects



2.1.1 Country- and programme-level risks

Political risk



Political events, such as war, civil disturbance, breach of contract, and expropriation (including creeping expropriation),[4] leading to the non-honouring of government obligations, can adversely impact the value of investments. While political events can impact all stages of the auction process, the first impact of the risk will be at the bidding stage. High levels of perceived political risks could lead to undersubscription during this stage, resulting in lower levels of competition and higher prices.

Political risks have typically been allocated to the host country government through credit enhancement and loan or payment security measures, such as sovereign guarantees, letters of credit and guarantee mechanisms offered by international financial institutions (see Table 1 for available instruments for breach of contract risk). These guarantees and undertakings formally oblige the host country government to compensate the project investors if certain risks are realised (*e.g.* expropriation, non-honouring of government obligations) or to indemnify the project owners or investors of their obligations during events such as war or civil disturbance.

These guarantee arrangements are typically provided as part of the packages in response to requests for qualifications or proposals. Sovereign guarantees are usually issued by the Ministry of Finance (or equivalent) and reviewed by the attorney-general to ensure that the guarantee does not contradict any legislation. These guarantees can cover non-payment by the offtaker (insofar as it is a state-owned enterprise), any other obligation of the utility as stated in the power purchase agreement (PPA), unilateral changes in tax treatment, termination clauses, and currency inconvertibility and currency transfer restrictions (IRENA, 2020).

Countries such as Argentina (RenovAr), South Africa (Renewable Energy Independent Power Producer Procurement Programme [REIPPPP]), Uganda (GET FiT), and Zambia (Scaling Solar) have all provided sovereign guarantees that cover political risk as part of their bidding packages (Eberhard, Kolker and Leigland, 2014; Electricity Regulatory Authority, n.d.; IFC, 2020; World Bank, 2018). In some instances, additional cover was provided by MIGA (World Bank Group), which explicitly insures against political risks. MIGA cover formed a core part of the Scaling Solar bidding programmes in Africa, as well as Argentina's auction programme. International bidders in South Africa have also taken out MIGA cover on their own to cover potential political risk events (Eberhard and Naude, 2017).

Governments have become increasingly reluctant to issue guarantees due to disputes where the independent power producer (IPP) invoked sovereign guarantees that were brought to arbitration and resulted in the IPP receiving an (at least partial) award. These cases have made governments more aware of the risk that comes when they issue a guarantee. In some countries, the offtaker (primary obligor) has to pay a significant amount to the Ministry of Finance to obtain the guarantee. Sovereign guarantees are (or can be) treated by the International Monetary Fund (IMF) as a contingent liability and may be included in public debt metrics (*e.g.* debt-to-GDP); this ratio defines the capacity of a country to take on additional debt without losing potential IMF support (IRENA, 2020). This further compounds the country's ability to take on additional debt, as higher contingent liabilities may weigh on sovereign credit ratings and raise borrowing costs. Box 1 discusses some alternative solutions to sovereign guarantees, which could be considered in auction design.

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[4] *While governments may seek to retain or gain ownership of key and strategic infrastructure for public interest, any transfer of ownership should be done through legal, transparent and pre-agreed means, using mechanisms like a build-own-operate-transfer (BOOT) model (see IRENA and CEM [2015]).*

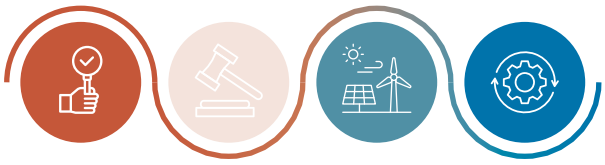
Box 1
Alternatives to sovereign guarantees

In contexts where sovereign guarantees are not ideal, some alternative risk mitigation tools can be considered:

- **Letters of comfort or support:** Less binding assurances from ministries of finance. As these mechanisms are non-contractual, investors and lenders may require stronger risk mitigation agreements.
- **Preferred creditor status (PCS) of multilateral banks and insurers:** Countries can make a formal commitment to DFIs (*e.g.* World Bank, MIGA, Asian Development Bank) by assigning them PCS. This means that if there is a risk that the beneficiary of the PCS will suffer a loss that is directly or indirectly caused by the government, the government will take all measures to resolve the issue in good time. If that is not possible, the government has to compensate the beneficiary of the PCS for the loss.
- **Bilateral treaties:** In these agreements between two governments, the parties promise that transactions made by a company from one country will not suffer from political risk events caused by the other government. They often guarantee that the host government would take reasonable measures to protect the investment from physical harm.
- **Put and call option agreement (PCOA):** These agreements replace traditional PPA termination clauses with a commercial transaction, allowing IPPs to sell the project back to the government at a pre-agreed price if the PPA is breached. This can potentially mitigate immediate accrual to the national debt if the offtaker breaches the PPA and the IPP chooses to trigger termination clauses. However, the IMF treats PCOAs as a contingent liability because they do not completely eliminate fiscal risk – the government would need to buy the project or make the agreed termination payment if the IPP invokes the PCOA.
- **External credit guarantee from independent entities:** For example, South Africa is establishing a credit guarantee vehicle to help de-risk private investment in infrastructure. The entity will be a stand-alone insurance-type company, which means it absorbs risks on its own balance sheet, not on the sovereign balance sheet. The National Treasury will provide 20% of its initial capital; the rest will come from DFIs, philanthropic sources and other sources through the Just Energy Transition Partnership.

Sources: (IRENA, 2020; Naidoo and Prinsloo, 2025).

Policy and regulatory risk



Policy and regulatory risk arises from legal or regulatory changes that can negatively affect project development or implementation, such as shifts in incentives, taxes, interconnection rules or permitting (see Box 2). These risks are greater when there is political instability, regulatory gaps or tightly controlled energy markets that may limit investors' ability to offset changes (since there are no alternative "markets" in which to sell their power). This risk is most likely to occur during the construction and operation phases, though as with political risks they are also likely to impact competition levels during the bidding process.

Box 2
Policy and regulatory risks for renewable energy projects

Key regulatory risks in higher-risk contexts include the following:

- **Failure to secure licences or permits** (*e.g.* for generation, grid connection, business operations, construction, import or land). For instance, during the long-term power auctions held between 2015 and 2017 in Mexico, many awarded projects stalled or considered exiting their PPAs because developers could not obtain the necessary construction permits after the award.
- **Retroactive changes to support schemes.** This happened in Spain back in 2014, when the government changed its renewables support framework retroactively (2010-2014), reducing previously promised revenues for operating plants. These retroactive changes triggered a long wave of investor-state disputes, and tribunals have continued to rule against Spain for those retroactive reversals.
- **Regulatory agencies not approving awarded tariffs.** In the Bihar (India) 2019 solar tender (250 megawatts [MW]), the Bihar Electricity Regulatory Commission rejected the tariff resulting from competitive bidding and ordered renegotiation within a lower benchmark range; it even advised cancelling and retendering if renegotiation failed.
- **Government agencies challenging or rescinding previously awarded permits.** This is exemplified by the case of offshore wind projects in the United States in 2025.

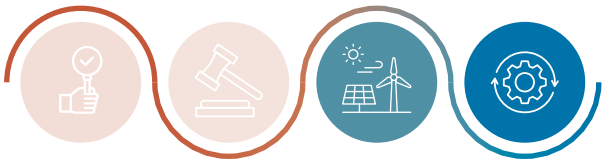
Sources: (Guadarrama, 2018; Milman and Noor, 2025; Parikh, 2019; Strategic Energy, 2025).

This risk is usually allocated to the government through contractual mechanisms such as stabilisation clauses, change-in-law provisions and government support agreements (Tahsin *et al.*, 2023). However, even if the government shoulders this risk, the project developer must still follow the new rules.

These risks can be mitigated by having regulatory agencies participate in the auction design to ensure that bidding information aligns with what is required in the licensing process. This was the case in Namibia, where the regulator was an adviser throughout auction design and implementation to speed up the process for generation licensing of the awarded projects (Kruger, 2022).

A long-term schedule of auctions, as part of broader commitments through targets and nationally determined contributions can demonstrate regulatory and political commitment and help reduce these risks (section 3.1.1).

Currency risk



In many EMDEs, local currencies can be perceived as too volatile for long-term project contracts. Local currency financing can also be more expensive than international financing owing to local banks being more risk-averse, having limited experience with renewable energy projects. As a result, the majority of project funding – both debt and equity – is sourced from international investors and banks. These loans and equity contributions are typically meant to be repaid over long periods (10-20 years) and denominated in hard currencies, such as US dollars or euros, to match funders' requirements. If the local currency depreciates against these hard currencies, the real value of the project's revenues declines.

Currency risk can be a major deterrent to bidders in the bidding and contracting stages. If it materialises, it will likely do so during the operation phase (and the construction phase for long project lead times).

Box 3 shows the depreciation of currencies in EMDEs against the dollar in 2016-2024, showcasing the amount of risk projects would have been exposed to if they were financed in hard currency in 2016 and expected to be paid back over 10-20 years through PPAs.

Box 3
Currency depreciation against the US dollar in EMDEs, 2016-2024

A significant number of EMDEs experienced substantial to extreme depreciation against the US dollar between 2016 and 2024. This trend often reflects domestic economic instability (high inflation, fiscal deficits), political uncertainties, and vulnerability to global economic shocks (*e.g.* commodity price fluctuations, shifts in investor sentiment).

Countries with extreme depreciation (over 1 000% against the US dollar):

- **Argentina:** The Argentine peso depreciated by over 6 000% from 14.76 ARS/USD in 2016 to 914.69 ARS/USD in 2024.
- **Lebanon:** The Lebanese pound depreciated by over 5 800% from 1 507 LBP/USD in 2016 to 89 500 LBP/USD in 2024.
- **South Sudan:** The South Sudanese pound depreciated by over 4 500% from 46.73 SSP/USD in 2016 to 2 163 SSP/USD in 2024.

Some countries – such as Afghanistan, Guinea, Liberia, Mauritania, Myanmar, Somalia, Syrian Arab Republic, Bolivarian Republic of Venezuela and Zimbabwe – have significant data gaps within the 2016-2024 period, preventing a full calculation. However, for those with partial data (*e.g.* Afghanistan, Myanmar, Syrian Arab Republic, Zimbabwe), extreme depreciation was observed during their available data windows.

Box 3 (continued)

Countries with very significant depreciation (200% to 1 000% against the US dollar):

- **Türkiye:** The Turkish lira depreciated by approximately 986% from 3.02 TRY/USD in 2016 to 32.80 TRY/USD in 2024.
- **Nigeria:** The Nigerian naira depreciated by approximately 483% from 253.49 NGN/USD in 2016 to 1 478.96 NGN/USD in 2024.
- **Angola:** The Angolan kwanza depreciated by approximately 431% from 163.66 AOA/USD in 2016 to 869.85 AOA/USD in 2024.
- **Egypt:** The Egyptian pound depreciated by approximately 352% from 10.03 EGP/USD in 2016 to 45.30 EGP/USD in 2024.
- **Suriname:** The Surinamese dollar depreciated by approximately 433% (data up to 2023) from 6.23 SRD/USD in 2016 to 33.18 SRD/USD in 2023.
- **Uzbekistan:** The Uzbek sum depreciated by approximately 326% from 2 965 UZS/USD in 2016 to 12 652 UZS/USD in 2024.
- **Ethiopia:** The Ethiopian birr depreciated by approximately 280% from 21.73 ETB/USD in 2016 to 82.60 ETB/USD in 2024.
- **Ghana:** The Ghanaian cedi depreciated by approximately 263% from 3.91 GHS/USD in 2016 to 14.18 GHS/USD in 2024.
- **Pakistan:** The Pakistani rupee depreciated by approximately 166% from 104.77 PKR/USD in 2016 to 278.58 PKR/USD in 2024.
- **Zambia:** The Zambian kwacha depreciated by approximately 154% from 10.31 ZMW/USD in 2016 to 26.17 ZMW/USD in 2024.
- **Lao People's Democratic Republic:** The Lao kip depreciated by approximately 148% from 8 124.37 LAK/USD in 2016 to 20 167.33 LAK/USD in 2024.
- **Haiti:** The Haitian gourde depreciated by approximately 108% from 63.34 HTG/USD in 2016 to 131.81 HTG/USD in 2024.
- **Sri Lanka:** The Sri Lankan rupee depreciated by approximately 125% (data up to 2023): 145.58 LKR/USD in 2016 to 327.51 LKR/USD in 2023.
- **Democratic Republic of the Congo:** The Congolese franc depreciated by approximately 132% (data up to 2023) from 1 010.30 CDF/USD in 2016 to 2 340.04 CDF/USD in 2023.

Twenty-four countries had their currencies depreciate by more than 20% against the US dollar in the period 2016-2024, and about 13 countries saw depreciation between 10% and 20%.

Source: (IMF, n.d.).

How this risk is managed is determined by the denomination and/or indexation stipulated in the PPA: hard currency PPAs, local currency PPAs indexed to foreign exchange, or local currency PPAs. The options are presented in Table 23 and discussed further in section 3.5.4.

Transfer and convertibility risk

Transfer and convertibility (T&C) risk is a form of political risk that occurs when a government imposes capital or exchange controls that prevent an entity from moving funds. Various DFIs and MDBs, such as the International Finance Corporation (IFC) and MIGA offer different instruments, including partial credit guarantees and political risk insurance, to mitigate this and other related risks. By providing a guarantee to cover the debt service due during the estimated duration of a T&C event, a partial credit guarantee allows the borrower to obtain, in a cost-effective manner, a rating elevation through mitigation of the T&C risk without the need for political risk insurance. This is especially helpful for borrowers with a non-investment grade international foreign currency rating but an investment grade international local currency rating, allowing them to achieve an investment grade rating for cross-border debt with relatively low levels of credit enhancement (IFC, n.d.).

In Ethiopia, the National Bank's initial reluctance to guarantee currency convertibility likely discouraged some bidders in the first round of the country's Scaling Solar programme in 2019. This resulted in only one of six shortlisted bidders being able to submit a bid in 2018 and, ultimately, to the cancellation of projects (Kruger, Stuurman and Alao, 2019). Guarantee facilities for currency convertibility, such as the Transferability and Convertibility Facility by European DFIs, have emerged to support renewable energy projects in countries facing this risk (Box 4).

Box 4
Transferability and Convertibility Facility by European DFIs

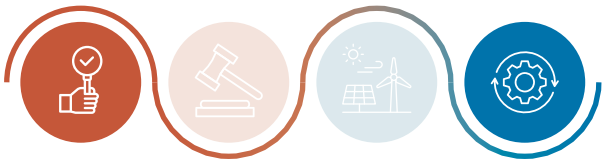
To address T&C risk, the Transferability and Convertibility Facility for renewable energy projects was launched in 2021 by the Association of European Development Finance Institutions Management Company (EDFI MC) – a platform established by European DFIs. EDFI MC administers the facility on behalf of Proparco, the French DFI, for a total amount of EUR 26.2 million.

The facility, supported by a European Union (EU)-funded guarantee, offers protection against losses resulting from an investor's inability to convert local currency into hard currency or transfer hard currency out of the host country due to government actions or inactions, covering up to 12 months of principal and interest over a maximum period of 7 years. The facility has an amount of EUR 26.2 million and is applicable in 48 African countries. It aims to complement a standard project debt service reserve account to address payment risks, thereby facilitating risky investments that face T&C challenges.

While this initiative did not yield results (the guarantee was unused), one of its benefits was the establishment of a facility that aided several European DFIs and targeted energy infrastructure projects, which often pose higher risks due to the longer duration of project implementation and the need for extended loan terms. However, the scale of the facility remained relatively small, and it depended on guarantees, a method increasingly less favoured by the European Commission.

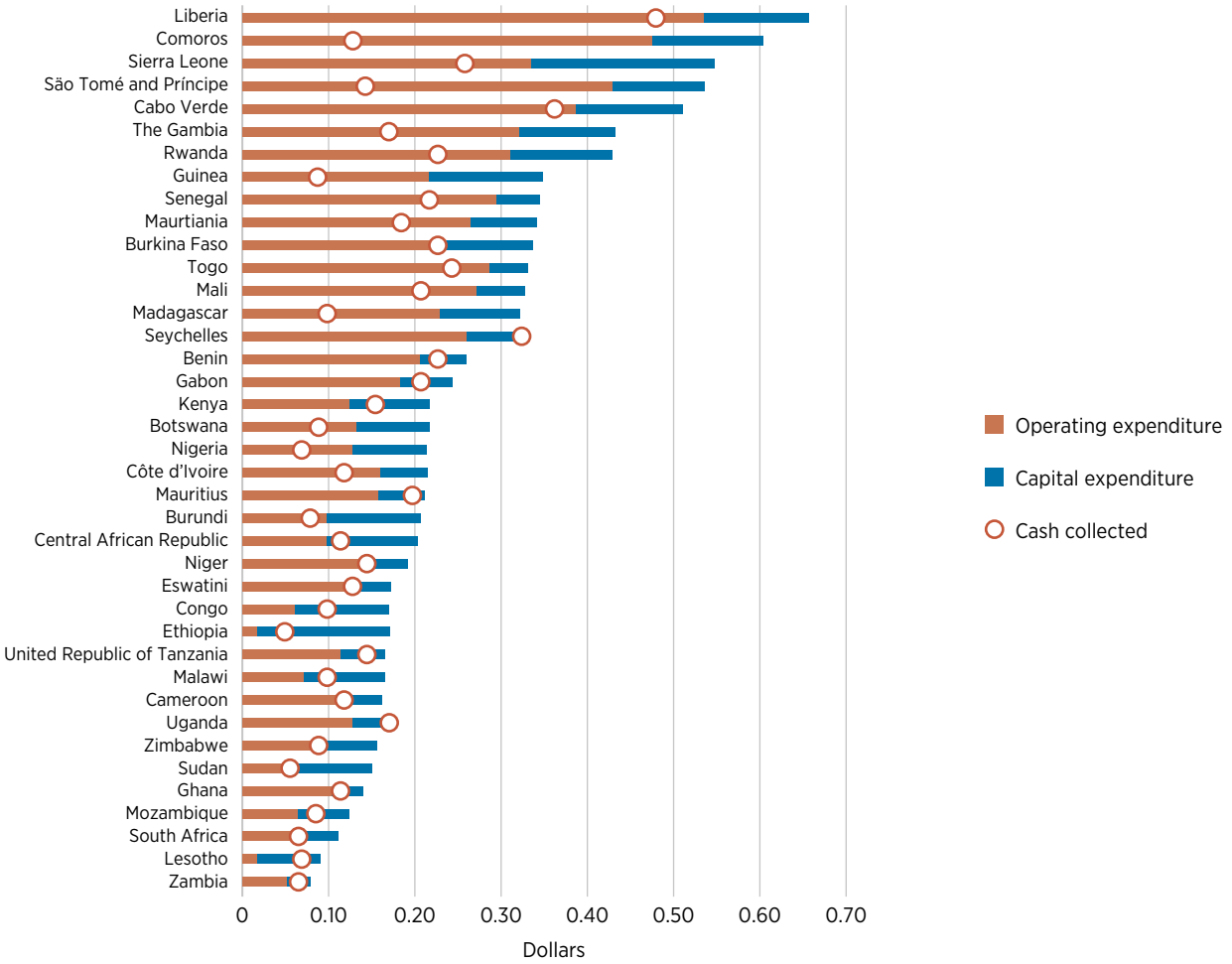
Sources: (Karaki, 2024; Proparco Group AFD, 2021).

Counterparty (offtaker) risk



Counterparty risk refers to the risk of default or non-payment by the power offtaker. Many utilities face financial sustainability issues, as their cash collections may not be sufficient to cover operational and capital expenditures. Figure 3 shows the supply costs versus cash collected by utilities in 39 African countries in 2014. It shows that of the 39 countries studied, only Seychelles and Uganda were fully recovering their operational and capital costs. In only 19 countries did the cash collected by utilities cover operational costs; just four of these countries were also covering half or more of capital costs, based on new replacement values of current assets (Kojima and Trimble, 2016). Such large funding gaps prevent power sectors from being financially viable. As such, there is a risk that the offtaker will not be able to meet periodic payments as stipulated in PPAs. In Sub-Saharan Africa, most utilities are effectively operating at a loss, whether due to tariff levels being too low, financial mismanagement, operational or technical challenges, or a combination of these factors (Timilsina, 2025). While counterparty risk is only likely to occur during the operation phase of a project, its impact is most visible during the bidding process, as bidders need to decide whether they are willing to take a long-term "bet" on the offtaker's ability to pay for power.

Figure 3 Comparison of electric supply costs with cash collected in 2014, USD/kWh billed



Source: (Kojima and Trimble, 2016).

There are two main risks involved in counterparty risk: liquidity risk and breach of contract. Instruments to cover liquidity risk are meant to provide flexibility for the short-term cash flow issues of utilities. Instruments to mitigate breach of contract cover occurrences where the offtaker does not honour contractual obligations in the PPA (*e.g.* choosing not to buy power when it is obliged to per the contract), which may lead to losses for investors and lenders. Table 1 lists available risk mitigation options for both types of counterparty risk.

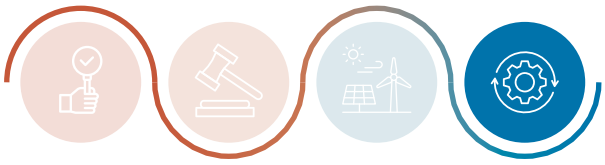
Table 1 Counterparty risks and available risk mitigation instruments

Liquidity risk (short term)	Breach of contract
Letter of credit or escrow account. These arrangements normally cover about six months' worth of invoices and can be provided by the offtaker or the host government or supported by international financial institutions. Letters of credit have been provided to renewable energy projects (as part of the request for proposals package) in Zambia through the Scaling Solar and GETFiT programmes (World Bank, 2020). In the case of GETFiT, this letter is provided by the Regional Liquidity Support Facility, funded by KfW and administered by the African Trade Insurance Agency. In The Gambia, a liquidity facility was set up supported by an International Development Association grant to support a 50 MW solar plant with battery energy storage system in Soma. The facility is a cash account holding six months of payments, managed by an escrow agent. When cash is drawn, the utility or government is obligated to reimburse it within a certain period. **External liquidity guarantees from MDBs.** In one example of these guarantees, MIGA provided a liquidity support guarantee to RenovAr projects in Argentina, facilitated through FODER (a trust fund for renewable energy). This ensured that projects with the guarantee received payments on time, despite the offtaker facing cash flow issues during the financial crisis beginning in 2018.	**Sovereign guarantees.** These guarantees can offer termination payments or "put and call option" agreements if the offtaker defaults. This is a standard requirement in contexts where the power offtaker is state owned and not creditworthy. **Cover from MDBs.** Examples of such cover include MIGA political risk insurance, MDB loan guarantees, and partial risk guarantees provided by the World Bank, the Asian Development Bank and the African Development Bank. **Contract provisions that allow energy sales to alternative offtakers if there is a default.** In India, renewable energy projects sign PPAs with the Solar Energy Corporation of India, which in turn enters into PPAs with distribution companies as offtakers (Patro, 2024). In Brazil, this risk is mitigated through a portfolio effect: each awarded bidder enters into PPAs with all distribution companies, in proportion to the company's demand. The impact of a single offtaker defaulting is massively reduced by spreading the risk among a pool of offtakers (Tolmasquim *et al.*, 2021).

While existing mitigation approaches can address counterparty risk, they push most of the burden onto host governments and, ultimately, consumers. These instruments are costly: liquidity facilities, MDB guarantees and contingency funds all translate into fiscal liabilities. Sovereign guarantees, in particular, place contingent liabilities on states that are often already fiscally constrained. Given this significant trade-off, there is a case for envisioning a fairer allocation of risks among governments, investors, project companies and international DFIs (including through modified guarantee terms or the new risk mitigation instruments), so that private investors do not consistently secure highly protected returns at the expense of affordability and government balance sheets.

In auction design, this risk depends on the choice of offtaker (section 3.1.3).

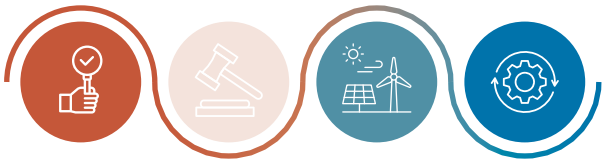
Market risk



Market risk refers to the possibility that actual electricity demand will fall short of projections, or that the market price of electricity will become lower than projected in liberalised markets, reducing revenue to power producers. This risk would become apparent during commercial operations of the project. Underdeveloped or poorly forecasted electricity markets may lead to this risk, especially when industrial demand is not stable or household affordability is constrained.

Long-term PPAs with a take-or-pay clause – a contractual provision that requires the buyer or offtaker to pay for a specified amount of a product or service whether or not it is actually taken or used – shield generators from demand variability and place the risk on the offtaker. Curtailment (and transmission delay) provisions are discussed in section 3.5.6. In extreme cases (*e.g.* pandemics), governments can issue loans to cover temporary demand shortfalls, with repayment through future tariff adjustments. Additionally, auction design can incorporate demand profiles or market-based remuneration to better align generation with actual system needs, as discussed in section 3.5.3. For instance, Mexico discloses hourly adjustment factors ahead of its auctions; projects whose generation profile aligns with system needs receive extra remuneration (those whose profiles do not are penalised). This process shields investors from unexpected market risks while steering production towards demand windows (IRENA, 2019).

Grid and transmission risk



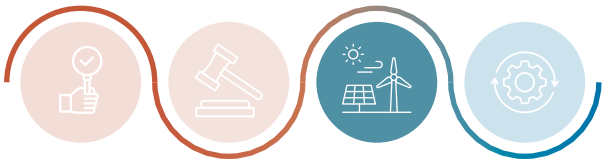
Grid and transmission risk refers to limitations in interconnection, grid management and transmission infrastructure (including curtailment risks). Transmission buildout risk is most likely to impact the construction phase, while grid unavailability or curtailment risk is likely to occur during operations. Uncertainty about how these risks will be treated is likely to lead to lower competition levels during the bidding stage.

Responsibility for grid transmission and the associated risks and costs is defined in the auction design and can be allocated to the transmission company (often also the offtaker) or to the developer. Potential penalties for delays are allocated accordingly (IRENA and CEM, 2015). To mitigate this risk to investors, curtailment limits for grid maintenance need to be clearly stipulated in the project contract. Deemed energy payments may also need to be made for transmission buildout delays or grid unavailability. These aspects are discussed in section 3.5.6.

This risk can also be reduced by guiding projects to zones close to the grid or close to specific substations (see section 3.2.1). In the case of Uganda's GET FiT solar facility, site selection carried explicit evaluation weight: projects were scored based on site quality and proximity to the grid (sites within 3 kilometres of a transmission line received points) (IRENA, 2018a). In Zambia's GET FiT programme, bidders were provided with a list of substations that had spare capacity, and an "interim rapid grid assessment" was performed between the request for qualifications and request for proposals stages to check whether submitted projects would cause grid congestion (Kruger and Eberhard, 2019).

Auctioning authorities can also select the project site – with the required grid infrastructure – to mitigate this risk (section 3.2.1). This has most famously been done in India through the Solar Parks scheme and has also been applied in Africa through the Scaling Solar programme, as well as Namibia's solar auctions, albeit with some additional risks for the auctioneer.

Technology risk

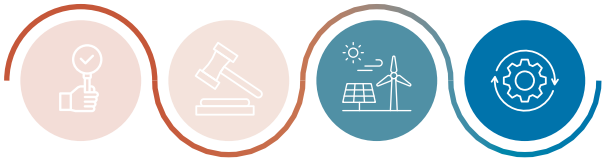


Technology risk typically refers to the use of nascent technology or unexperienced labour. In high-risk contexts, it can also refer to risks related to local content requirements. Where local markets for renewable energy equipment or support services do not exist or are in early stages, construction or operation can be delayed or halted and equipment costs can increase. This risk is most likely to impact the construction phase.

Technology risk is generally allocated to the IPP or project company. Project funders (*e.g.* banks) can mitigate this risk by requiring turnkey or wrapped engineering, procurement and construction (EPC) and operations and maintenance (O&M) contracts between developers and contractors.

Technology risk can be mitigated in auction design by using technology-specific auctions limited to proven commercial technologies (see section 3.2.2). The auction may require bidders to secure signed agreements with reputable EPC and service providers (including warranties) and compliance certificates from technology providers at the bidding stage to ensure bid quality and lower the technology risk (section 3.3.2). This was done in South Africa's initial bidding rounds, although the requirement was removed in later rounds as the bidding authorities became more comfortable with the technology risks (Eberhard, Kolker and Leigland, 2014).

Supply chain risk

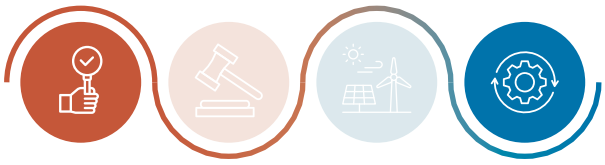


Supply chain disruptions are increasingly a major challenge to renewable energy project implementation. These challenges have significantly impacted equipment availability, pricing and delivery times. The COVID-19 pandemic, for example, triggered a wave of factory shutdowns, port bottlenecks and logistics delays, followed by a surge in demand that further strained supply chains. The conflict in Ukraine compounded these issues, leading to sharp increases in commodity and energy prices. The result was a rapid escalation in the cost of key components. For example, solar panel prices rose by around 20% in 2021, and polysilicon prices increased more than threefold between 2020 and 2022 (IRENA, Forthcomingb). Most recently, the trade wars in 2025 have resulted in higher prices on goods and services, supply chains disruptions, job cuts and falls in productivity. These effects are highly pronounced in EMDEs. Lacking sufficient capacity to move beyond resource extraction into processing, they derive only limited economic benefits and remain vulnerable to commodity price fluctuations. Consequently, most renewable energy jobs in these countries are concentrated in mining, construction, installation and O&M, rather than manufacturing (IRENA and ILO, 2024).

In many cases of supply chain disruptions, developers had already signed contracts based on pre-crisis pricing assumptions, with fixed-price terms that left no space for renegotiation. This dynamic has led to a wave of project delays, requests for deadline extensions and, in some cases, contract terminations or withdrawals.

Developers often absorb supply chain risks through cancellations or penalties for delays or cost overruns. Auction design – as part of a broader industrial policy – can address such disruptions over the long term through mechanisms such as strengthening local value chains. More immediate measures, such as extending project timelines, revising or cancelling bonds or penalties, or reviewing contracts, can also be considered. Auctions can also be designed in a way that relies more on local services and goods through local content requirements and incentives. A more detailed analysis of auction design to address supply chain risks can be found in the report (IRENA, Forthcomingb).

Financing or refinancing risk



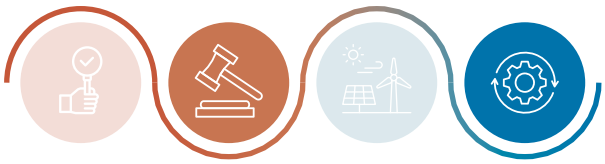
Financing or refinancing risk refers to the risk that a borrower is unable to refinance the outstanding loan during the life of the project due to inadequate loan terms, such as a high cost of borrowing or a mismatch between the loan maturity (often 7-10 years) and the lifetime of the asset (15-30 years). In practice, DFIs and MDBs are often the only institutions able to provide 15-20 year loans that align with project lifetimes. Hence, DFIs have a critical role in mitigating refinancing risk in many EMDEs.

Financing risk also refers to the risk that projects will not be able to secure financing once awarded. This happened in some of Argentina's auction rounds (2016-2018), where deteriorating macroeconomic conditions led to many projects being unable to secure debt and therefore not being able to advance to construction.

This risk is generally allocated to the project company or investor, but it can be mitigated by the auctioneer requiring lender commitment letters or signed loan term sheets at the bidding stage (see section 3.3.2). This effectively outsources due diligence to these lenders and ensures that compliant bids are bankable.

For example, South African banks were closely involved in auction design, and bidders had to submit lender commitment letters, resulting in a highly bankable programme with strong project realisation. Similar requirements have since been adopted in Ethiopia, Namibia, Uganda and Zambia (Eberhard and Naude, 2017; Kruger and Alao, 2024; Kruger and Swartz, 2020; Kruger, Stuurman and Alao, 2019).

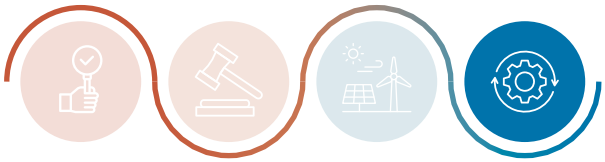
Arbitration and contract enforcement risk



Arbitration and contract enforcement risk refers to the perception that local courts may not provide impartial hearings or enforce contracts for project owners or funders, especially foreign entities. While this risk usually materialises during commercial operations, it is also relevant before financial close when negotiating the PPA, as international arbitration clauses are often a precondition for bankability.

This risk is generally allocated to the host country government through international arbitration clauses in the project documents. Most African project contracts, for example, have to include international arbitration clauses to be considered bankable by international investors, although Namibia and South Africa have been able to do without these clauses based on their judiciaries' track records. In Egypt, contestation about this clause delayed the financial close and construction of several large utility-scale projects for many months before eventually being resolved (Pothecary, 2016).

Force majeure event risk



Force majeure event risk refers to the risk that a natural disaster (or pandemic, etc.) would impact the ability of either counterparty to fulfil their obligations (*e.g.* the seller to produce power or the offtaker to make payments), usually during the commercial operation phase. These risks are generally covered in force majeure clauses of contracts that share the burden among the parties and relieve the affected party of their obligations for a certain period.

Lenders also usually require project owners to take out insurance covering this risk as a requirement for project financing. Examples of governments invoking force majeure during the COVID-19 pandemic are presented in Box 5.

Box 5
Invoking force majeure during COVID-19: India and South Africa

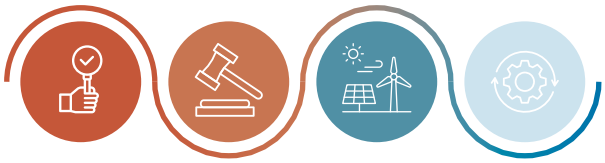
In South Africa, Eskom, the state utility, issued force majeure notices to 22 operational wind farms in April 2020, citing reduced electricity demand during the national lockdown as justification for curtailing wind output without compensation. IPPs contested this, arguing that the PPAs required "deemed energy" payments even during curtailment and that temporary demand drops did not qualify as unforeseeable force majeure events (Bulbulia, 2020). The PPAs contained a definitive list of force majeure events, which did not include reduced demand (Dyk, 2020). This dispute highlighted the importance of clear contractual definitions and the potential risks when offtakers reinterpret obligations during crises.

In March 2020, the Indian Ministry of New and Renewable Energy issued a memorandum stating that delays due to supply chain disruptions from the COVID-19 outbreak would be considered force majeure. In April 2020, the ministry provided a blanket extension for all renewable energy projects under implementation equal to the duration of the lockdown plus 30 days, without requiring evidence from developers. This provided relief to developers, prevented litigation and ensured continuity of projects (Delhi Electricity Regulatory Commission, 2021).

2.1.2 Project-level risks

Resource risk

Resource risk refers to the risk associated with uncertainties about the availability of renewable energy resources, which can increase costs for bidders and delay reaching financial close. In addition, construction may be delayed or halted if there are resource issues.



This risk can be allocated to the government through site-specific auctions that include resource assessments with shared data (section 3.2.1). IRENA runs comprehensive renewable energy resource assessment activities through the Global Atlas for Renewable Energy initiative to support countries in planning and deploying renewable projects at different scales: utility, off-grid and city (see Box 6).

If there are high levels of uncertainty regarding the resource (*e.g.* geothermal power), a dedicated government agency can take on upstream risks if it has sufficient capacity (*e.g.* exploration, drilling for geothermal). Kenya's Geothermal Development Company, for example, sells geothermal steam to IPPs for electricity generation after drilling and developing geothermal sites.

Box 6
IRENA's renewable energy resource assessment – country-level support

IRENA's Global Atlas for Renewable Energy initiative encompasses:

Spatial assessment, which is a GIS-based multi-criteria analysis developed to map investment opportunities within a country for the development of utility-scale solar photovoltaic or wind projects. The methodology combines high-quality data on resources with data on infrastructure and land features, including road and transmission line networks, topography, protected areas and population density, to:

- identify the zones of high feasibility for the development of solar and onshore wind projects
- calculate the attributes characterising these zones, which include potential installed capacity, hourly energy generation profiles, distances to transmission and road infrastructure, and levelised cost of electricity

This service is conducted in close collaboration with a country's energy planning department, and it aims to support countries in developing and implementing their national energy generation and transmission master plan.

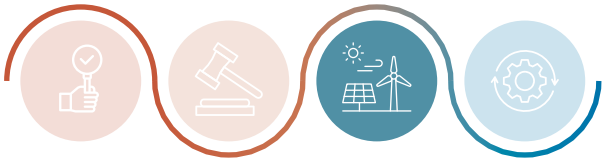
Site assessment, which is a cost-effective pre-feasibility analysis developed to support countries in finding economically viable sites for solar (photovoltaic, parabolic trough collector, central receiver system, and linear Fresnel) and wind (onshore and offshore) project development. The assessment is conducted in close consultations with country representatives and includes:

- *Technical assessment*, which calculates the energy output of the power plant using site-specific renewable resource data and industry-standard energy yield models and methodologies
- *Financial assessment*, which simulates the tariffs and levelised costs that make a site viable for project development

Through this service, IRENA has assisted local authorities, ministries and public utilities in several countries in Africa and Latin America, as well as small island developing states, in selecting and screening more than 150 promising sites for solar and onshore wind power projects.

Construction risk

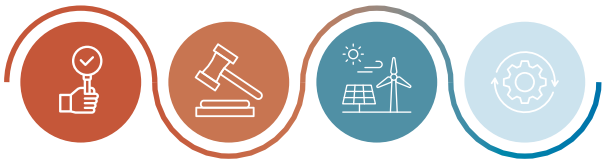
Construction risk includes the possibility of project delays, cost overruns due to inflation (among other reasons), or failure to reach commercial operation due to technical or logistical issues. This risk can be higher in contexts with weak infrastructure, permitting delays, adverse site conditions, or limited availability of skilled labour and equipment.



In auction design, construction risk is typically allocated to project developers through several mechanisms, including stringent technical and financial qualification criteria to ensure bidder capability (section 3.3.1), the requirement for performance bonds to guarantee timely completion and penalties for underperformance or delays (section 3.3.3) as well as provisions for transmission delays (section 3.5.6). In contexts with high uncertainty, project delays may be managed through flexible contract provisions that allow for extensions under justifiable conditions, while still ensuring project delivery.

Inflation risks can be mitigated through contract indexation (see section 3.5.5 and [IRENA, Forthcomingb]). Auctioneers may also monitor project progress post-award to identify bottlenecks early.

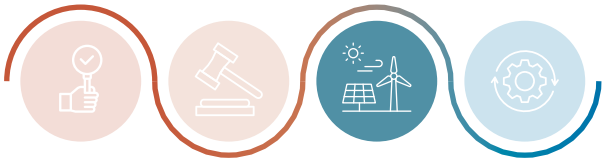
Site provision and preparation risk



Site provision and preparation risk refers to the risk that land ownership of the project site is unclear or that private land ownership is not allowed. It also refers to the risk that a government-provided site is poorly prepared or selected. This is most likely to impact the construction phase, although it also impacts the bidding process, as well as the award or financial close phase by impacting the potential viability of bids.

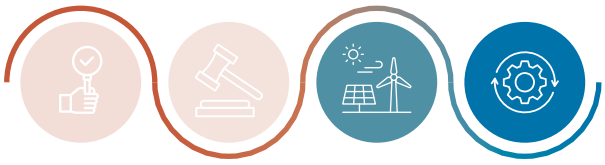
Site provision and preparation risks can be allocated to the project or IPP by requiring that the site be secured by the bidder, or they can be allocated to the auctioneer or host government if it selects, prepares and provides the site (section 3.2.1). In practice, however, the site-related risks ultimately stay with the project or IPP, whether the government provides and prepares the site or not. During the Scaling Solar programme in Zambia, for example, the provided sites were found to contain sinkholes, and part of the sites extended onto a national park. This delayed financial close and construction and increased the costs (which the bidders had to absorb) (Kruger and Eberhard, 2019). In Namibia, NamPower failed to fully secure all project sites prior to the bidding process. Once bids were submitted, it became clear that NamPower would only be able to secure one of the three sites. The utility then opted to locate all three solar projects on this one site, instead of on three sites as originally specified. This led to a material change in the bidding rules, which prompted a legal challenge and saw the award being overturned (Kruger, Alao and Eberhard, 2019).

Permitting risk



Permitting risk refers to the risk that permits (*e.g.* environmental authorisation, building permits, generation licences) are not provided at all or in a timely manner. Permitting issues are likely to emerge during the project construction phase. Although project owners are usually dependent on government agencies to provide these permits, this risk is generally allocated to the IPP. The government or the offtaker can take on some of the permitting responsibilities and risks if the site is provided or the country is using specific corridors or zones. In South Africa, for example, lighter environmental impact assessments requirements are applied to designated renewable energy development zones (Eberhard and Naude, 2017).

Social and environmental risk



Social and environmental risk refers to social and/or environmental factors associated with the project site that can delay the project, increase costs and/or stop implementation. While social and environmental aspects are often embedded under permitting risk (*e.g.* through environmental and social impact assessments), they warrant distinct discussion. Beyond questions of timing or administrative delay, social and environmental risk concerns whether a project secures and maintains a social licence to operate, which can fundamentally determine project viability. A relevant example is the Scaling Solar programme in Zambia, which encountered some legacy issues on one of the chosen sites.

This risk is generally allocated to the project company, unless the government or offtaker provides and prepares the site (section 3.2.1). Even then, this risk ultimately remains with the project since social issues, particularly, are bound to emerge during construction and operation if not properly assessed and mitigated. Community representatives can negotiate with developers for certain benefits (*e.g.* building of roads or hospitals, dedicated revenue share) in exchange for their lands being used for the project. Financiers also tend to mitigate this risk by requiring project sites to be prepared in line with social and environmental performance standards (*e.g.* IFC Performance Standards on Environmental and Social Sustainability). However, project developers face a range of challenges when conducting socio-economic impact assessments (SEIAs) that adhere to the stringent standards of the IFC Performance Standards. These standards are often more comprehensive and demanding than national regulations and aim for best international practices (Box 7).

Box 7
Challenges faced by bidders when conducting SEIAs following IFC standards

Some of the key challenges project developers face when conducting SEIAs that adhere to the stringent standards of the IFC Performance Standards include the following:

- **Data gaps and baseline studies.** Obtaining comprehensive, reliable and geographically relevant baseline data for both environmental conditions (*e.g.* biodiversity, water quality, air quality) and social conditions (*e.g.* demographics, livelihoods, cultural heritage, health profiles of affected communities) can be difficult, especially in remote areas. Historical data are often scarce or non-existent. For instance, IFC Performance Standard (PS)1 on the assessment and management of environmental and social risks and impacts, PS6 on biodiversity conservation and the sustainable management of living natural resources, PS7 on Indigenous Peoples, and PS8 on cultural heritage require robust baseline data to accurately predict and manage impacts.
- **Complexity of impact identification and prediction.** Accurately predicting the direct, indirect, cumulative and induced environmental and social impacts over the entire project life cycle (from construction to operation to decommissioning) is inherently complex. It requires specialised technical expertise across multiple disciplines.

Box 7
(continued)

- **Stakeholder engagement and free, prior and informed consent.** Engaging effectively with a diverse range of stakeholders, including vulnerable groups, Indigenous Peoples and geographically dispersed communities, is time-consuming and requires cultural sensitivity. Obtaining free, prior and informed consent from Indigenous Peoples is a particularly rigorous and often lengthy process that requires good faith negotiation and a culturally appropriate approach, not just consultation. Managing expectations and potential grievances throughout the project lifecycle is also critical.
- **Land acquisition and resettlement.** Resettlement (physical or economic displacement) is one of the most challenging aspects of land acquisition. Ensuring that displaced persons' livelihoods and standards of living are "restored or improved" (the IFC benchmark) is challenging, especially in contexts with weak land tenure systems or informal economies. Valuation of assets, compensation and economic rehabilitation programmes are complex.
- **Alignment between national and international standards.** Project developers often need to navigate discrepancies between national environmental and social regulations and IFC Performance Standards. This requires conducting "gap analyses" and developing a compliance strategy that meets the higher standard, which can add complexity and cost.
- **Capacity and expertise.** Finding qualified and experienced local or international consultants who thoroughly understand and can effectively implement IFC Performance Standards requirements can be difficult, especially in EMDEs. Often, this expertise has to be sought from abroad and can incur major costs.
- **Cost and time implications.** Conducting a comprehensive SEIA that meets IFC standards is often more expensive and time-consuming than a standard national environmental impact assessment. This can impact project budgets and timelines, especially if unexpected issues arise during the assessment phase or if free, prior and informed consent processes are extended.
- **Management of transboundary and cumulative impacts.** Projects with potential transboundary impacts (*e.g.* shared river basins) or significant cumulative impacts (the combined effect of the project and other existing or planned developments) are associated with more complex data collection, impact assessment and mitigation planning processes, requiring co-ordination with multiple jurisdictions and stakeholders.
- **Security risks.** In some operating environments, conducting fieldwork for baseline data collection, stakeholder engagement, or monitoring can pose security risks to SEIA teams and project personnel. PS4 (community health, safety and security) addresses project-related security, but the SEIA process itself needs to consider and mitigate risks to SEIA personnel.

Addressing these challenges is very resource intensive and requires strong commitment from project developers, adequate resources, a clear understanding of IFC standards and, often, the engagement of experienced environmental and social specialists.

Source: (The Environment Consultant, n.d.).

2.2 THE IMPACT OF TYPICAL RISK ALLOCATION ON BROADER OUTCOMES

Since 2015, the use of public funds to mobilise private capital has been pursued as a silver bullet solution in all countries and contexts. In auctions, this means dedicating public resources to design auctions that allocate the risks outlined in section 2.1 from the developers to the host government.

One example that pioneered this model in high-risk contexts is the Scaling Solar programme, launched in 2016 by the IFC. Although the programme was successful and can be used as a blueprint for partnerships between public and private players, it is important to transparently showcase the underlying support of the public sector. Box 8 describes the real costs behind the results of the Scaling Solar programme in Zambia and demonstrates that risk mitigation from the investor's perspective simply means allocating these risks to the government and that the public resources needed remain more or less the same.

Box 8
The real cost of risk mitigation and the role of public funds and DFIs

The Scaling Solar programme presented some of the earliest examples of auction designs that achieved low prices by mitigating risks for private developers through assigning the bulk of the risks and costs to other stakeholders (in this case, the IFC and other World Bank Group partners, as well as the Zambian government) in addition to providing concessional finance from DFIs.

The Zambia project involved USD 24.5 million in private equity investment, as well as USD 81.5 million in DFI debt financing and an International Development Association guarantee of USD 5.7 million. That means it took more than USD 3.50 of public international finance to bring in each dollar of private finance, and the effective subsidy rate on the debt is estimated to be the equivalent of about USD 10 million a year. Using a discount rate of 15% over ten years (the estimated high cost of private borrowing), that comes to a net present value of USD 53 million, which means it took at least USD 2 of subsidy to bring in each dollar of private finance. That is excluding the International Development Association guarantees, the subsidies related to providing free land, tax breaks, project preparation, and the implicit guarantee related to all finance from DFIs.

This example provides evidence against the mainstream idea that it is easy to unleash a flood of private infrastructure finance to low- and lower-middle-income countries with just a transparent, stable enabling policy framework and some amount of project preparation.

Subsidised and concessional public finance, including from DFIs, is still needed to achieve leverage ratios of two to one: USD 2 in public finance for each private dollar that comes in. Scaling Solar illustrates how the private sector-led model of infrastructure development very much resembles the state-owned/directed model, with 80% of the funding in the Zambia deal coming from state-owned enterprises of one sort or another. It is therefore time to acknowledge that most infrastructure has always been, and will continue to be, financed by the public sector, while infrastructure governance choices are made by the public sector or a hybrid of public and private entities.

Sources: (Emery, 2023; Hodge, 2023; Kenny, 2023).

Auction design needs to determine the most suitable allocation of risks among the different stakeholders (auctioneer, project developers or investors, offtaker, government, consumers, DFIs). A sound auction design looks beyond mitigating all the risks for developers and investors to achieve low prices and considers the trade-offs of assigning the risks to particular stakeholders. The impacts of typical investor-centric risk mitigation on broader socio-economic and environmental outcomes are illustrated in Table 2.

Table 2 shows that typical approaches to risk allocation often prioritise investor certainty while creating broader fiscal, developmental and social vulnerabilities. Yet auctions are not simply price discovery mechanisms: they can be flexible instruments for structuring how risks are distributed across investors, governments, offtakers and communities. In this sense, auction design can be understood as a deliberate exercise in strategic risk allocation. The next section builds directly on the risks identified here, examining how specific design features – such as auction demand, site and technology choices, qualification requirements, remuneration models, and end of contract provisions – can be deployed to address these risks in ways that attract investors while also safeguarding fiscal sustainability, affordability, and broader development objectives.

Table 2 The impact of typical risk allocation in current practice on broader country outcomes

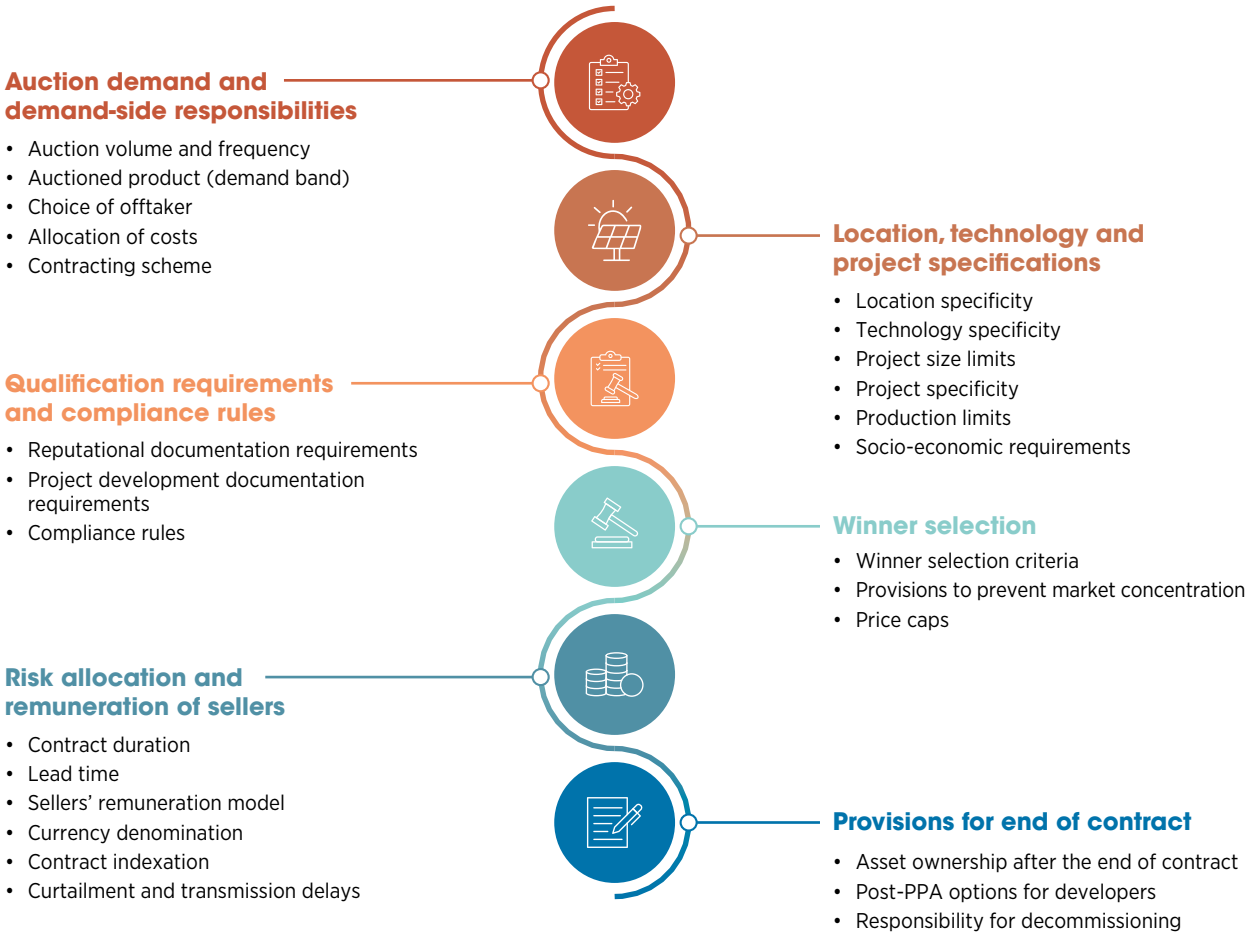
Risk	Typical investor-centric risk allocation	Impact on broader outcomes			
		Increasing level of indebtedness pertaining to debt burden, creditworthiness and financial stability of a country	Falling behind on SDG7 (access, reliability and affordability)	Missing out on opportunities to develop domestic supply chains and create local value	Negative social and environmental impacts
Political	Sovereign guarantees/ government written undertakings (if invoked)	✓			
Policy and regulatory	Government assumes this risk through contractual mechanisms such as stabilisation clauses, change-in-law provisions and government support agreements		✓		
Currency	Allocated to offtaker and passed to government through sovereign guarantees	✓			
	Passed on to consumers		✓		
Transfer and convertibility	Sovereign guarantees	✓			
Counterparty (offtaker)	Sovereign guarantees, letters of credit, or liquidity facilities from public institutions	✓	✓		
Market	Long-term PPAs with a take-or-pay clause	✓			
Grid and transmission	Responsibility and costs allocated to government or grid operator	✓	✓		
Technology	Developers select technology and service providers with proven experience, typically foreign			✓	
Supply chain	Index contracts to inflation	✓		✓	
	Renegotiate contracts, including extending project deadlines		✓		
Financing or refinancing	Typically on the developer to secure project finance				
Arbitration and contract enforcement	International arbitration clauses; government assumes risk via sovereign guarantees or implementation agreements	✓	✓		
Force majeure events	Shared via force majeure clauses	✓	✓	✓	
Resource	Auctioneer provides resource data and/or site		✓		*
Construction	Typically on the developer to reach construction timelines		✓	✓	✓
Site provision and preparation	Government provides the site		✓		*
Permitting, including social and environmental	Streamline permit process				✓
	Project-specific auction	✓			

Note: * = depends on quality of assessment.

3. AUCTION DESIGN FOR STRATEGIC RISK ALLOCATION

This section analyses the implications of decisions for each design element (Figure 4) and the trade-offs that should be considered when aiming to achieve one or several objectives: low bid prices, high project realisation rates, limited fiscal risks and debt burdens, and broader development goals such as local value creation and reliable, sustainable and affordable energy for all. This is illustrated through a visual matrix, where (+) denotes a positive relationship and (–) denotes a negative relationship of each design element on the respective objectives.[5]

Figure 4 IRENA's updated renewable energy auction framework



[5] *For example, if the choice of design element is expected to lead to higher cost of public support, the relationship is positive (+) even though the impact is not the desired outcome.*

Each design choice operates as a risk allocation mechanism: not only shaping whether the auction succeeds at creating competition and attracting investors and developers with low prices bid but also assessing the costs to the public sector and the fiscal, social and developmental risks (as identified in section 2.2). The following subsections illustrate how design choices distribute the risks, and what trade-offs this creates for achieving both bankable projects and sustainable national outcomes.

3.1 AUCTION DEMAND AND DEMAND-SIDE RESPONSIBILITIES

This category of design elements determines the auctioned product, volume and frequency of auctions as well as the demand-side responsibilities in terms of the choice of offtaker, allocation of costs and contracting scheme.

3.1.1 Auction volume and frequency

A key design element is the amount of renewable power to be contracted. The amount should be aligned with government plans to achieve certain targets while being consistent with the existing power system's technical capabilities to absorb the power, the level of development of the local sector, and the resulting competition. There are three ways to determine the auctioned volume:

1. Fixed auction volume – the most common and straightforward approach, determined by the auctioneer in a unilateral way. Determining the volume brings additional options to consider: whether the total volume should be auctioned at once or whether it should be auctioned at different stages following a preannounced schedule (see auction frequency).

2. Price-sensitive demand curves – where demanded quantities are affected by the auction's equilibrium prices according to a rule determined ahead of time. For example, if a much higher price had been estimated, the volume contracted could be increased from the initial plan if investors offer much lower prices.

3. Multi-criteria volume-setting method – where other parameters and more complex guiding principles may be used to determine the demand level.

In all three options, there is an additional decision to be made regarding whether the determined volume will be disclosed to potential bidders.

In the fixed auction volume option, the choice of the volume auctioned primarily addresses **policy and regulatory risks**. By auctioning a large volume at once, the risk of policy and regulatory changes that occur mostly at the end of political cycles can be partially mitigated for both the auctioneer and the bidders. In addition, frontloading contract signing can address other risks that may be expected to materialise with time, such as **currency risks** if the currency is at risk of depreciating against hard currencies over time (as shown in Box 3), **market risks** if over the long run the expected utility electricity demand does not materialise, and **technology risks** if contracts are awarded based on existing technologies instead of pushing the contracting time for when technologies are further developed. **Supply chain risks** can also be addressed by frontloading supply agreements based on near-term prices as opposed to the way the prices are expected to evolve over time.

Large auction volumes (in the presence of other attractive conditions) also tend to attract large and/or foreign companies to bid, which could drive down prices and increase the likelihood of project realisation, if other design elements conducive to creating competition are in place.

Auctions with large volumes can be held as stand-alone events, or the total demand can be partitioned into smaller auctions following a long-term schedule with planned rounds and volumes. Regular auctions or bidding rounds can (i) help break down the total volume to be auctioned into smaller demand bands, which can lower bid prices over time through increased competition (smaller volume bid) and technological advancement, (ii) capture learning rates from different rounds while making adjustments, and (iii) support local value chain development. Stand-alone auctions can be used to pilot auctions and gather lessons for future rounds (Box 9). A hybrid approach can combine both, with a set annual schedule and ad hoc increases as needed.

Box 9
Stand-alone auctions in Botswana

While most successful auctions in Africa, including South Africa's REIPPPP, Morocco's Noor Ouarzazate and Zambia's Scaling Solar 1, have been designed in a programme format, whereby the government commits to future bidding rounds, Botswana has used a stand-alone approach.

The country had made several attempts to competitively procure solar capacity, beginning in 2015, with little success due to challenges beyond the auction itself. Examples include a 2 × 50 MW solar photovoltaic auction close to the Jwaneng and North-west mines and a 2 × 100 MW concentrated solar power auction in Maun, in the north-west of the country, and Letlhakane in the Central district. This example shows how stand-alone auctions can be used to test the market and address existing barriers before committing to a programme.

In 2020, a competitive process was conducted by the state-owned Botswana Power Corporation, and a 60 MW project was awarded to Scatec in 2021. In 2023, IFC committed to financing the project through a USD 31.4 million debt package consisting of innovative dual currency financing, with IFC providing USD 16.4 million and USD 15 million equivalent mobilised in local currency from the First National Bank of Botswana, acting through its Rand Merchant Bank division.

Sources: (IFC, 2023; Reuters, 2022).

Table 3 summarises the risks and impacts of various choices made in relation to auction volume and frequency.

Table 3 Auction volume and frequency: associated risks and impact on outcomes

Auction volume and frequency Risks impacted: Policy and regulatory, currency, market, and technology risks						
Impacts		**Fixed auction volume**				**Price-sensitive demand curves or multi-criteria volume setting**
		Large volume auctioned in one stand-alone round		**Total volume partitioned over predetermined schedule of planned rounds and volumes**		
Impact on price competitiveness (and consumer affordability)	(–)	Tends to limit competition, leading to higher prices	(+)	Helps increase competition, leading to lower prices, and helps alleviate technology risks as players gain experience and technology continues to advance	(+)	Responds dynamically to supply and demand dynamics, enabling price discovery
Impact on cost of support (and government debt)	(+)	Commits the government to a higher level of support, determined by other design elements	(–)	Gives the opportunity to shift some of the risks to the bidders as investor confidence increases	(+)	Limits the cost of support
Impact on the potential to develop domestic supply chains and create local value	(–)	Tends to favour large and/or foreign players with no incentives for local market development	(+)	Gives enough time and opportunity to mobilise domestic players and encourage new market entrants, as well as build their capacity	(=)	No theoretical impact

3.1.2 Auctioned product (demand band)

Demand bands are associated with the total volume being allocated to products with different characteristics in such a way that several mini-auctions are running in parallel in the same round. This way, projects with different characteristics (defined by other design elements such as technology specificity or socio-economic requirements) do not directly compete with one another.

This design element has no obvious implications for risk allocation.

3.1.3 Choice of offtaker

The contract offtaker is the entity that signs the contract with the auction winner and becomes responsible for the contract payments. In most EMDEs, a state-owned company plays the role of the contract offtaker. The utilities that service the regional load can be good candidates, since they typically already conduct corporate sourcing, which enables private offtakers to get into agreements with the sellers (IRENA, 2018b). Depending on the organisational structure of the power sector, there can be multiple offtakers in an auction.[6] For instance, in a hybrid offtake arrangement, a share of the auctioned power is sold to the main utility, while another share is contracted to private offtakers such as corporations or large industrial consumers, as will be the case in Egypt (Box 10).

[6] *IRENA has analysed the organisational structures of power sectors in (IRENA, 2022).*

Box 10
Phase 0 of market opening: Pilot Private-to-Private (P2P) in Egypt

At present, Egypt's power sector follows the single buyer model, whereby the single buyer sits within the Egyptian Electricity Transmission Company (EETC). The Electricity Law in Egypt envisages a gradual opening of the market. This includes a period during which there are two segments that operate in parallel:

- a regulated segment in which generators sell electricity to the single buyer and the single buyer in turn sells this electricity to buyers at regulated prices.
- a deregulated segment in which eligible consumers (*i.e.* those who have the right to buy electricity directly from generators) purchase electricity from eligible producers.

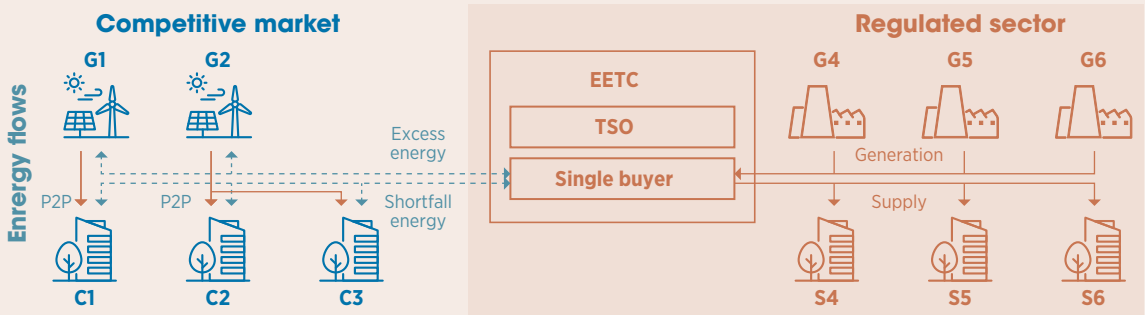
This approach is similar to what other countries have adopted. For example, in the United Kingdom, groups of electricity consumers were allowed to enter into bilateral contracts in waves, starting with the largest electricity consumers.

Figure 5 shows an intermediate stage of market opening, whereby the regulated segment is still functioning but a day-ahead market is set up in which electricity is traded (across both the regulated and deregulated segments), representing trading of electricity on an organised market. On a short-term basis, generators and consumers can trade electricity with each other and they can also trade with the single-buyer.

This intermediate stage follows earlier stages in which there is a market operator, and buyers and sellers in the P2P segment rely entirely on the single buyer in the regulated segment for mismatches between supply and demand (including short-term balancing). This is facilitated by obliging the single buyer to buy and sell electricity at pre-determined regulated prices (since it has a monopoly over this service).

In the future, the regulated segment is expected to disappear altogether. This would be the type of market seen in the European Union.

Figure 5 Design of the power market in Egypt, Phase 0 of market opening



Source: (Hewicker, 2023).

Notes: EETC = Egyptian Electricity Transmission Company (EETC); TSO = Transmission System Operator; G = generator; S = Supplier; C = Consumer.

The most important attribute of the contract offtaker is its creditworthiness; otherwise, concerns about counterparty risk may drive away potential bidders, as described in section 2.1.1. If a jurisdiction's state-owned companies are not financially stable, it is sometimes desirable to seek alternative entities to play the offtaker role. PPAs can include provisions to allow IPPs to change offtakers in the event the utility defaults. Table 4 outlines the potential impacts of offtaker choice. The impact on consumer affordability depends on how the costs are passed on to consumers.

Peru is an example of a country that revised its contracting arrangements, changing the contract's offtaker. In hydropower-exclusive auctions carried out in 2009 and 2011, distribution companies had been used as offtakers. However, in the country's renewable energy auctions in 2010 and 2011, the Peruvian government itself was the contract's offtaker (represented by the Ministry of Mines and Energy), likely so as to eliminate any doubts about counterparty creditworthiness (IRENA and CEM, 2015).

Table 4 Choice of offtaker: associated risks and impact on outcomes

Choice of offtaker Risks impacted: Counterparty (offtaker) risks						
Impacts		**Single buyer model (*e.g.* contract with state-owned utility)**		**Independent entities (*e.g.* industries)**		**Multi-buyer offtake**
Impact on price competitiveness	(=/–)	Price increases with the perception of risk in the case of low creditworthiness of utilities	(+)	Selling directly to consumers with strong ability to pay can add confidence	(+)	Reduces risk as offtake does not rely on one utility, especially if its creditworthiness is weak
Impact on cost of support (and government debt)	(+)	Increases if payments to be made by state utility are higher than revenues from consumers	(+)	Can erode the utility's revenue base unless tariffs are restructured to make sure fixed costs (*e.g.* grid maintenance) are still paid	(–)	Since payment obligations are diversified, the government may be less exposed financially
Impact on the potential to develop domestic supply chains and create local value	(=)	No theoretical impact	(+)	Direct PPAs with industries empower them as market actors and align renewables with green industrialisation	(+)	Can align new renewable energy capacity with industrial growth priorities (*e.g.* green hydrogen clusters, powering industrial parks)

3.1.4 Allocation of costs

The allocation of costs including the overruns due to increases resulting from currency fluctuations, inflation or cost of grid connections, for example, can follow multiple methods of implementation. Costs can be passed on to consumers or mitigated through government subsidy or support, or absorbed by the project developer (who in turn would have accounted for it in the bid). Where the state absorbs costs and overruns, these costs can be covered (partly or entirely) from government budgets, state-owned companies, or in some cases international aid entities.

Table 5 showcases the trade-offs to consider when deciding on the allocation of costs in terms of impact on outcomes and associated risks.

Table 5 Allocation of costs: associated risks and impact on outcomes

Allocation of costs Risks impacted: Political, currency, counterparty (offtaker), grid and transmission, supply chain, construction, and force majeure event risks						
Impacts		**Passed through to consumers**		**Fully funded by the state**		**Shouldered by project owner**
Impact on price competitiveness	(+)	Price at the time of bidding can be low if contracts are indexed	(+)	Price at the time of bidding can be low if contracts are indexed and state is creditworthy	(–)	Would increase prices to account for increasing costs
Impact on consumer affordability	(–)	Directly impacted by events of currency exchange fluctuations, inflation, etc.	(+)	Borne by the government	(=)	No impact, as project absorbs costs and tariff remains fixed
Impact on project realisation	(+)	Developers would be more confident regarding cost recovery	(–)	Developers would be less confident regarding cost recovery	(–)	Higher exposure to cost overruns or currency shocks can jeopardise financial close or delay construction
Impact on cost of support (and government debt)	(=)	No impact	(–)	Can be considerable	(=)	No impact
Impact on the potential to develop domestic supply chains and create local value	(+)	Can impact industries if electricity costs increase	(=)	No impact	(+)	Developers may be more incentivised to mitigate impacts of currency and inflation through local sourcing

3.1.5 Contracting scheme

In some high-risk circumstances, contracting schemes may be designed to allocate the least risk to developers and investors by taking on all investment uncertainty through organising the auction around the EPC of the project, which would be operated by the government, rather than holding an auction for a long-term contract that includes the obligation to operate and maintain the plant over its lifetime. In contrast, PPAs – following a build-own-operate (BOO) or build-own-operate-transfer (BOOT) model (see section 3.6.1) – assign the responsibility of financing, building, owning and operating the project to private developers, who then sell the power following the rules defined in the PPA. Table 6 outlines the trade-offs to consider between the two options.

Table 6 Contracting scheme: associated risks and impact on outcomes

Contracting scheme Risks impacted: counterparty (offtaker), construction, financing or refinancing, and arbitration and contract enforcement risks				
Impacts		**EPC**		**PPA**
Impact on price competitiveness	(+)	Government takes on long-term risks	(–)	Long-term risks are factored in
Impact on project realisation	(+)	Straightforward role for developers	(+)	Strong commercial incentive to complete the project on time since IPP only earns if it delivers
Impact on cost of support (and government debt)	(+)	High upfront public spending and/or debt. Can raise public debt levels or contingent liabilities	(–)	Leverages private capital, limiting government fiscal exposure, but overall cost of support depends on other design elements
Impact on the potential to develop domestic supply chains and create local value	(=)	Local benefits depend on auction design (*e.g.* local content rules, socio-economic criteria)		

3.2 LOCATION, TECHNOLOGY AND PROJECT SPECIFICATIONS

This category of design elements determines the choices made regarding the specificity of the projects in terms of technology, site, project size and production limits. It also specifies the socio-economic requirements imposed on projects.

3.2.1 Location specificity

This design element addresses the allocation of **site provision and preparation risks, social and environmental risks, permitting risks, and grid and transmission risks**. There are three options auction designers can consider (see Table 7 for a discussion on trade-offs):

- **Site-specific auction:** The auctioneer identifies and predevelops a suitable site with grid access. By providing sites with land and grid access, auctioneers can reduce developer uncertainty and lower bid prices. This approach has enabled record-low tariffs in some cases – for example, Zambia's Scaling Solar tender (2016), for which the Industrial Development Corporation handled site acquisition and grid interconnection (IRENA, 2018a), and India's solar park auctions (*e.g.* the Rewa 750 MW park), with prices reaching grid parity with coal (World Bank, 2021). However, the process of government-handled site selection in Zambia was not without challenges, as detailed in Box 11.
- **Guidance:** Bidders choose the location with guidance from the government (in the form of zone-specific capacity limits) towards or away from predetermined zones. An example is South Africa's renewable energy development zones and five power corridors in Round 5 of the REIPPPP, which sought to concentrate wind and solar photovoltaic (PV) projects in specific geographical areas where investments to strengthen the transmission grid would be concentrated and strategic environmental assessments would be undertaken (IRENA, 2018a). An alternative is to use incentives or penalties, for example by assigning a weight to a site's proximity to the grid or by awarding projects bonuses or penalties according to their technical characteristics and the stress they impose on the system, as in Mexico (IRENA, 2019).
- **Free siting:** bidders can choose the location for their projects freely.

Table 7 Location specificity: associated risks and impact on outcomes

Location specificity Risks impacted: site provision and preparation, social and environmental, permitting, and grid and transmission risks							
Impacts		**Site specific**		**Guidance**		**Free siting**
Impact on price competitiveness (and consumer affordability)	(+)	Lower project risk and lower costs related to resource and social and environmental impact assessments reduce the bid prices	(–)	May steer projects to areas with grid availability or need for socio-economic activities, which might not be the most resource-rich areas, possibly increasing prices	(+)	Developers typically go after the most competitive sites
Impact on project realisation	(+)	Reduces costs and risks related to securing sites and increases project realisation if projects are built in viable locations	(+)	The auctioneer typically guides projects towards viable sites	(–)	Higher risk of delays due to site grid limitations, permitting, etc.
Impact on cost of support (and government debt)	(+)	Public spending on land and infrastructure can increase the cost of support, but costs may be recovered through savings on transmission costs	(–)	Less public spending on direct project costs, but still requires planning and oversight (*e.g.* incentives, zone designation)	(=/+)	No cost implications in the short run but in the long run may incur additional costs for balancing the system (*e.g.* transmission)
Impact on socio-economic benefits	(+)	Sites can be selected based on areas that would benefit the most from the economic activity	(+)	Projects can be guided towards areas that would benefit the most from the economic activity	(–)	Bidders typically focus on financial returns while selecting the sites

Box 11
Zambia's difficult experience with government-led site selection

In Zambia's Scaling Solar Round 1 (2016), project sites were preselected and allocated by the government with the support of IFC advisers to ensure grid availability, permits and coordinated development. The Zambian Development Authority chose the Lusaka South Multi-Facility Economic Zone, offering tax incentives, and the Industrial Development Corporation leased land and provided extensive studies funded by US Agency for International Development's Power Africa initiative, covering environmental, legal and technical aspects.

Developers were responsible only for shallow grid connections, with technical details and data made available through a virtual data room. Despite this streamlined approach, issues arose: environmental and social impact assessments were complex due to past resettlements; one site required legal changes due to its proximity to a conservation area; and geotechnical problems, including sinkholes, led to delays and at least one EPC contractor's withdrawal.

Source: (Kruger and Eberhard, 2019).

3.2.2 Technology specificity

Technology-neutral auctions, where the different technologies compete with one another, aim to identify the most cost-competitive technology in a specific context or for predetermined objectives (*e.g.* delivering power at specific times of the day).

Technology-specific auctions, on the other hand, can be used to diversify the electricity mix and/or develop supply chains of specific technologies. More than one technology can be targeted at the same time. Some countries (*e.g.* South Africa, Ukraine) use separate technology demand bands within a single auction round. Auctioneers can adjust technology limits based on system needs and price signals – before and during awards processes (if clearly signalled and governed).

This design element can cover the allocation of **resource, construction** and **technology risks,** as well as **permitting** and **supply chain risks** (see Table 8).

In technology-neutral auctions, the choice of technology (and all the associated risks) is the purview of the developers. Although these risks might be factored into the bid, the auction is still aiming for the lowest technology costs.

In technology-specific auctions, these risks are partly allocated to the auctioneer. In the most extreme cases, such as site- or project-specific auctions, they are fully allotted to the auctioneer (section 3.2.1) but in less extreme cases, the developer takes on some of the risks. These risks may be related to the technology itself – allotted to the developer through the imposition of technological specifications – or they may be related to the supply chain, allotted to the auctioneer through measures to support the development of a given technology.

Table 8 Technology specificity: associated risks and impact on outcomes

Technology specificity Risks impacted: resource, construction, technology, permitting and supply chain risks				
Impacts		**Technology-neutral auctions**		**Technology-specific auctions**
Impact on price competitiveness (and consumer affordability)	(+)	Allows for competition between technologies, leading to optimal price discovery through the least-cost option	(–)	Bands dedicated to less mature technologies can limit competition, increasing prices in the short term
Impact on project realisation	(+)	Least-cost technologies are usually more mature and have a higher likelihood of project realisation	(+)	Greater support for project realisation in cases where the technology-specific auctions are also project or site-specific
Impact on the potential to develop domestic supply chains and create local value	(–)	No indication to market players on which technology has promising market growth	(+)	Provides a signal to market players regarding the potential opportunities in specific supply chains

3.2.3 Project size limits

The auction can also specify project size limits. This design element determines whether **grid and transmission risks, social and environmental risks, and supply chain risks** get allocated to one bidder or many bidders (see Table 9). A benefit of determining an upper limit on the project size is distributing these risks over several projects, reducing the risk of one big project failing. Ultimately, the auctioneer must set project size limits that are realistic (especially in the case of grid capacity), while also ensuring projects are financially viable for developers.

Table 9 Project size limits: associated risks and impact on outcomes

Project size limits Risks impacted: grid and transmission, construction, social and environmental, and permitting risks				
Impacts		**Minimum project size limits**		**Maximum project size limits**
Impact on price competitiveness (and consumer affordability)	(+)	Could encourage economies of scale and lower bid prices	(–/+)	May limit economies of scale but can increase competition
Impact on project realisation	(+)	Lower limits may attract experienced players with higher chances of delivering projects on time	(+)	Upper limits aligned with IPP and grid capacity can make project completion more feasible
Impact on the potential to develop domestic supply chains and create local value	(–)	A large minimum project size might limit participation to players that can handle a project that size, deterring small and new players	(+)	If maximum limits are linked to multiple projects and multiple auction rounds, it can signal certainty to domestic suppliers and can allow new market players

3.2.4 Project specificity

This design element combines location specificity with technology and project size specificity, allocating all their associated risks to the auctioneer. Project-specific auctions place all the responsibility of resource assessments and obtaining permits on the auctioneer. They encourage bidder participation in early stages of development of the sector, but as shown in the Scaling Solar programme in Zambia, although they have big potential to result in low prices, they may delay project realisation if not properly implemented. Table 10 summarises the outcomes.

Table 10 Project specificity: associated risks and impact on outcomes

Project specificity Risks impacted: grid and transmission, social and environmental, supply chain, site provision and preparation, and grid and transmission risks				
Impacts		**Project-specific auctions**		**Bidders have flexibility**
Impact on price competitiveness (and consumer affordability)	(+)	Can encourage bidders, increase competition and lower bid prices	(=)	Depends on other factors and design elements
Impact on project realisation	(+)	Theoretically, the site assessments and permits are provided	(–)	Developers might run into complications securing site or grid connection
Impact on cost of support (and government debt)	(+)	Can be costly for governments in the short term but have long-term benefits	(=/+)	No direct impact in the short term but can have costly impacts on the system in the long run
Impact on the potential to develop domestic supply chains and create local value	(+)	Can create economic activity and opportunities for local job creation and stimulate small business growth in specific locations	(=/–)	Bidders typically focus on financial returns while selecting location, technology and project size

3.2.5 Production limits

Auction schemes can set minimum or maximum annual production limits for renewable electricity generation. Minimum production thresholds ensure a stable energy supply, support system reliability, and help meet

specific generation targets. Maximum production caps can support grid integration, limit spending on subsidies when they are needed, and ensure renewable energy is used optimally. Table 11 further outlines the trade-offs for production limits.

For instance, certain schemes cap annual full-load hours to align with expected renewable electricity availability and market dynamics. These limits are tied with compliance rules, as was the case in early auctions in Brazil, where annual production below 90% of the contracted quantity triggers a 115% price penalty to sellers and the shortfall must be made up the next year. Output above 130% earns 70% of the contract price, with the extra 30% carried over to the following year. Deviations between 90% and 130% can be accounted for and offset within four years (IRENA, 2013).

Setting production limits can impact certain risks:

- **Market risk** – Production limits must balance the reliability of supplying power with developer flexibility if there is variability in demand. The auctioneer can anticipate market risk by using dynamic caps based on system modelling.
- **Resource risk** – Inadequate thresholds increase exposure to variability in resource availability.
- **Grid and transmission risk** – Production mismatches can cause instability or curtailment.

Table 11 Production limits: associated risks and impact on outcomes

Production limits Risks impacted: market, resource, and grid and transmission risks				
Impacts		**Minimum production thresholds**		**Maximum production caps**
Impact on price competitiveness (and consumer affordability)	(=)	No direct impact on the price	(–)	Maximum limits may result in higher prices, with the total profits to be made spread out over a small volume of power sold
Impact on cost of support (and government debt)	(=)	No direct impact	(–)	Caps help avoid overspending on energy that is not needed

3.2.6 Socio-economic requirements

The auction can impose local content requirements – a mandatory share of project equipment, labour and services to be sourced locally (Box 12) – or the auction may introduce a quota for women or marginalised populations, such as in South Africa. Other socio-economic requirements include the share of project benefits going back to the host community, for example in the form of clean electricity, shared revenues, or social services such as school, health care, water and sanitation, as in El Salvador and Morocco (Ouarzazate).

Box 12
Socio-economic requirements in renewable energy auctions in selected countries

In **Argentina**, foreign technology imports are allowed only when there are no local alternatives available. Tax certificate regimes exist for projects that source at least 60% of their materials locally.

In **Brazil**, a local content requirement for wind projects is necessary to qualify for subsidised loans, although it does not apply to bidding rights. This has successfully fostered the development of local wind supply chains. However, the cancellation of wind auctions in 2016 and a change in turbine size requirements – from 2 MW to 3 MW – created challenges for local manufacturers.

In **Malaysia's** Large-Scale Solar auction, foreign ownership is capped at 49%. Bidders must be local companies with at least 51% Malaysian equity or must form a consortium that includes at least one local company, with the Malaysian equity stake also being at least 51%.

In **Saudi Arabia**, the 2017 solar PV auction featured a local content requirement of 30% for services and equipment. By its completion in 2019, the Sakaka PV IPP achieved over 30% local content during the construction and development phases. The project also committed to a 100% local employment rate within its first year, with 90% of the workforce coming from the Al Jouf region where the project is based.

In **South Africa**, the REIPPPP established local content requirement thresholds starting at 45% for solar PV and 40% for other technologies, with targets increasing to 65% in later rounds. Local content commitments for all projects procured were around USD 4.7 billion (ZAR 67.1 billion), representing 45% of the total project value. Although local manufacturing saw early success and a small export market developed for wind and solar, delays of three years in finalising PPAs from previous rounds led to many factories shutting down or scaling back operations. This indicates how political decisions to halt renewable energy programmes can disrupt broader industrialisation efforts.

Türkiye has set a 65% local content requirement for auctions in its renewable energy resource areas. The winning bidder for solar PV must construct a solar panel manufacturing facility in Türkiye with a capacity of at least 500 MW within two years of the contract date and must also establish a research and development facility employing a minimum of 100 permanent technical staff. For onshore wind projects, the winning bidder is similarly required to create a research and development facility.

In the **United Kingdom's** contract for difference support scheme, offshore wind projects with a capacity of 300 MW or more must submit a supply chain plan that details strategies for fostering local innovation, competition and skill development. Currently, only about one-third of the supply chain is localised, but the government aims to boost this share to 60%. This scheme is not a local content requirement; rather, it evaluates the local impact of the project.

Source: (IRENA, 2019).

If embedded in a broader long-term industrial strategy, socio-economic requirements such as local content requirements can help anticipate potential **supply chain, currency, and T&C risks** as the share of goods and services that can be sourced locally increases. Such a strategy must foster, over time, the conditions that make local manufacturing viable, such as adequate market size, sufficient and reliable industrial capacity, and a predictable and sizeable demand pipeline based on long-term procurement.

In the immediate term, local content requirements could lead to extended project lead times and higher project implementation costs. To be effective and ensure continuity in any effort to localise value chains, a long-term renewable energy plan must be firmly integrated in a national industrial policy framework. Local content requirements can be also regional, mandating a certain share of value to be sourced from a specific region, potentially under the framework of a regional trade agreement. This can facilitate a larger market size, ease market access and leverage regional capabilities. In addition, capacity-building support – providing financial or technical assistance and technology transfer to local suppliers – can ensure they are able to meet project demands.

Socio-economic requirements that enable benefit-sharing with local communities can promote social acceptance of the project and therefore mitigate **construction, permitting, and social and environmental risks** (IRENA, 2025). Table 12 presents the impacts of socio-economic requirements on various outcomes.

Table 12 Socio-economic requirements: associated risks and impact on outcomes

Socio-economic requirements Risks impacted: supply chain, technology, construction, permitting, and social and environmental risks		
Impacts		**Inclusion of socio-economic requirements**
Impact on price competitiveness (and consumer affordability)	(–)	Requirements may increase project costs in the immediate term
Impact on project realisation	(–)	Especially stringent or unrealistic requirements may delay financial close, procurement and project execution in the short term
	(+)	Requirements that benefit communities can increase social acceptance and support timely project realisation
Impact on cost of support (and government debt)	(+)	In the short term, costs might be higher, especially if the government subsidises local industry development
	(–)	In the long term, projects that benefit the economy can lead to the development of a beneficial sector that fuels green industrialisation
Impact on the potential to develop domestic supply chains and create local value	(+)	Strong stimulus for domestic industries and jobs
	(–)	Overly stringent local content requirements may deter investment or exclude new or small bidders

3.3 QUALIFICATION REQUIREMENTS AND COMPLIANCE RULES

Prequalification criteria and documentation requirements are a direct lever to manage most of the risks that impact project cost and realisation, including **technology, construction, resource, site provision and preparation, permitting, social and environmental, grid and transmission, supply chain, and financing or refinancing risks**. By requiring proof of financing and technical capacity, as well as lender commitment letters, auctioneers effectively outsource risk due diligence to the financial sector, ensuring that bids are realistic. However, stringent requirements can exclude smaller, new or local firms, potentially raising questions about local value creation and inclusivity. The same goes for enforcement mechanisms. While bonds and penalties

can ensure that contractual obligations are met in a timely manner, overly burdensome compliance rules can potentially deter bidders. This not only excludes some players, but it also limits competition, potentially lowering price competitiveness.

3.3.1 Reputational documentation requirements

Prequalification requirements related to bidder reputation and experience are designed to improve project realisation, minimise delays and align with broader policy goals (Table 13). They serve as evidence of a developer's capability and assess technical, financial and legal readiness. The required documentation may include proof of legal status, financial capacity and technical experience. Moreover, if localising value chains is an objective of the auction design, then proof of partnerships (*e.g.* joint ventures) with local players can be required.

Prequalification helps mitigate **technology**, **construction, supply chain, and financing or refinancing risks**. While such requirements help ensure credible bids and deliver socio-economic impacts, they can raise the risk of sunk costs for unsuccessful bidders, potentially discouraging smaller or newer market participants.

Table 13 Reputational documentation requirements: associated risks and impact on outcomes

Reputational documentation requirements Risks impacted: technology, construction, financing or refinancing, and supply chain risks		
Impacts		**Inclusion of reputational documentation requirements**
Impact on price competitiveness (and consumer affordability)	(–)	Strict qualification criteria lowers the number of eligible bidders, reducing competition
Impact on project realisation	(+)	Limits participation to bidders who are more likely to deliver on time
Impact on the potential to develop domestic supply chains and create local value	(–) (+)	May deter small, domestic or new players Requirements related to experience in the domestic market can support local players

3.3.2 Project development documentation requirements

Auctions can either require advanced project development with detailed documentation or allow early-stage participation with minimal requirements (Table 14). These requirements include:

- Project site selection – proof of land use and right-of-way permits, building permits, construction plans, water licences, renewable resource measurement records.
- Securing grid access – grid access or expansion assessments (in some countries, this can be conducted by the utility or auctioneer) or grid access permit (if required before the auction, then participating projects usually do not need grid expansion). See Box 13 for an example of strict requirements in renewable auctions in the Netherlands.
- Environmental and social impact assessments.

These decisions will have direct impacts on **permitting risk, site provision and preparation risk, grid and transmission risk, and social and environmental risk, which in turn may impact construction risk.** Strict qualification criteria requiring permits, grid access, and land allocation can improve timely project realisation and delivery as per the bid, yet could be difficult for developers if the processes to obtain these documents are costly, slow or unclear (with no guarantees of winning the bid).

Another decision is at what stage to require the documents: at the bidding stage as a prerequisite for the bid to be considered or at the contract award stage as a prerequisite for financial close.

Table 14 Project development documentation requirements: associated risks and impact on outcomes

Project development documentation requirements Risks impacted: permitting risks, site provision and preparation risks, grid and transmission risks, and social and environmental risks						
Impacts		**Minimal requirements**		**Detailed documentation required at bidding stage**		**Detailed documentation required only at contract signing stage**
Impact on price competitiveness (and consumer affordability)	(+)	Can boost competition and lower bids	(–)	Can limit competition and raise prices	(+)	Can boost competition and lower bids
	(-)	Can increase uncertainty about project risks, which may raise financing costs and ultimately prices	(+)	Reduces uncertainty and financing costs	(–)	Might lead to lowest bidders pulling out at this stage
Impact on project realisation	(–)	May negatively impact project realisation	(+)	Enhances project feasibility and ability to deliver as bid	(–)	May negatively impact project realisation
Impact on the potential to develop domestic supply chains and create local value	(+)	Can facilitate the participation of small, new or domestic players as they only invest in the documents later in the process	(–)	May exclude smaller players that lack resources	(+)	Can facilitate participation of small, new or domestic players as they only invest in the documents once they have been selected

Box 13
Strict qualification requirements in renewable energy auctions in the Netherlands

The Netherlands was the first European country to implement a large-scale, technology-neutral auction scheme through the Stimulering Duurzame Energie (SDE+) programme in 2011. This model has auctioned government financial support for approximately 25.6 gigawatts (GW) of new renewable capacity to be installed.

The Netherlands auction design mandates strict qualification requirements. Since 2014, a feasibility study has been a key qualification criterion, significantly contributing to improved realisation rates. Among the required documents for participants (excluding for offshore wind projects) are the following:

- environmental and, if necessary, mining permits submitted with the bid
- feasibility study for installations exceeding 500 kilowatts (kW)
- energy yield calculations for onshore wind and solar PV installations
- geological surveys for geothermal plants
- owner's permission if the bidder does not own the land
- financial guarantee for projects exceeding USD 460 million

The feasibility study must include several components:

- an exploitation statement detailing investment costs for each major component of the production installation, a cost-benefit analysis, and a profit and loss statement with anticipated returns on investment
- a statement of equity and financing levels accompanied by supporting documents (for projects with less than 20% equity, this would be a letter of intent from a financing entity confirming capacity and willingness to finance), along with calculations and projections of expected output from wind, hydro, biomass and waste sources
- for biogas projects, a statement from the responsible distribution system operator regarding the costs of connecting to the gas network
- for renewable heat projects, an evaluation of heat demand, including proof of sufficient customers for the heat generated by the installations

Until 2014, nearly 50% of the auctioned volume was not realised due to delays. However, after 2014, the introduction of the feasibility study and stricter permitting regulations began to improve the rate of realisation. As a result, the realisation rates for 2012 and 2013 were close to 50%. By the end of 2019, only about 10% of project capacity auctioned in 2015 remained unrealised.

Source: (Jakob *et al.*, 2019).
Note: A currency conversion of EUR/USD = 1.15 was used.

3.3.3 Compliance rules

There are three main instruments to ensure project developers meet their contractual obligations, such as project completion or required electricity supply volumes:

- Bid bonds – Bidders will not get their bond amount back unless they comply with the offer submitted in the auction.
- Performance or project completion bonds – This type of bond is sometimes converted from bid bonds. They are submitted by awarded bidders to incentivise project completion or a sufficient supply of electricity as agreed in the contract.
- Penalties for underperformance or delays – These are penalties for not meeting the required supply of electricity or deadlines (*e.g.* the deadline for the commercial operation of the power plant).

Compliance rules are helpful in managing **financing or refinancing risk**, since bid bonds can deter speculative bidding. Compliance rules in contracts are also important for **arbitration and contract enforcement risk**, as these rules can reduce the likelihood of disputes if obligations and consequences are clearly stipulated. Clear penalty regimes serve to ensure developers meet contract requirements and reach project completion (see Box 14 for examples of penalties and incentives for project realisation).

Table 15 Compliance rules: associated risks and impact on outcomes

Compliance rules Risks impacted: financing or refinancing, and arbitration and contract enforcement risks							
Impacts		**Bid bonds**		**Performance bonds**		**Penalties**
Impact on price competitiveness (and consumer affordability)	(–)	Increase upfront bid costs and may reduce number of bidders, increasing the price	(–)	Could be priced into tariffs if bonds are substantial	(–)	May lead to higher bid prices to offset penalty exposure
Impact on project realisation	(+)	Improve quality of bids by filtering out speculative or underprepared bidders	(+)	Incentivise projects to be completed on time and to specification	(+)	Encourage compliance with timelines and output targets
Impact on cost of support (and government debt)	(=)	Limited direct impact	(=)	Limited direct impact	(–)	Can offset some government costs in the case of non-realisation
Impact on the potential to develop domestic supply chains and create local value	(–)	May deter the participation of small, new or domestic players (unless they are exempt)				

Box 14
Delay penalties and early realisation incentives in renewable energy auctions: Namibia, South Africa and Zambia

Namibia, South Africa and Zambia incorporated strict penalty regimes into their auctions to support project realisation (Table 16), but there was reluctance to enforce them rigidly. Auctioneers feared that penalties could jeopardise the completion of projects, especially in contexts where sponsors already faced tight margins and competitive pressure.

Over time, Namibia and Zambia eased these regimes, with performance bonds and liquidated damages either removed or reduced. The most consistently enforced penalty has been the automatic reduction of PPA length for delays, which offers a gradual and enforceable disincentive without overwhelming developers. Early connection payments have also proven to be effective incentives for timely completion (Kitzing *et al.*, 2021), though only South Africa has effectively used this mechanism, largely due to more generous timelines compared to Namibia and Zambia. However, strict or relaxed penalty regimes can raise project costs, particularly for EPC and O&M contracts, as developers hedge against potential risks.

An exception to the easing trend is the use of penalties to enforce socio-economic development commitments. These penalties were applied in South Africa, particularly when bidders made unrealistic pledges (*e.g.* high procurement targets for women-owned enterprises) to boost their bid scores. Some developers assumed they could simply absorb the penalties but underestimated both the financial cost and the risk of PPA termination through a points-based penalty system. In response, affected bidders submitted and followed mitigation plans, demonstrating that the threat of penalties and contract termination can be effective in improving compliance on non-technical obligations. This highlights the continued relevance of robust enforcement mechanisms in achieving broader policy goals beyond project delivery.

Table 16 Penalties and incentives: Namibia, South Africa and Zambia

Country	Liquidated damages	PPA length reduction	Early connection payment
Namibia	Hardap project: 0.25% of EPC costs per week delay 1% of EPC costs for every 0.1% below contracted performance ratio 1% of EPC costs for every 100 kW of which plant is below contracted capacity	1 day reduction for 1-day delay	None
	Khan project: None	1 day reduction for 1-day delay	None
South Africa	None, though projects were awarded termination points for SED underperformance	3 days' reduction for 1-day delay	60% of Bid tariff
Zambia	World Bank's Scaling Solar program: USD 7 500 for every 0.1% annual plant performance ratio below estimated performance ratio	Scaling Solar: 1 day reduction for 1-day delay	Scaling Solar: 80% of tariff
	GETFiT: USD 500/MW per day delay	GETFiT: 1 day reduction for 1-day delay	GETFiT: 80% of tariff

Source: (Kruger, 2021).

3.4 WINNER SELECTION

This category of design elements determines the choices related to how bids are collected, winners selected, and contracts awarded including provisions to avoid market concentration and ensure prices fall within pre-determined thresholds.

3.4.1 Winner selection criteria

The winner selection criteria determine how bids are ranked and how winners are selected. Auctioneers can choose to either have price-only auctions, where the bidder with the lowest price is awarded the contract, or multi-criteria auctions with determinants of the winning bid that go beyond price. The latter is more complex and requires capacity to design well-structured evaluation criteria and transparent scoring methodologies, assign the proper weights to the different criteria and evaluate complex bids. A robust, transparent selection criteria would reduce the likelihood of legal disputes on the winner selection process.

For multi-criteria selection, the weights of the scores indicate the auctioneer's priorities (*e.g.* price, system integration, socio-economic benefits). The auctioneer can assess projects based on their exposure to selected risks such as **grid and transmission, site provision and preparation, supply chain, technology, construction, permitting, and social and environmental risks**. Box 15 details examples of price-only auctions and multi-criteria auctions.

Box 15
Non-price criteria in renewable energy auctions

In Colombia, the criteria in the winner selection process aligned with the policy objectives, which were targeted with the following scoring methodology:

- Up to 25 points for enhancement of the resilience and adaptability of the energy system through diversification of the energy mix
- Up to 25 points for the complementarity of the project's seasonal profiles with historical flows in the main hydropower basin
- Up to 25 points for the contribution of the project to the reduction of CO_2 emissions
- Up to 25 points for the impact on the supply-demand balance and reduction of operational restrictions

In **Uganda's** auctions for biomass, hydro and bagasse power plants, developers compete based on financial and economic performance (up to 35 points), environmental and social performance (up to 30 points), and technical and organisational performance (up to 35 points).

Participants that receive an overall score of less than 70 points out of the total 100, or that score less than half of the points in any of the three categories, are eliminated. Since the premium payments are already established by the programme, based on the levelised cost of electricity for each of the technologies, there is no price competition.

For solar PV projects, however, price is included in the auction's winner selection criteria, with a weight of 30%. The government made this decision because the solar PV market is changing so rapidly, making the levelised cost of electricity more difficult to calculate.

In the European Union, new rules were adopted by the European Commission for non-price criteria in renewable energy auctions in EU countries. The criteria, designed to scale up the EU's manufacturing capacity for net-zero technologies, include responsible business conduct, cybersecurity, and sustainability and resilience contribution. These rules must be applied to 30% of auction volumes (*i.e.* 6 GW per year per EU country) by 30 December 2025.

Sources: (EU Commission, 2025; IRENA, 2018a, 2021).

Auctions with multiple criteria need to be transparent about how they plan to score bids. This is crucial in mitigating **arbitration and contract enforcement risk** because clear, transparent selection criteria reduce legal disputes and ensure enforceability of contracts. Bidders are likely to view opaque scoring criteria as a potential governance risk for the auction and may decide not to submit a bid, thereby reducing competition. Auctions should have quantifiable scoring criteria and published evaluation methodology, including milestones and penalties for non-delivery. Table 17 details the impact on outcomes of minimum price vis-à-vis multi-criteria auctions.

Table 17 Winner selection criteria: associated risks and impact on outcomes

Winner selection criteria Risks impacted: arbitration and contract enforcement, grid and transmission, site provision and preparation, supply chain, technology, construction, permitting, and social and environmental risks				
Impacts		**Price-only auctions**		**Multi-criteria auctions**
Impact on price competitiveness (and consumer affordability)	(+)	Ideal for lowest-price objective, as winning bid will be the least-cost option	(–)	Puts less emphasis on price and targets other policy objectives
Impact on project realisation	(–)	The winning projects might be the most aggressive, with risk of underbidding	(+)	If technical or project preparation criteria are included, may lead to selecting better prepared projects
Impact on cost of support (and government debt)	(–)	Puts less pressure on cost of support	(+)	May increase fiscal exposure if multi-criteria result in higher tariffs or need for subsidies
Impact on the potential to develop domestic supply chains and create local value	(–)	Large international developers may be favoured over local players with limited experience	(+)	Can set criteria linked to socio-economic benefits (job creation, local manufacturing, and skills development), favouring projects that drive development

3.4.2 Provisions to prevent market concentration

Auctioneers can prevent market concentration by setting rules, such as (i) limiting the share a single bidder can bid (*e.g.* the European Hydrogen Bank auction limits individual bids to 33% of the total auctioned budget, helping to distribute market opportunities more broadly (IRENA, 2024)); (ii) limiting the share a single bidder can win (*e.g.* Colombia's first renewable energy auction in 2019); (iii) separating auctions with a certain share of the capacity for smaller players (see demand bands in section 3.1.2), or (iv) excluding previous winners in certain auction rounds to broaden market participation (*e.g.* 2005-2008 tenders in Portugal). Such rules may be included to mitigate **financing and construction risks** in case one bidder defaults and can also address **supply chain risks** by encouraging the participation of more bidders and the diversification of suppliers (Table 18).

Table 18 Provisions to prevent market concentration: associated risks and impact on outcomes

Provisions to prevent market concentration Risks impacted: construction and supply chain risks				
Impacts		**No provisions**		**Strict provisions**
Impact on price competitiveness (and consumer affordability)	(+)	Can lead to the awarding of a higher volume to the lowest bidder	(–)	Might lead to awarding projects that bid higher than the lowest price
Impact on project realisation	(–)	Might impact project realisation if bidder awarded with large volume defaults	(+)	The volume is spread out over several projects, reducing the risk of volume auctioned not being delivered
Impact on cost of support (and government debt)	(–)	Lowest price puts less pressure on cost of support	(+)	My lead to higher cost of support if bid prices are higher
Impact on the potential to develop domestic supply chains and create local value	(–)	Can lead to market concentration and slow development of local supply chains	(+)	Can encourage the participation of a higher number of bidders and suppliers, indirectly supporting local supply chains

3.4.3 Price caps

A ceiling price sets an upper limit on bids and helps limit offers below a predetermined value, particularly in low-competition auctions. Conversely, a floor price establishes a minimum acceptable bid to deter unrealistically low offers that could jeopardise project viability. Both aim to maintain a balance between affordability and sustainability in auction outcomes (Table 19). Beyond the decision on whether to introduce a price cap, design elements include the value of the cap and whether to disclose it to the bidders before they bid.

Price caps allocate (i) **counterparty risks** – a price ceiling reduces the risk that the offtaker would not be able to pay for the power but places the burden of minimising the price on the bidders; (ii) **construction risks** – price floors could support project feasibility but place the burden on the buyer; and (iii) **financing risks** – price caps can be set too low, rendering the project unfeasible.

Table 19 Price caps: associated risks and impact on outcomes

Price caps Risks impacted: financing or refinancing, counterparty (offtaker), and construction risks								
Impacts		**Undisclosed price ceilings**		**Disclosed price ceilings**		**Undisclosed price floors**		**Disclosed price floors**
Impact on price competitiveness (and consumer affordability)	(+)	Can reduce the risks of collusion and windfall profits among bidders	(–)	May lead to collusion and bids submitted just below the ceiling in low-competition settings	(–)	Filters out bids presented that are below the set threshold	(–)	Keeps bids above a defined threshold
Impact on project realisation	(–)	Can result in many (disqualified) bids presented above the ceiling price, lowering the probability of meeting the volume auctioned	(–)	Bidders might be incentivised to underbid in order to qualify	(+)	Helps ensure project viability by filtering out projects deemed unrealistic	(+)	Helps ensure project viability by avoiding underbidding, which can lead to defaults or delays
Impact on cost of support (and government debt)	(+)	High potential for minimised subsidy levels, but if too low, can lead to failed auctions and repeated rounds	(–)	May lead to unnecessary subsidies in the case of collusion and bids submitted just below the ceiling	(+)	May lead to failed auctions and repeated rounds	(+)	More support may end up being provided than needed if price floor is higher than feasible
Impact on the potential to develop domestic supply chains and create local value	(–)	If ceilings are too low, local firms may be priced out of the market			(+)	By supporting realistic pricing, price floors can help smaller or local players bid without competing with developers that may submit unrealistically low bids		

3.5 RISK ALLOCATION AND REMUNERATION OF SELLERS

The design elements associated with the sellers' liabilities and remunerations are directly linked to the way risk is allocated among the different stakeholders.

3.5.1 Contract duration

The duration of a PPA determines how long support payments are available, impacting government obligations and project viability. When determining the contract duration, a common strategy is to calibrate the duration so it is close to the project's estimated lifetime. Otherwise, a fair estimation of the plant's residual value once the contract terminates will be needed, as will considerations for post-contract provisions (see section 3.6). The contract duration should also be compatible with the duration of the typical financing maturity given by banks. Latin American countries, such as Brazil and Peru, follow this rule when setting the contract duration (IRENA and CEM, 2015). Moreover, contract duration can be selected in a way that reduces risks associated with inflation.

Longer contracts (from 20 to 30 years) tend to favour bidders, since they provide them with a more secure revenue for a longer period. Shorter contracts allocate more risks to the bidders as they have to look for other arrangements to sell the power post-contract. In Argentina, PPAs were reduced from 20- to 25-year lengths during the RenovAr tenders (2016-2019) to 15-year lengths during the RenMDI tenders (2023).

Contract duration is linked with **policy and regulatory risk**, as long contracts require stable long-term policy frameworks. The risk can be particularly mitigated with stabilisation clauses within the PPAs stipulating that the contract would not be altered and will remain "stabilised" even if the host government enacts new legislation relevant to the project. **Counterparty risk** is also relevant, with long-term contracts providing certainty and therefore improving financing or pricing but possibly increasing government financial exposure. **Market risk** is also relevant, as contracts place these risks on the auctioneer, away from the sellers. **Currency** and **supply chain risks** are relevant as well, as the contract duration determines the period during which sellers would be protected from these risks.

Table 20 Contract duration: associated risks and impact on outcomes

Contract duration Risks impacted: policy and regulatory, counterparty (offtaker), market, currency, and supply chain risks				
Impacts		**Contract aligned with plant life**		**Contract shorter than plant life**
Impact on price competitiveness (and consumer affordability)	(+) (–)	Spreads costs over longer period, reducing price. Can subject the project to currency and inflation for longer periods, which might be accounted for in the price.	(+)	Leads to higher prices due to compressed payback periods, depending on provisions for after the end of contracts.
Impact on cost of support (and government debt)	(+)	Can raise contingent liabilities for governments, especially if backed by guarantees. Long contracts can also lock in outdated prices, avoiding future cost declines.	(–)	Limits long-term liabilities and can avoid overburdening government in the long term.
Impact on the potential to develop domestic supply chains and create local value	(+)	Provides market certainty; can encourage local investment and supply chain growth.	(–)	May offer weaker incentives depending on provisions for after the end of contracts.

3.5.2 Lead time

The lead time determines how long successful bidders would have to complete the project until the contract begins. Excessively generous lead times might attract some speculative bidders – for example, those who plan to delay the beginning of construction in anticipation of reductions in development costs. Even though construction times are relatively well known for each type of renewable energy power plant, substantial

administrative requirements that must be met after the auction might take significantly more time. Therefore, a schedule that adequately considers these requirements should be adopted.

Several auction design alternatives seek to offer more flexibility to the auction winner with respect to lead time. For example, the lead time may begin at the point of contract signing, rather than at the point that the auction is held. This can be an attractive provision when there is a risk that the contract signing process will be lengthy and will compromise the construction schedule. It is also possible to let bidders suggest their desired lead time, taking this variable into account in the winner selection process. Another possibility is to include provisions to anticipate the contract's starting date in case the plant is completed earlier than anticipated. These possibilities offer incentives for generators to start operations as soon as possible, and they can be effective additions to the auction design.

The lead time is associated with (i) **policy and regulatory risk**, as bidders might be driven to sign contracts fast if there is a risk of regulatory change, and with (ii) **construction, site provision and preparation, and permitting risks**, as those risks heavily impact the timely delivery of projects. Other risks, **such as currency and supply chain risks**, are also relevant, as these might impact the economics of the project from when the bids are submitted until the contracts are signed and projects are delivered (Table 21).

Table 21 Lead time: associated risks and impact on outcomes

Lead time Risks impacted: policy and regulatory, construction, site provision and preparation, permitting, currency, and supply chain risks				
Impacts		**Shorter lead times**		**Longer lead times**
Impact on price competitiveness (and consumer affordability)	(–)	Shorter period for drop in technology costs	(+)	Longer period allows for drop in technology costs
	(+)	Shorter period for currency and inflation to impact prices	(–)	Longer period for currency and inflation to impact prices
Impact on cost of support (and government debt)	(+)	Higher technology costs reflected in cost of support	(–)	Lower technology costs reflected in cost of support
Impact on project realisation and system integration	(–)	Less time to build transmission and secure permits and land and grid access	(+)	More time to build transmission and secure permits and land and grid access
Impact on the potential to develop domestic supply chains and create local value	(–)	Less time to mobilise local suppliers	(+)	More time to mobilise local suppliers

3.5.3 Sellers' remuneration model

The way sellers are remunerated determines how risks related to market design and matching of supply with demand are allocated. Remuneration models and their associated risks include the following (see Table 22 for each model's impacts on several outcomes):

Fixed-price model. A public or private offtaker guarantees purchase of power at a fixed price, ensuring revenue stability. **Market risk** is fully allocated to the offtaker, and the sellers or investors account for **counterparty risk,** requiring guarantees, credit enhancements or liquidity facilities.

Contracts for difference (CfD) model. In liberalised markets, the offtaker pays the seller when the market price is below the strike price[7] (*e.g.* Netherlands, United Kingdom). In a one-way contract for difference, sellers are allowed to keep additional profits if wholesale market prices exceed the strike price agreed on. In a two-way contract for difference, sellers refund the difference when the market price exceeds the strike price. As a result, the generator always receives a fixed payment (as with a fixed-price PPA), regardless of the time of production, with no incentive to ramp up production during periods of high prices, schedule maintenance during low-demand periods, curtail output during times of low or negative prices, or invest in power plants designed to capture above-average market prices with flexible generation profiles. As such, **market risk** is fully allocated to the government, and the sellers or investors account for **counterparty risk**.

Fixed premium model. Bidders compete over a fixed government-paid premium per unit of energy produced, added to market revenue, transferring price and offtake risks to bidders (*e.g.* European renewable energy auctions[8]). In this case, **market risks** are fully allocated to the sellers, who are encouraged to optimise the production of their plants according to market signals.

Table 22 Sellers' remuneration model: associated risks and impact on outcomes

Type of remuneration Risk impacted: market risk								
Impacts		**Fixed price**		**Two-way contract for difference**		**One-way contract for difference**		**Fixed premium**
Impact on price competitiveness (and consumer affordability)	(+)	Reduces bidders' exposure to market volatility, which can lower their risk premium					(–)	Bidders might anticipate low market price with the high share of variable renewable energy and bid for high premiums to compensate
Impact on project realisation and system integration	(–)	No incentive for sellers to match production with demand			(+)	More incentive for sellers to increase production when market prices exceed strike price (meaning supply is low)	(+)	Sellers are fully incentivised to match production with demand
Impact on cost of support (and government debt)	(+)	Entails long-term payment commitments, especially if backed by sovereign guarantees	(–)	Lower cost of support than one-way CfDs as sellers refund the difference when the market price exceeds the strike price	(–)	May reduce fiscal exposure if market prices remain high but still involves some budgetary commitments	(=)	Depends on competition bid results

[7] *A price set by the bidders that guarantees a certain level of income and provides a predictable revenue stream to attract investment, whereby the government would cover the difference between this and the fluctuating market price to ensure a guaranteed price for the generator.*

[8] *Starting 1 January 2027, European Union regulations require that new state-backed renewable energy support schemes include a repayment (clawback) clause. A clawback clause limits the revenues that state-supported renewable projects can retain, requiring any earnings above a set threshold to be reimbursed to the state (Kyllmann, 2024).*

3.5.4 Currency denomination

The different ways in which currency risks can be allocated to different stakeholders are presented in Table 23.

Table 23 Options for allocating currency risk

Entity	Hard currency PPAs	Local currency PPAs indexed to foreign exchange	Local currency PPAs
Project company, developer or seller	No foreign exchange risk exposure.	No foreign exchange risk exposure but exposed to convertibility risk.	Exposed to foreign exchange and convertibility risks. If project finance is in hard currency, the company faces financial strain.
Public offtaker	Without external buffer or insurance, may experience financial strain if local currency depreciates.	Comparatively takes less risk as no foreign currency needs to be procured. The potential financial strain if local currency depreciates depends on whether the revised prices after indexation are passed on to consumers or covered by another source.	No foreign exchange risk. May lead to higher prices in the bids if developers or investors add risk premium in their bid to manage foreign exchange risk if their project finance is in hard currency.

The most extreme way of mitigating **currency and T&C risks** for investors is through denominating contracts in hard currency (*e.g.* Nigeria, Uganda, Zambia,). In this case, the risk is either passed on to the consumer or is borne by the offtaker or government. Although this option can be successful in attracting foreign capital, it places a lot of risk on the country. With more than 50% of their sovereign debt in foreign currency, EMDEs are particularly susceptible to currency depreciation, which can significantly affect debt servicing and overall debt vulnerabilities. Ghana exemplifies this issue: despite experiencing economic growth over the past decade, the Ghanaian government defaulted in 2022, largely due to its dependence on foreign currency borrowing. Although there is growing interest in local currency financing and increased global advocacy for its adoption from coalitions like the G77 and the Bridgetown Initiative, it is still underused, representing less than 20% of the portfolios of European DFIs (Karaki, 2024). The ideal solution is to reduce currency mismatch by using local debt (and equity) investors to fund the project. This has been done in South Africa, whose relatively advanced capital markets enable local banks and funders to provide over 90% of renewable energy project debt. South Africa also implemented policies to support the development of domestic supply chains, meaning a share of expenditures could be paid for in local currency. In addition, the South African auction allowed bidders to adjust their final bid price based on currency movements between the bid award and financial close dates (only up to a specified percentage of capital costs based on local content requirements) (Eberhard and Naude, 2017). Namibia has likewise been able to secure local currency debt – largely thanks to the Namibian dollar being pegged to the South African rand, which allowed South African banks to fund Namibian projects.

The conditions in these two countries that make it possible to opt for local currency funding do not, however, extend to many other countries in Sub-Saharan Africa or EMDEs in general. Several EMDE banking systems are still building the depth and tenor to support the financing of utility-scale projects. To avoid repeatedly placing currency risk on governments and consumers while investors remain protected, auctions and financing frameworks should encourage more balanced burden-sharing among private investors, DFIs and MDBs and host governments. MDBs could bridge this gap as key actors to reduce host government exposure to foreign currency risk and facilitate local currency financing, given their capacity to manage this risk (Box 16).

Box 16
The potential role of MDBs in enabling local currency lending and challenges facing European DFIs

MDBs could play a unique role in expanding the availability of local currency lending to help countries reduce currency risk. Several options can be explored:

- **Deploy local currency facilities:** MDBs can allocate part of their capital base to support longer-term, lower-interest loans in local currencies. Further market development support (hedging instruments, developing local bond market) can help these facilities achieve affordable pricing and reach scale and long-term sustainability. Loan repayments in local currency could finance future lending.
- **Provide guarantees to extend local currency lending:** MDBs can offer partial credit or risk-sharing guarantees to domestic banks, enabling them to provide longer-tenor, local currency loans to renewable energy projects while taking on only part of the credit risk.
- **Offer hedging solutions:** MDBs can accompany hard currency loans with currency hedging products that reduce the exposure of borrowers to currency risk. This may, however, increase the cost of borrowing.
- **Enhance technical support:** Technical assistance for public and local financial actors could help EMDEs better understand and manage foreign exchange risks.
- **Boost local market liquidity:** MDBs could manage pooled local currency liquidity through shared treasury services. This would reduce dependency on offshore markets.

DFIs are generally not willing to take local currency lending risks because of (i) path dependency, referring to the concept that current outcomes are heavily influenced by past events and decisions, creating a path that constrains future choices, even if those past decisions were not the most efficient; (ii) the costs or (lack of) availability of local currency lending and risk hedging solutions; (iii) the associated complexity, in terms of financial and time resources; (iv) the risk management framework that comes with strict eligibility requirements and excludes EMDEs; and (v) the application of general rules of prudent banking.

The majority of local currency lending focuses on private sector clients within the micro, small and medium enterprise sector, typically facilitated by financial intermediaries, and is often found in countries with relatively developed or liquid currency markets (typically, upper-middle-income countries). This pattern can be attributed to micro, small and medium enterprise financing typically requiring shorter-term products – generally under five years – rendering the DFI's investment less exposed to currency fluctuations and thus lower in risk. In contrast, sovereign operations usually involve larger volumes and have a long-term orientation (over 15 years), making local currency financing more expensive and/or riskier.

Sources: (International Commission of Experts on Financing for Development, 2025; Karaki, 2024).

Looking at a long-term perspective, a more sustainable way to mitigate currency risk is by localising value chains through incentives or local content requirements, particularly in the context of a broader implementation of industrial policy. In the immediate term, shortening project lead times and contract duration may provide a temporary buffer – the longer the time needed to pay back the project, the higher the risks of currency devaluation.

The choice of denomination determines the extent of currency risk and who bears it. Hard currency lowers investor risk but shifts the burden to the offtaker; local currency supports domestic demand but raises investor exposure (Table 24). Auctioneers can consider combining hard currency contracts with indexation mechanisms; introducing currency hedging facilities (*e.g.* foreign exchange guarantee funds); breaking down the price into two parts, one in local currency the other in hard currency; denominating contracts in local currency, blended with concessional finance or partial risk guarantees to lower risk premiums.

Table 24 Currency denomination: associated risks and impact on outcomes

Currency denomination Risk addressed: currency and supply chain risks						
Impacts		**Hard currency**		**Local currency indexed to foreign exchange**		**Local currency**
Impact on price competitiveness (and consumer affordability)	(+)	Lowers financing costs resulting in lower prices	(=)	Depends on transfer and convertibility risk	(–)	Raises risk premiums due to foreign exchange exposure, pushing up bid prices
Impact on project realisation	(+)	Reduces currency risk, supporting project delivery			(–)	Increases foreign exchange risk, which can lead to default if currency devaluation is severe
Impact on cost of support (and government debt)	(+)	Shifts foreign exchange risk to the government, increasing fiscal pressure if the local currency depreciates			(–)	Avoids exchange rate exposure for governments
Impact on the potential to develop domestic supply chains and create local value	(=)	Does little to support local market participation			(+)	Incentivises developers to spend in local currency, source domestic goods and services, and access finance from domestic banks

In extreme situations where macroeconomic conditions heavily impact the developers' ability to deliver projects at the agreed prices, the government can make provisions to cancel the contract without charging penalties. The RenovAr programme in Argentina presents a case study on the link between currency devaluation and underperformance after the awarding of projects (detailed in Box 17). Similar to the Argentine example, the recession experienced by Brazil between 2015 and 2016, coupled with excess energy supply in the same period, led the government to cancel renewable energy contracts awarded through auctions. In this case, developers who had won contracts during the reserve energy auctions had the chance to bid to have their projects cancelled. In total, up to 557.4 MW of solar and wind projects were cancelled. The winning bidders avoided fines for non-completion and retained their project guarantees (Bellini, 2017).

Box 17
Lessons from Argentina's RenovAr: dollar-denominated PPAs, peso revenues

The RenovAr programme, launched in 2016, aimed to add 10 GW of renewable energy capacity to Argentina's grid by 2025. Through competitive tenders, the programme awarded 20-year PPAs with CAMMESA (Argentine Wholesale Electricity Market Clearing Company) as the offtaker, with contracts denominated in US dollars. To support non-recourse financing, the FODER Trust provided two types of guarantees, for liquidity and termination. An optional third-tier guarantee was offered through the World Bank, covering up to USD 500 million in project assets. By 2019, three bidding rounds had been completed, with 147 projects awarded, primarily wind and solar.

The auction achieved historically low prices, but installation fell short due to Argentina's worsening macroeconomic environment in 2018. Out of the 4.73 GW of capacity awarded during RenovAr (2016-2019), only about 2.85 GW of projects became operational. By 2018-2019, the transmission system was already congested; inflation, currency devaluation and heightened country risk made financing difficult; and local banks' inexperience and stringent World Bank environmental and social standards further constrained access to guarantees. In addition, the difference between the offered and awarded prices was subject to adjustment factors (an incentive factor to encourage early commissioning and an annual adjustment factor to reflect inflation), which could raise the price paid by CAMMESA by up to 20%. This US dollar-denominated tariff structure placed significant fiscal strain on the government amid peso devaluation.

There is no indication that the termination guarantee has been called. However, the liquidity reserve of FODER was used several times when CAMMESA could not pay generators on time, because distribution companies could not collect fees on time against the backdrop of the financial crisis and pandemic. The projects that were not cancelled managed to continue through the following approaches:

- The Argentina government provided some lead time extensions and penalty reductions (but subject to terms like local content requirements, reduced tariffs and increased bonds).
- Some IPPs used internal revenues from existing assets to fund new projects awarded under RenovAr.
- Some local developers who were awarded PPAs decided to sell the project to bigger or international IPPs or utilities.
- Some projects secured financing early on from international DFIs (IFC, Inter-American Development Bank).
- Big IPPs issued green bonds to finance the operations of their RenovAr projects.
- The guarantees provided by FODER and the International Bank for Reconstruction and Development assured IPPs that they would receive payments even if CAMMESA had temporary liquidity issues.

While RenovAr's strong legal and financial structuring helped lower risks and attract bids, the results of the programme illustrate that currency denomination and mismatch issues can derail projects even when contracts are denominated in hard currency. Auctioneers must take into consideration the various trade-offs of PPA currency denominations, along with available risk mitigation instruments and approaches, against the backdrop of their countries' macroeconomic contexts.

Sources: (World Bank, 2017, 2022).

3.5.5 Contract indexation

When a contract includes periodic price adjustments based on changing market conditions such as currency exchange or inflation, it helps account for cost fluctuations over time such as rising capital costs during construction or higher O&M costs during project operation. If the contract is indexed to currency (Table 24) or inflation, it also protects against devaluation of returns from inflationary pressures. Without such protection, bidders typically add a risk premium to their bids to ensure they can meet long-term debt service and investor return requirements.

Contract indexation helps mitigate **currency, construction and supply chain risks**, as indexed contracts reduce volatility in input costs. The specific benchmark chosen for indexation will depend on the project and market context: while inflation (*e.g.* consumer price indices) is the most common reference, contracts may also be indexed to other references, such as interest rates, key commodity prices (*e.g.* steel, fuel), or shipping costs. However, careful selection of reference indices (*e.g.* Consumer Price Index, sectoral price indices) will be important. Parties can also negotiate to (i) include caps or floors on adjustments to avoid extreme tariff shifts, (ii) consider partial indexation (*e.g.* only O&M costs indexed) to balance consumer affordability and investment certainty, or (iii) build internal review mechanisms to periodically reassess indexation parameters. Types of indexations are weighed against several auction outcomes, as shown in Table 25; examples within Sub-Saharan Africa are detailed in Box 18.

Table 25 Contract indexation: associated risks and impact on outcomes

Contract indexation Risks impacted: currency, construction, and supply chain risks				
Impacts		**No indexation**		**Inflation-based indexation**
Impact on price competitiveness (and consumer affordability)	(+)	Raises risk premiums due to exposure to inflation, pushing up bid prices	(–)	Future tariff adjustments would reflect inflation
Impact on project realisation and operation	(–)	Inflation during construction can affect project completion	(+)	Supports project completion if applicable to the construction stage and continued operation
Impact on cost of support (and government debt)	(–)	Avoids exposure of governments to inflation	(+)	Support levels may increase depending on inflation
Impact on the potential to develop domestic supply chains and create local value	(–)	Can deter small players	(+)	Protects small and new players and their suppliers

Box 18
Contract indexation in Sub-Saharan African countries

Mauritius allowed bidders to submit prices in Mauritian rupees, or in a combination of Mauritian rupees, US dollars and euros, provided the foreign currency component did not exceed 80% of the total tariff. The local currency portion typically included an escalation rate over the PPA duration. This hybrid model offers flexibility to bidders while capping foreign exchange exposure for the utility. Mauritius's approach reflects a broader trend in African procurement frameworks to experiment with mixed currency structures to balance bankability and macroeconomic stability.

Box 18 (continued)

Namibia's Hardap solar PV project involved a 25-year take-or-pay PPA denominated in local currency (Namibian dollar or South African rand) and fully indexed to local inflation. The project was uniquely financed in local currency without a sovereign guarantee, thanks to a collaboration between a commercial bank and a DFI. This reduced the foreign exchange and fiscal burden on the government. In a later round, for the Khan project, bidders were asked to propose their own indexation rates, shifting inflation risk to developers. Bids ranged from −5% to 6%, with the winning bid set at 3%. This unusual risk allocation contributed to project delays, as the Khan project had yet to reach commercial operation by mid-2023.

In **South Africa**, bid tariffs are denominated in South African rand and fully indexed to the Consumer Price Index over the 20-year PPA, limiting foreign exchange exposure for the offtaker. Bidders submit both fully and partially indexed (20%-50%) prices, with fully indexed bids required to stay below technology-specific caps. Although the sellers bear foreign exchange risk on some capital and post-commercial operation date operating costs, only capital expenditures are eligible for exchange rate adjustments at financial close; operational expenditures adjustments are not permitted by the Department of Energy. This take-or-pay arrangement offers a degree of price certainty for the offtaker.

The GET FiT Solar Facility in **Uganda** offered 20-year PPAs denominated in US dollars, with only the O&M portion indexed to US inflation. Additionally, a euro-denominated premium subsidy was front loaded to reduce early-stage financing risk: 50% was paid at the commercial operation date, and the remaining 50% was spread over the first five years based on performance. This structure eased repayment during the most critical debt servicing phase and provided developers with early cash flow support – unlike the South African case, where inflation indexing covered the entire tariff.

Zambia's renewable energy auction programme did not include any indexation. While tariffs were denominated in US dollars, their real value declined over time due to inflation, resulting in winning tariffs being effectively lower than announced. This structure achieved some of the lowest real-term prices but exposed the government to significant foreign exchange risks, especially amid local currency depreciation. However, Zambia's large mining sector, responsible for 40% of electricity demand and paying in US dollars, provides a natural hedge that partially mitigates these risks.

These cases illustrate the trade-offs involved in choices for contract indexation. South Africa shows how indexation to inflation can reduce foreign exchange risk for the offtaker but requires tariff caps; Uganda demonstrates how hybrid structures can blend indexation with front-loaded subsidies to ease early debt repayment; Zambia highlights the affordability gains but heightened foreign exchange risk from no indexation in volatile contexts; Namibia illustrates both innovation and pitfalls when shifting inflation risk to developers; and Mauritius reflects hybrid currency/indexation models that cap exposure while retaining flexibility. In practice, partial or hybrid indexation is often a pragmatic middle ground, balancing affordability for offtakers with risk coverage for developers. Furthermore, MDB- and DFI-backed foreign exchange facilities could complement indexation schemes and support bankability in high-currency risk environments.

Sources: (IRENA, 2018a; Kruger, Alao and Eberhard, 2019).

3.5.6 Curtailment and transmission delays

Two liabilities that must be accounted for in a PPA include the risk of curtailment and the risk of delayed delivery of energy or capacity when the required grid expansion is not completed on time. Both are inextricably linked and are associated with **grid and transmission, market, and arbitration and contract enforcement risks**. One common reason for renewable energy curtailment is transmission bottlenecks, which prevent generators from delivering energy to meet existing demand. Another common cause for curtailment is insufficient demand (or excess generation), which occurs when there are renewable resources available to produce energy (*i.e.* the wind is blowing, and the sun is shining) but no demand for it. In both cases, it will be necessary to decide whether the risks should be borne by the seller or the government.

In the case of delayed grid expansion, the auction design can assign the liabilities to the project developer or to another agent, usually an entity responsible for expanding the grid (the transmission system operator, the central planning agency, or other agents, depending on the regulatory framework of the jurisdiction).

In the case of curtailment, the PPA must define whether the seller has the right to be paid in situations in which excess electricity supply in the system forces some generation to be curtailed (and if so, under what conditions). Table 26 maps the trade-offs for these choices.

Table 26 Curtailment and transmission delay provisions: associated risks and impact on outcomes

Curtailment and transmission delay provisions Risks impacted: Grid and transmission, market, and arbitration and contract enforcement risks				
Impacts		**Sellers protected against curtailment and transmission delay risk**		**Full or partial risk allocation to sellers**
Impact on price competitiveness	(+)	Developers exclude curtailment and grid delay risks from their bids, resulting in lower bid prices	(–)	Risk factored into bid price
Impact on project realisation	(+)	Projects are less likely to be abandoned or delayed	(–)	Project may be delayed if grid and transmission risks are high
Impact on cost of support (and government debt)	(+)	Can lead to potential cost overruns and fiscal strain	(–)	Public finances partly or fully insulated from direct curtailment or delay payments
Impact on the potential to develop domestic supply chains and create local value	(+)	Auction more accessible to smaller or local developers who might otherwise be priced out by risk	(–)	Higher entry barrier for smaller nascent local companies

3.6 PROVISIONS FOR END OF CONTRACT

This category of design elements determines the choices related to asset ownership, operations and decommissioning after contracts expire.

3.6.1 Asset ownership after the end of contract

After a PPA ends, the question of who owns and operates the asset moving forward is determined by the ownership model that is set before bids are submitted. The most common are Build-Own-Operate (BOO) and Build-Own-Operate (BOOT) models. Under a BOOT model, ownership is transferred back to the government after a defined period. Once the plant is transferred, the government must decide how to operate it: either keep it in the state utility's generation fleet or concession it out again. The government can launch new auctions to grant a different project company concession to the plant once the original PPA expires. This is the case for four large hydropower projects in Argentina, the shares of which will be publicly auctioned nationally and internationally after their concession contracts end, via Official Resolution 1200/2025 (Ministry of Economy, 2025). Generally, a potential risk is that if the government takes over without allocating sufficient funds for O&M, plant operations could become suboptimal.

If the project company retains ownership, the key question is how and where the power will be sold (section 3.6.2) and who would be responsible for decommissioning the project at the end of its life (section 3.6.3). The associated risks include **policy and regulatory, counterparty (offtaker), financing or refinancing, arbitration and contract enforcement, and market risks** as the seller retaining the project after the end of the contract would need to find the appropriate framework under which they can continue to sell power. Table 27 identifies possible trade-offs among the two ownership models.

Table 27 Asset ownership after the end of contract: associated risks and impact on outcomes

Asset ownership after the end of contract Risks impacted: Policy and regulatory, counterparty (offtaker), financing or refinancing, arbitration and contract enforcement and market risks				
Impacts		**Ownership is transferred back to the government (BOOT)**		**Project company retains ownership (BOO)**
Impact on price competitiveness	(–)	All returns on investment must be made during the contract duration	(+)	Opportunities for revenues exist beyond the contract duration
Impact on cost of support (and government debt)	(+/–)	Transfer clause at the end of the contract can lead to higher price, but at the end the government gains infrastructure asset	(–)	Lower prices mean lower cost of support, and by the end of the contract, the project might be able to sell power without the need for support
Impact on the potential to develop domestic supply chains and create local value	(+)	Presents continued opportunities for O&M and signals strong commitment from the government towards renewables	(–)	Market players have less clarity regarding the future

3.6.2 Post-PPA options for developers

When a PPA expires and the project company retains ownership, the key question is how and where the power will be sold. The associated risks include **policy and regulatory, market, counterparty (offtaker), construction, financing or refinancing, arbitration and contract enforcement, supply chain, and permitting risks.**

Some options are listed here, and trade-offs are explored in Table 28.

- **New or extended PPAs.** This could mean renewing the contract or renegotiating with the existing offtaker or signing a PPA with a new buyer, such as a corporate offtaker. Renegotiating with the utility may involve a shorter term and a lower price than the initial PPA, since the project's capital cost has largely been repaid. However, the IPP must navigate post-PPA risks (*e.g.* expired land leases and other permits, re-financing risk). To extend the plant life, owners can invest in repowering – wherein technology is upgraded or replaced to extend the project's life and improve performance. This is primarily beneficial to the sellers when they are able to sell the additional power produced. Repowering is especially relevant for wind farms (IRENA Coalition for Action, Forthcoming).
- **Sell the power to the market (merchant operations).** The project company could sell its power into the electricity market without a long-term contract. This exposes the IPP to market price fluctuations. A combination of the first two options is also possible with multi-buyer offtake arrangements. This option is only available in countries that have an active market. Where a national utility is the single buyer, other options are more suitable.
- **Sell the asset to another entity.** The IPP may decide to sell the plant to a new owner, for example an infrastructure fund, institutional investor, or utility seeking operational renewable assets. These transactions are common in mature markets where developers recycle capital by selling de-risked, operational assets and reinvesting in new projects. A new owner may bring a different risk appetite and strategy, such as pursuing corporate PPAs and accepting more market exposure.
- **Decommissioning.** The IPP may decide that the project should be decommissioned. In this case, a decision needs to be made on the party responsible for decommissioning (section 3.6.3).

Table 28 Post-PPA options for developers: associated risks and impact on outcomes

Post-PPA options for developers Risks impacted: market, counterparty (offtaker), construction, financing or refinancing, arbitration and contract enforcement, supply chain, and permitting risks								
Impacts		**New or extended PPAs**		**Merchant operations**		**New owners**		**Decommission**
Impact on price competitiveness (and consumer affordability)	(+/=)	Can support stable and predictable prices if PPAs are competitively negotiated or tendered. Tariffs may be lower than in the initial PPA as capital costs have largely been repaid.	(+/–)	Exposes prices to market conditions. Depending on the market, this can raise or reduce costs for end users.	(=)	Depends on new owners' decisions on where to sell the generated power, as well as on regulatory oversight.	(=)	Depends on whether the government has plans to replace the forgone supply of power (*e.g.* with new capacity or imports) and at what cost.
Impact on project continued operation and system integration	(+)	Strong incentive to keep the plant operating reliably to earn revenue; facilitates integration for the system operator.	(=)	Depends on dispatch of power via the grid. If grid constraints are high, this may affect the project operation.	(+/=)	New owners, motivated by securing revenue, may invest in life extension and improved integration (*e.g.* storage).	Not applicable.	
Impact on cost of support (and government debt)	(+)	If offtaker is a public entity since the offtaker is liable for the extended contract.	(=)	No direct impact as private capital is leveraged.	(=)	Depends on the agreement between the new owner and offtaker (if public entity).	(-)	The government does not bear costs of decommissioning.
Impact on local industry development	(+)	If PPAs (and repowering) prioritise local firms and procurement.					(–/=)	Negative where local firms and workers relied on the plant; neutral if mitigated by alternative projects and just transition measures.

3.6.3 Responsibility for decommissioning

One last decision that should be made is which entity would be responsible for decommissioning the power plants (see Table 29 for trade-offs to consider on this particular choice). Under the BOO model, owners may ultimately choose to decommission if it is economically difficult to retain the project, perhaps due to increasing costs or the uncertainty of securing a buyer.

Under the BOOT model, if no other option is viable, the government may choose to decommission the plant and remove all equipment and infrastructure. Decommissioning is generally considered a last resort because it means forfeiting potential generation from an existing asset. However, it can occur if the asset is in poor condition or market conditions make it difficult to continue operations.

Table 29 Responsibility for decommissioning: associated risks and impact on outcomes

Responsibility for decommissioning Risk impacted: arbitration and contract enforcement risk				
Impacts		**Responsibility of seller**		**Responsibility of government**
Impact on price competitiveness (and consumer affordability)	(-)	Decommissioning costs are factored in the price	(+)	No decommissioning costs factored in the price
Impact on cost of support (and government debt)	(=)	Depends on how much is paid through support versus passed on to consumers	(-)	Included in the total cost
Impact on local industry development	(+)	Supports the development of local expertise and capacity in end of life services and activities		

4. CONCLUSION AND RECOMMENDATIONS

Recent renewable energy auction awards at competitive prices in investment contexts like Ethiopia, Senegal and Zambia have proven that they are able to deliver significant benefits to EMDEs. As countries with varied experiences in implementing renewable energy auctions proceed with their next rounds, auction design can further evolve to allow for contractual arrangements where risks are shared more equitably and objectives beyond price and project realisation are also prioritised.

This report has shown that in high-risk investment contexts, auction designers have the complex task of ensuring they (i) send out the right signals to the market to facilitate renewable energy deployment, (ii) provide a secure and affordable supply of energy to populations, (iii) capitalise on the link between the procurement of energy and boosting local industry, and (iv) allocate project risks and benefits in the most sustainable and equitable way. Sending the right signals to investors and project developers is crucial to ensuring high competition levels and a low cost of capital and to attracting capable, experienced bidders. The most important of these signals include whether the project's revenue stream is secure (often requiring a host of risk mitigation and credit enhancement measures) and whether the market trusts the auctioning authority (and their advisers) and the auction process. Other auction fundamentals include setting prudent procurement volumes and project size limits and using appropriate qualification requirements. These act as barriers and incentives, strengthening the bidding pool, increasing competitive pressure and improving the likelihood of project realisation.

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Auction designers are also mandated to provide affordable and sustainable energy to consumers, while also ensuring fiscal sustainability and, more broadly, they should promote socio-economic development through the awarded projects. This report provides evidence that it is indeed possible to weave these objectives into several parts of the auction design process. In discussing design options, the report highlights several elements that can mitigate or reallocate risks in the short term, while also pointing to more fundamental measures aimed at risk transformation, such as the development of local currency financing markets and more resilient domestic supply chains.

Countries looking to set up auctions, and partners supporting them, therefore need to ensure that the auctioning authority is adequately resourced, well-staffed and politically supported and that the auction process is secure, transparent and fair. Developing strong institutional capacity is crucial and can be considered a foundational prerequisite to more sophisticated auctions (*e.g.* multi-criteria auctions). In high-risk contexts, however, a lot of the hardest work begins only once projects have been awarded, since local institutions and rules are often not set up to deal with these types of investments. For this reason, the support of a capable, influential auctioneer for awarded projects is essential in the post-award period through to commercial operation. Ultimately, this will require robust co-operation and trust between governments, project proponents and investors.

No auction takes place in a vacuum. There is a plethora of external factors that can and often do impact outcomes – especially project realisation and the longer-term sustainability of these programmes. For this reason, auction designers need to work closely with key local decision makers and constituents to ensure that there is adequate appreciation of local priorities in how the auctions are designed and rolled out.

Auctions offer a potentially powerful way of securing renewable energy capacity at competitive prices as well as spurring local industry and improving local capacity, even in difficult investment contexts. Realising this potential requires a great deal of work and resources – more than is normally needed in other contexts and often with the support of development partners – but the rewards for countries that do this properly can be transformative, especially when renewable energy markets are created to provide overreaching economic benefits.

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