FROM RESOURCE POTENTIAL TO BANKABLE POWER: FINANCING UTILITY SCALE SOLAR IN NORTH AFRICA

Risk allocation, derisking instruments and the cost of capital in Morocco, Egypt and Tunisia

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Abstract

North Africa has abundant solar resources, yet utility scale solar PV pays far more for capital than in Europe. This paper questions why well resourced projects take years to reach financial close and how public derisking can lower the cost of capital. It compares eleven publicly documented PV projects in Morocco, Egypt and Tunisia, builds an open database of their financing and derisking instruments, and publishes a calibrated project finance model, the SolarRisk Calculator. Utilizing the data sourced from these eleven projects, the model reconstructs how each deal was structured, identifies which risks public support absorbed, through which instruments, and at what public cost. The comparison shows that concessional debt and guarantees carry most of the weight, that their public cost differs sharply across the three countries, and that bankable, reusable contracts, a shared public and private view of risk, and local support shape how quickly projects reach financial close. The financial model then provides a baseline for assessing the support new projects would need. We recommend testing bankability before tender with lenders, building reusable templates, aiming support at the binding risks and disclosing financing terms transparently.

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1. Context and research purpose

North Africa can expand affordable renewable electricity for the region and develop strong power trade opportunities with Europe if investment in generation is matched by credible revenues, deliverable grid connections and financially sustainable risk sharing. This paper argues that public support should address the specific constraints preventing finance, with its value judged by electricity delivered, private capital mobilized and the liabilities retained by the public sector.

1.1. The gap between solar potential and investment

Africa's solar resource is substantial, but resource quality has not translated into a comparable share of investment. The IEA estimated in 2022 that Africa held 60% of the world's best solar resources but only 1% of installed solar PV capacity, and in 2025 it placed Africa's share of global clean energy investment at just 2%.[1] Around 600 million Africans still lacked electricity access in 2025, yet North and South Africa together accounted for most of the continent's installed capacity, and a large share of its energy investment. Of the countries analyzed, despite having abundant solar resources, fossil fuels still dominate electricity generation (Exhibit 1).

Exhibit 1. Renewable electricity remains a minority of generation in the study countries

Country	Total generation GWh	Renewable generation GWh	Renewable share %	Solar share %
Tunisia	20,166	1,133	5.6	2.8
Morocco	40,995	7,595	18.5	5.3
Egypt	229,619	27,070	11.8	2.3

Source: IRENA (2025a–c), Tunisia, Morocco and Egypt statistical profiles, p. 3; authors' calculations. All figures refer to 2023. Shares are calculated from reported GWh and rounded to one decimal. Solar includes PV and solar thermal; renewable totals include hydropower, wind and other renewables. These are shares of domestic generation, not installed capacity or electricity consumption.

Financing is a major part of this gap between solar potential and solar investment. The IEA and AfDB reported in 2023 that capital costs for utility-scale clean energy in Africa were at least two to three times those in advanced economies and China.[2] For solar PV, whose costs are concentrated in construction, expensive or short-tenor finance can outweigh much of the advantage of stronger irradiation. Research across 46 African countries shows that high financing costs disproportionately affect capital-intensive renewables, while financial de-risking can improve their competitiveness and substantially increase modelled deployment.[3] Furthermore, risks extend beyond the cost of borrowing, in particular, in Egypt's experience, its first feed-in-tariff round stalled over concerns about tariff sustainability and arbitration provisions, while revised contractual terms and standardized financing documentation subsequently helped mobilize private investment.[4]

1.2. Research questions argument and contribution

The paper addresses four research questions:

RQ1. How are the risks allocated among sponsors, utilities, governments, lenders and development institutions?

1. IEA, *Africa energy outlook 2022*, 2022; IEA, *Global energy investment in 2025*, 2025a.

2. IEA & AfDB, *Financing clean energy in Africa*, 2023.

3. Sweerts et al., *Financial de-risking to unlock Africa's renewable energy potential*, 2019; Egli et al., *Bias in energy system models with uniform cost of capital assumption*, 2019.

4. IFC, *Nubian Suns (Egypt): Scale at speed*, 2019.

RQ2. How do alternative derisking packages affect financing cost, debt capacity and the required tariff, and which offer the best value once public costs are included?

RQ3. Which financing, policy and governance lessons can scale renewable electricity in North Africa, and under what conditions can trade with Europe support domestic development?

Our central argument is that credible risk allocation is a central, actionable condition for bankability. Governments and development finance institutions (DFIs) should first resolve the constraints that private parties cannot efficiently manage, especially payment reliability, grid readiness and enforceable public obligations, and only then use financial support for residual risks. The effectiveness of risk allocation also depends on transparent procurement, enforceable contracts and the capacity of public institutions to meet their obligations (Section 2.4). Even where these conditions are met, projects may still struggle to attract investment if their underlying economics are weak, grid infrastructure is inadequate or land, social and environmental risks remain unresolved (Section 2.5).

As none of the case studies disclose their cost of debt or weighted average cost of capital (WACC), the analysis cannot determine whether specific financing arrangements reduced capital costs or identify an optimal financing structure. Instead, it focuses on how risks are allocated across projects and highlights the limitations of publicly available financial data.

2. Bankability risk allocation and public support

2.1. How risk changes financing terms

A project is bankable when lenders and equity investors are willing to fund it on terms that credible project revenues can sustain. In non-recourse or limited-recourse finance, repayment depends principally on the project's cash flows and contractual rights, so revenues must cover operating costs, taxes and debt service under plausible downside conditions while providing an acceptable return to equity. A project that closes only through extensive public support may still impose an unaffordable burden on consumers or the state.[5]

Risk affects both price and availability. Lenders may charge higher margins, shorten maturities, reduce leverage, require reserves or guarantees, or decline to lend, and equity investors may demand higher returns. Risks also reinforce one another. Currency depreciation can weaken utilities with foreign-currency payment obligations, while a late grid connection postpones revenue and adds construction-period interest.[6] The comparison therefore tracks the cost, currency and tenor of debt, leverage and the DSCR, cash available for debt service divided by principal and interest due. WACC summarizes the overall cost of finance but does not show whether a project runs out of cash in a particular year.

5. UNDP, *Derisking renewable energy investment*, 2013; IEA & AfDB, *Financing clean energy in Africa*, 2023.
6. IEA & AfDB, *Financing clean energy in Africa*, 2023; UNDP, *Derisking renewable energy investment*, 2013.

2.2. Major risks and who can manage them

Seven categories of risk are used to assess how risks are allocated and managed across the projects examined in this paper (Exhibit 2). For each category, the analysis considers its potential financial impact, which parties bear responsibility, their ability to meet their obligations and the extent to which these arrangements are publicly disclosed.

Exhibit 2. Bankability depends on the allocation and credibility of specific obligations

Risk category	Effect on project finance	Allocation and mitigation to assess
Country and political	Expropriation, conflict or public breach can impair assets and repayment. Sovereign stress can weaken several counterparties at once.	Political-risk insurance and enforceable public commitments; examine the insured party, exclusions, coverage period and claims conditions.
Regulatory and contractual	Uncertain permits, changes in law or weak termination rights can delay close or leave debt unrecoverable.	Credible procurement, enforceable contracts, durable permits, change-in-law provisions, termination compensation and lender step-in rights.
Offtaker and revenue	Payment delays, offtaker default or insufficient contracted revenues reduce cash available for debt service and weaken project viability.	Offtaker creditworthiness, tariff adequacy, payment security mechanisms, escrow accounts, letters of credit and payment guarantees.
Currency and capital transfer	Exchange-rate depreciation can increase debt-servicing costs where revenues and financing are denominated in different currencies. Currency conversion or transfer restrictions may prevent international payments.	Currency-matched financing, tariff indexation and hedging; separate guarantees or insurance for currency convertibility and transfer restrictions.
Grid connection	Delays in grid infrastructure or connection approvals can postpone commissioning, delay revenues and increase financing costs.	Responsibility for financing and delivering grid infrastructure, connection deadlines, completion guarantees and compensation for delays.
Curtailment and dispatch	Grid congestion, dispatch restrictions or insufficient system flexibility can reduce electricity delivered and associated revenues, weakening debt repayment capacity.	Clear dispatch rules, deemed-generation provisions, compensation for eligible curtailment events and allocation of associated financial risks.
Financing and project preparation	Limited long-term debt access, interest rates exposure or incomplete studies raise funding needs and delay investment.	Project preparation support, realistic procurement requirements, long-tenor financing, interest-rate hedging and adequate construction financing.

Source: Authors' analytical framework, informed by UNDP (2013) and IEA and AfDB (2023). Categories are analytical groupings.

Technical, construction, environmental and social risks cut across these categories (Section 2.5). Yield uncertainty, contractor performance, land rights, community consent and environmental requirements can all affect completion and lender eligibility, so contracts, independent assessments, insurance and due diligence remain necessary even when guarantees are in place.[7]

2.3. How derisking instruments work

Public support can improve project bankability in three main ways. Policy reforms and project preparation can reduce underlying risks, guarantees and insurance can transfer specified risks to other parties, while concessional loans and grants can reduce financing costs or investment requirements. These instruments are often combined, but their effectiveness depends on the specific constraints they address. Providing cheaper finance, for example, may improve project viability without resolving weaknesses in payment security, grid infrastructure or contractual enforcement.[8]

7. MIGA, *Tozeur and Sidi Bouzid solar plants*, 2024b.

8. UNDP, *Derisking renewable energy investment*, 2013.

Appendix Exhibit A1 summarizes the instruments identified across the eleven case studies, the risks they are intended to address and the frequency with which they appear in publicly available project documentation. The comparison distinguishes between measures that reduce risks, transfer financial exposure or lower financing costs.

2.4. Institutions and divergent views of risk

Effective risk allocation requires credible institutions capable of enforcing contracts and meeting public obligations. Transparent procurement, enforceable agreements and capable public authorities are essential to investor confidence. Even where responsibilities are clearly defined, uncertainty about whether public counterparties can fulfil their obligations may prevent projects from securing finance.

Differences between public and private perceptions of risk can further complicate project development. A survey of 142 public and private stakeholders across seven countries, including Morocco, Egypt and Tunisia, conducted by RES4Africa and PwC in 2021, found that private respondents generally perceived greater investment risks than public respondents.[9] Across the surveyed countries, 60% of private respondents considered financing availability a high risk, compared with 39% of public respondents. Grid access ranked first among private-sector concerns but seventh among public-sector concerns. These differences suggest that governments may underestimate constraints that influence lenders' and developers' investment decisions.

Such differences matter when designing procurement frameworks and allocating responsibilities. Projects may attract initial developer interest but struggle to reach financial close if payment security, contractual protections or grid arrangements do not satisfy lenders. Wider infrastructure experience illustrates the difficulty of translating planned investments into financeable projects. BCG (2025) reports that approximately 65% of around 130 African Union-backed transnational infrastructure projects had stalled before final investment decision.[10] Although this evidence extends beyond renewable energy, it reinforces the importance of institutional capacity and effective project preparation.

These findings provide a basis for examining whether procurement arrangements, contractual provisions and public commitments adequately address investor concerns. The case-study analysis considers how these conditions differ across the projects, while recognising that survey responses measure perceptions rather than the bankability of individual transactions.

2.5. Environmental, social and governance impacts and risks

Environmental, social and governance (ESG) considerations influence both the development of renewable energy projects and their eligibility for financing. Although solar PV provides low-carbon electricity, utility-scale installations require land, infrastructure and construction activities that can affect local communities, ecosystems and workers. Unresolved land rights, inadequate consultation, labour disputes or environmental concerns can delay permitting and construction, increase costs or prevent lenders from approving finance. Lenders increasingly ask whether a project has local support, because early engagement reduces opposition, permitting delays and reputational and political risk.[11]

These considerations extend beyond financial performance. Respect for community rights, fair working conditions and environmental protection are important development objectives in their own

9. RES4Africa & PwC, *Assessing investment risk in renewable energy: A survey on Southern and Eastern Mediterranean countries*, 2021, *pp. 5–8 and 22*.

10. BCG, *Africa unleashed: Bridging Africa's infrastructure execution gap*, 2025, *p*. 4.

11. Chiesa, *Rinnovabili, l'asset che fa la differenza per ottenere i finanziamenti dalle banche? Avere l'ok del territorio*, Corriere della Sera, 6 October 2026 (interview with K. Balanda, Nadara).

right. The Business & Human Rights Resource Centre (2020) documented 197 allegations of human rights abuses associated with renewable energy projects worldwide between 2010 and 2020, highlighting the need for effective safeguards and accountability mechanisms.[12] These allegations demonstrate that renewable energy investments require appropriate environmental and social oversight.

Development finance institutions (DFIs) assess environmental and social risks through project due diligence, often applying the IFC Performance Standards or comparable frameworks.[13] Commercial lenders that have adopted the Equator Principles apply similar requirements to eligible project-finance transactions.[14] These frameworks address land acquisition, labour conditions, community engagement and environmental protection, among other issues.

Exhibit 3 identifies the main ESG considerations affecting project development and financing, alongside safeguards and evidence that developers, governments and lenders should examine. Although a detailed assessment of ESG performance falls outside the scope of this paper, these considerations remain relevant to improving bankability and ensuring that renewable energy investment delivers broader development benefits. issues are acknowledged as important conditions for responsible investment,

Exhibit 3. Environmental, social and governance considerations for renewable energy project finance

ESG issue	Effect on project development and finance	Safeguards and evidence to assess
Climate benefits	Renewable generation can reduce emissions and support climate finance. Benefits depend on electricity delivered and the generation displaced.	Expected and actual electricity generation, emissions-reduction estimates, calculation methods and climate-finance eligibility.
Land and biodiversity	Land disputes, displacement or biodiversity impacts can delay permitting and construction, increase costs or affect lender approval.	Land tenure and acquisition procedures, environmental and social impact assessments, biodiversity management plans and compensation arrangements.
Community participation	Inadequate consultation and unresolved grievances can delay development, weaken community support and create reputational risks.	Stakeholder engagement plans, evidence of meaningful consultation, grievance mechanisms and documented responses to concerns.
Labour conditions	Unsafe working conditions, labour disputes and contractor misconduct can disrupt construction and trigger lender compliance reviews.	Labour standards, occupational health and safety procedures, subcontractor oversight and worker grievance mechanisms.
Energy affordability	Tariff structures and public support arrangements affect the distribution of costs between utilities, consumers and governments.	Tariff affordability, distribution of costs and benefits, consumer protections and public financial commitments.
Consent and legal legitimacy	Unresolved land rights, consent requirements or territorial disputes can create legal uncertainty and affect lender participation.	Applicable legal requirements, evidence of required consent, land rights and independent legal due diligence.
Transparency and governance	Opaque procurement, limited disclosure and weak accountability can undermine confidence and increase legal or reputational exposure.	Transparent procurement, disclosure of material contractual obligations, independent oversight and accessible dispute-resolution mechanisms.

Source: Authors' analytical framework, informed by IFC, Performance Standards on Environmental and Social Sustainability (2012); Equator Principles Association, The Equator Principles (2020).

12. Business & Human Rights Resource Centre, *Renewable energy & human rights benchmark*, 2020.

13. Equator Principles Association, The Equator Principles, 2020.

14. IFC, Performance Standards on Environmental and Social Sustainability, 2012.

Note: The exhibit identifies potential risks and relevant safeguards rather than assessing individual project performance. Appropriate measures depend on the project context, applicable legal requirements and lender standards.

2.6. Evaluating bankability and the public cost of support

Public support should enable affordable renewable electricity while limiting unnecessary financial exposure for governments and consumers. Its effectiveness depends on whether it addresses investment barriers, improves financing conditions and offers better value than alternatives such as contract reform or grid preparation. Grants, concessional loans and guarantees create different financial obligations and must be assessed separately.

2.7. Conditions for mutually beneficial electricity trade with Europe

Electricity trade with Europe can attract investment through long-term contracts with creditworthy buyers, provided reliable transmission infrastructure is available. However, interconnector delays, outages and transmission constraints can threaten project revenues.[15] Cross-border investments therefore require coordinated grid development, clear allocation of risks and commercially viable agreements that protect domestic electricity reliability and avoid excessive public financial exposure.[16]

3. Method

This paper combines a structured comparison of eleven utility-scale solar PV projects with a project finance model calibrated using the same project data. Together, the projects represent approximately 1 GW of capacity and USD 1 billion in investment.

Morocco, Egypt and Tunisia were selected because they share several characteristics relevant to renewable energy financing. Each has a predominantly state-led electricity purchasing structure, ambitious renewable energy targets for 2030 and potential for electricity trade with Europe. However, their approaches to financing utility-scale solar differ, allowing the study to compare how similar risks are allocated and managed under different institutional and financing arrangements.

Projects were selected based on the availability of publicly documented financing information from DFIs, lenders, sponsors and public authorities. This allows the analysis to trace capital structures, financing instruments, participating institutions and key development milestones. Projects incorporating battery storage, substantially larger installations and those at significantly different development stages were excluded to improve comparability. Sidi Bouzid II, which reached financial close in June 2026, is the only project still under construction.

The sample has several limitations arising from project selection and data availability. Projects involving DFIs are over-represented because these institutions generally disclose more financing information than commercial lenders. Furthermore, since all eleven projects reached financial close and ten are operational, the analysis focuses on successfully financed projects and cannot explain why others failed to secure investment. The findings are also limited to utility-scale solar PV in Morocco, Egypt and Tunisia and are not representative of the wider North African or African infrastructure markets. Country-level comparisons therefore reflect differences among the selected projects rather than national averages.

Each project is assessed using a consistent framework covering material risks, their allocation between parties, mitigation instruments, the time between award and financial close, and the

15. World Bank, *Tunisia–Europe electricity interconnection project*, 2023.

16. World Bank, *Tunisia–Europe electricity interconnection project*, 2023; IEA & AfDB, *Financing clean energy in Africa*, 2023.

availability of supporting documentation. Arrangements that cannot be verified through public sources are recorded as not publicly disclosed.

Financial close is the principal reference milestone, defined as the point at which financing agreements are signed and applicable conditions precedent are satisfied. Where an explicit financial close date is unavailable, the closest documented financing milestone is used and identified accordingly. These include IFC loan signing for Al Subh (October 2017) and Kairouan (September 2023), and World Bank loan signing for the publicly developed Noor Tafilalt project (July 2015)[17]. Final investment decision dates are not used because they are not reported in the available sources.

The analysis draws on an open database covering country conditions, project financing, capital costs and green finance, these findings from the wider literature are distinguished.

4. Country Context

4.1. Sovereign and macroeconomic risk

Sovereign creditworthiness influences the cost and availability of finance for renewable energy projects. Morocco is rated just below investment grade (BB+), whereas Egypt (B) and Tunisia (B-) face higher sovereign risk.[18] Using Damodaran's country-risk estimates, Morocco has a sovereign default spread of 2.13%, compared with 6.37% for Egypt and Tunisia. The corresponding country risk premiums for equity are 3.24% and 9.71%, respectively.[19]

Assuming a risk-free rate of 3.6%, a mature-market equity risk premium of 4.23% and an equity beta of one, these inputs imply required equity returns of approximately 11% in Morocco and 17.5% in Egypt and Tunisia. These are indicative country-level benchmarks rather than observed project financing costs.

Macroeconomic conditions create further differences. Morocco has relatively low inflation and a more stable dirham, while Egypt faces higher public debt, persistent inflation and exchange-rate volatility following the introduction of a floating pound in March 2024.[20] Currency exposure is particularly relevant for projects with long-term power purchase agreements (PPAs), where local-currency revenues may need to service foreign-currency debt.

4.2. Power sector structure, offtakers and targets

The Electricity purchasing arrangements are central to project bankability because they determine the source and reliability of contracted revenues. Renewable energy projects typically sell their electricity through a long-term power purchase agreement (PPA), which sets out the terms of sale, including the tariff, payment obligations and allocation of key risks. The buyer under this agreement is known as the offtaker. In all three countries, state-owned entities play a central role in electricity purchasing: ONEE in Morocco, with Masen acting as an intermediary for certain projects; EETC in Egypt; and STEG in Tunisia. For lenders, the key considerations are the financial strength of the contractual offtaker, payment security and the extent of government support for its obligations.

17. World Bank, Private Participation in Infrastructure Database: Al Subh Solar PV Plant; IFC, IFC, AfDB and AMEA Power Introduce First Large-Scale Privately Financed Solar Project in Tunisia, 2023; World Bank, Loan Agreement for CTF Loan TF019266, 2 July 2015.

18. Fitch Ratings, *Fitch affirms Morocco at BB+; outlook stable*, 2026.

19. Damodaran, A. (2026). Country Default Spreads and Risk Premiums. NYU Stern School of Business.

20. IMF, Morocco: 2025 Article IV Consultation and Third Review Under the Arrangement Under the Resilience and Sustainability Facility, IMF Country Report No. 25/87, April 2025. IMF, Arab Republic of Egypt: 2025 Article IV Consultation and Fourth Review Under the Extended Fund Facility, IMF Country Report No. 25/186, July 2025.

All three countries have set ambitious renewable energy targets for 2030, increasing the need for affordable long-term investment. . [21] However, project revenues also depend on procurement arrangements, tariff structures, grid capacity and dispatch rules. Transmission constraints or insufficient system flexibility can lead to curtailment, reducing electricity delivered and potentially weakening debt repayment capacity. Renewable energy expansion therefore requires coordinated investment in generation and grid infrastructure.

5. Eleven Case Studies, Three Financing Models

5.1. Morocco: the Masen model

Three of the Moroccan projects form the Noor PV I programme. Masen tendered these projects and awarded them to ACWA Power, keeping a minority 25% stake in each project, through Masen Capital. Noor Ouarzazate IV was financed almost entirely by a German development loan from KfW channelled through Masen. Noor Laayoune and Noor Boujdour were funded mainly by Masen loans backed by Morocco's first, state guaranteed green bond.[22] On the contrary, Noor Tafilalt follows a different logic. This project is owned by ONEE and financed by the World Bank and the Clean Technology Fund under a sovereign guarantee, with no PPA.[23]

Risks and instruments. The public side carries the offtaker, regulatory, and currency risk. In regards to currency risk, Dirham debt matched with dirham revenues removes the currency mismatch at source. The Noor PV I plants transitioned from award to operational phase in about two years. Who builds and funds their grid connections, and any curtailment compensation, are not publicly disclosed. The structure is fast and inexpensive to finance, but public money covers most of the cost. Therefore, the risk has not disappeared, it has been transferred to the public balance sheet.[24]

5.2. Egypt: guaranteed IPPs

Kom Ombo, developed by ACWA Power, sells to the state-owned EETC under a 25 year take or pay PPA.[25] It was financed mainly by development lenders, with a substantial concessional component from the Green Climate Fund and SEFA.[26] Al Subh and ACWA Benban One belong to the Benban solar park and Round 2 of Egypt's feed in tariff, financed through an IFC-led programme; MIGA insured the ICBC lender tranche at Benban One and the equity investors at Al Subh.[27]

Risks and instruments. The key risks for lenders are offtaker payment and currency transfer over 25 years. A Ministry of Finance guarantee of EETC's state-backed obligations covers all three projects, and dollar pricing or indexation shifts most currency risk to the buyer. At Benban, EETC built the connection to the park substation, placing grid connection risk on the public side; Kom Ombo's take or pay PPA protects revenue if output is not taken, but its compensation formula is not publicly

21. Kingdom of Morocco, Ministry of Energy, Renewable Energies, n.d.; Arab Republic of Egypt, State Information Service, Energy, n.d.; Republic of Tunisia, Government Portal, Meeting of the Higher Committee for Private Electricity Production, 2026.

22. Masen, *Morocco's first green bond*, 2016; Le Desk, *Noor IV lancé, parachevant la méga-centrale solaire de Ouarzazate*, 2017; Le Vert, *Masen au capital des sociétés Noor PV I*, 2017; KfW, *Photovoltaikkraftwerk Noor IV*, n.d.

23. World Bank, *Morocco: Clean and efficient energy project*, 2015; World Bank, *Morocco: Clean and efficient energy project*, 2025.

24. Masen, *Morocco's first green bond*, 2016; KfW, *Photovoltaikkraftwerk Noor IV*, n.d.

25. ACWA Power, *Kom Ombo PV: Final project agreements*, 2021.

26. ACWA Power, *Kom Ombo solar project: Financial close*, 2023; AfDB, *Sustainable Energy Fund for Africa: Annual report 2024*, 2025.

27. IFC, *Nubian Suns (Egypt): Scale at speed*, 2019; CAO, *Al Subh, Sunrise and Rising Sun: Dispute resolution report*, 2025; EBRD, *ACWA Benban Solar PV I*, 2017; MIGA, *ACWA Benban One for Energy JSC*, 2017.

disclosed. DFI led loan syndicates bring in commercial banks, and at Kom Ombo concessional finance allowed a loan tenor about twice as long as local banks offer.[28] Round 2 plants reached financial close within months of their PPAs, while Kom Ombo took almost four years from its initial PPA (October 2019) to financial close (August 2023). Of the selected projects, Egypt attracts the most private investment, with nearly two private dollars for every public or DFI dollar invested, well above Morocco and Tunisia. (averages of project ratios; see Section 6).

5.3. Tunisia: DFI financed concessions

Tunisia's first concession round, awarded in December 2019, produced Tozeur and Sidi Bouzid I, sponsored by Scatec and Aeolus. Kairouan was sponsored by AMEA Power, at some of the lowest tariffs in the region.[29] All three projects analyzed were financed by DFIs with concessional tranches.[30] Sidi Bouzid II, from the 2024 round, reached financial close in June 2026 with loans backed by EU guarantees and an EU grant for its grid connection.[31]

Risks and instruments. Three risk categories dominate in Tunisia: a concession regume, state owned offtaker risk, and currency risk where Tunisian dinar revenues service euro dominated debt. MIGA insures the equity in all four projects, however no payment guarantee or long dated currency hedge is publicly disclosed.[32] Take or pay is reported for the concessions, but project-specific curtailment compensation terms are largely not publicly disclosed. The first-round projects took around four years from award to financial close (for Kairouan, IFC loan signing); Sidi Bouzid II, with the same sponsors and lenders, took only around a year and a half.

28. AfDB, *Egypt: Kom Ombo solar PV project*, 2021.

29. Tunisia Ministry of Energy, *Régime des concessions*, 2019; EBRD, *Scatec Tozeur PV Power*, 2024; Scatec, *Scatec and Aeolus: Tunisia solar projects*, 2024; Scatec, *Tunisia 120 MW solar plant: Financial close*, 2026.

30. MIGA, *Tozeur and Sidi Bouzid solar plants*, 2024b; MIGA, *Kairouan solar plant*, 2024a; IFC, *Kairouan solar plant*, 2022; AfDB, *Tunisia: Kairouan solar PV project*, 2022.

31. EIB, *Sidi Bouzid 2 Solar*, 2026; EBRD, *EBRD, EIB and EU support Tunisia's energy transition and resilience*, 2026a.

32. TCX, *Hedgeable currencies*, n.d.; EBRD, *Tunisia country strategy 2026–2031*, 2026b.

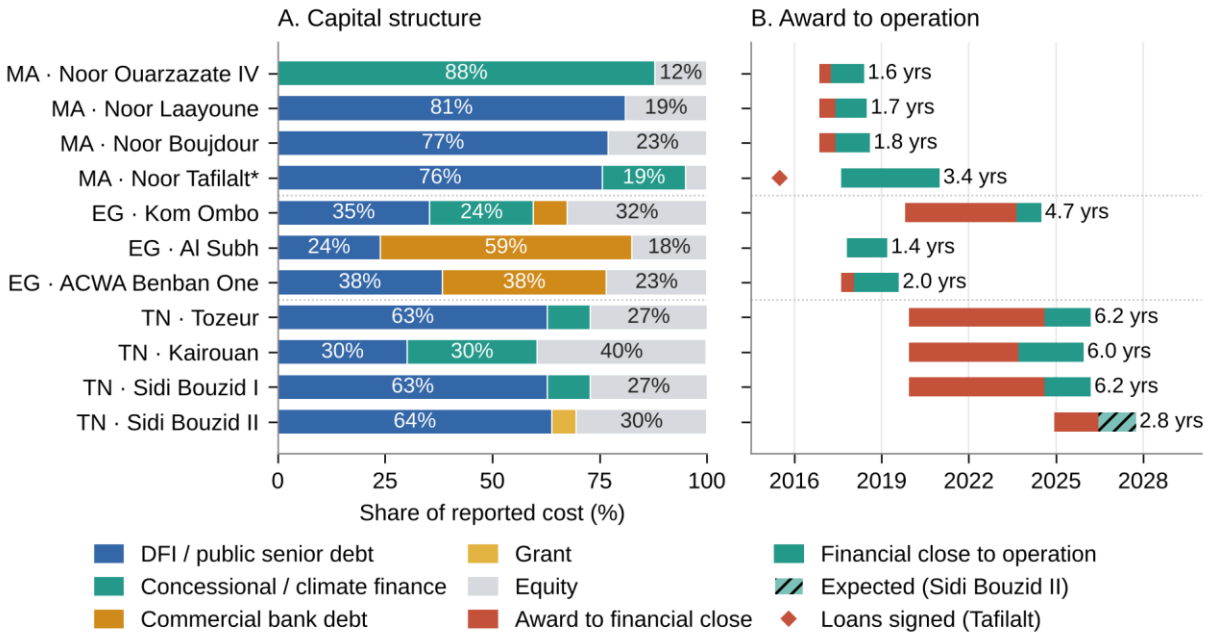
6. Comparison and Cross Case Findings

Exhibit 4. The three financing models across eleven projects (averages of the selected projects, not national figures)

	Morocco (4 projects)	**Egypt (3 projects)**	**Tunisia (4 projects)**
Financing model	State led: Masen is lender, buyer and co-owner; one ONEE owned plant	Guaranteed IPPs: DFI led syndicates + sovereign guarantee	DFI financed concessions: DFI and concessional debt + MIGA
Capacity; investment	292 MWp; USD 330m	327 MWp; USD 324m	360 MWp; USD 289m
Cost per MWp; debt share	USD 1.22m; 85%	USD 1.11m; 76%	USD 0.81m; 67%
Public / DFI share; concessional share	87%; 27%	41%; 8%	69%; 14%
Private USD per public or DFI USD (average of project ratios)	0.13	1.82	0.46
Tariff; PPA term	5.4 US¢ (MAD); 23 years	6.4 US¢ (USD or indexed); 25 years	3.1 US¢ (mostly TND); 24 years
Offtaker security	State owned buyer; state guarantee on debt	Ministry of Finance guarantee (3 of 3)	ND (0 of 4)
Political risk insurance	None reported (0 of 4)	MIGA (2 of 3)	MIGA, equity (4 of 4)
Grid connection	Routes in E&S assessments; who builds and funds ND	EETC built Benban connection; Kom Ombo network connection contract	EU grant for Sidi Bouzid II line; others ND
Curtailment compensation	ND (0 of 4)	Take or pay at Kom Ombo; formula ND	Take or pay reported; project terms largely ND
Award to close	About 6 months (Noor PV I)	Months (Round 2) to almost 4 years (Kom Ombo)	3.8 to 4.7 years (round 1); 1.5 years (round 2)
Distinct instruments used	9	15	15

Source: Authors' analysis. Simple averages of disclosed values; Tozeur and Sidi Bouzid II converted from EUR. Ratio on country totals = total private finance divided by total public and DFI finance. Award to close uses financial close or the closest evidenced milestone (Section 3). ND = not publicly disclosed.

Exhibit 5. Capital structure (share of reported cost) and time from award to operation



Source: ACWA Power (2021, 2023); AfDB (2021, 2022); EBRD (2017, 2024, 2026a); EIB (2026); IFC (2019, 2022); KfW (n.d.); Masen (2016, 2019a–b); MIGA (2017, 2024a–b); Scatec (2024, 2026); World Bank (2015, 2025); authors' analysis. *Noor Tafilalt is a public project: loans were signed in 2015, before the 2017 EPC award.

Exhibits 4 and 5 summarize the three financing models. An interesting finding is that despite the highest country risk, Kom Ombo achieved the lowest tariff in the sample. This finding is consistent with competitive procurement, blended finance and a sovereign guarantee. Although public data do not isolate the effect of each instrument, the success of this financing structure further emphasizes our thesis.[33]

What the private capital ratio measures. For each project, the ratio divides private finance (sponsor equity and commercial debt) by public and DFI finance as recorded in the database. The country figures in Exhibit 4 are simple averages of the project ratios analyzed in the sample.

Finding 1: three models, observed across eleven projects. Every Moroccan project relies on state lending or state guarantees, every Egyptian project on a Ministry of Finance guarantee and every Tunisian project on DFI debt with MIGA cover. This pattern suggests that national institutions and the distributional blend of public and private finance shape how risk is allocated, more than individual project characteristics.

Finding 2: a possible risk and instrument mismatch in Tunisia. Protection against offtaker and currency risk is clearest in Morocco and Egypt. In Tunisia the visible instruments insure equity and cheapen debt, but no project publicly discloses payment security and three earn dinar tariffs against euro debt.

Finding 3: time to close is a financing exposure, and it falls with repetition. There is a range in closing timing sequences amongst the projects, Noor PV I and the Benban Round 2 plants reached financial close within months, and Tunisia's first round and Kom Ombo took about four years or more. Additionally, Sidi Bouzid II, with standard documentation and an EU grant for its grid line, closed in

33. AfDB, *Egypt: Kom Ombo solar PV project*, 2021.

just a year and a half. Each month of delay exposes bids to changes in interest rates and equipment prices.[34]

Finding 4: derisking choices trade public cost against private co-investment. Morocco's state model is the fastest, but public money covers most of the cost. Egypt shows the highest private co-investment ratio, with commercial banks lending alongside DFIs under MIGA cover and sovereign guarantees, although part of Egypt's public commitment is contingent and outside the ratio; Tunisia sits in between (Exhibit 4).

Finding 5: transparency is a governance constraint. None of the eleven projects publishes its cost of debt or WACC, and only two disclose an equity return and one a minimum DSCR. Nondisclosure is not absence of protection, but it makes structures difficult to verify and replicate, and it prevents governments from benchmarking new tenders against past ones. This is why a model is urgently needed to contribute to the renewable transition, currently the undisclosed cost of capital can be estimated under stated assumptions.

7. Quantifying Derisking: the SolarRisk Model and Calculator

7.1. Model design

The model is a standard project finance cash flow model covering the life of each contract, calibrated on each project's cost, output, tariff, financing structure and tax rate from the database. The cost of commercial debt is built up from a benchmark rate and a lender margin plus one premium for each priced risk: the sovereign default spread from Damodaran (Section 4.1), and offtaker, currency and construction premiums set by the authors. Five levers can reduce risk or its cost: a capital grant, a concessional loan, a guarantee, a first loss reserve, and FX and liquidity cover.[35]

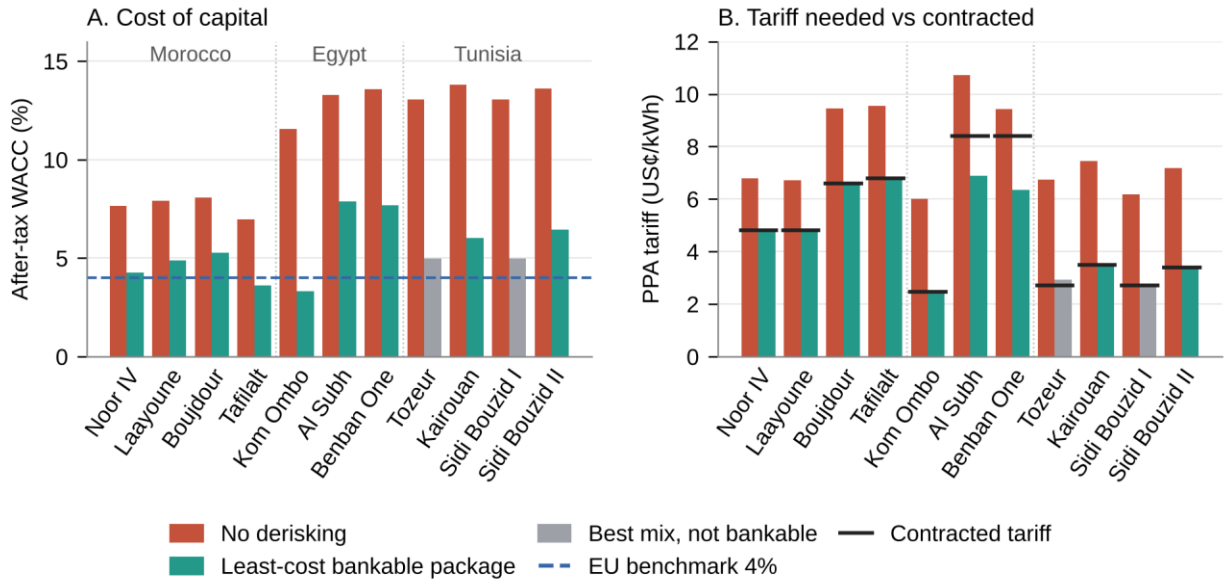
Bankability tests. Because no project discloses its IRR, cost of debt or WACC, the model does not compare an observed project return with an observed cost of capital. It asks instead whether, at the project's contracted tariff, three modelled tests hold: the minimum DSCR in any year stays at or above the lender minimum assumed in the model (1.3x in Morocco, 1.2x in Egypt and an assumed 1.25x in Tunisia); the equity return reaches its required return (Section 4.1); and the after-tax WACC is at or below the model's target. The model tests different combinations of the five levers and keeps the combination that passes all three tests at the lowest public cost, so "least public cost" means the cheapest package among those tested, not a global optimum.

34. Scatec, *Scatec and Aeolus: Tunisia solar projects*, 2024; Scatec, *Tunisia 120 MW solar plant: Financial close*, 2026.

35. Damodaran, *Country default spreads and risk premiums*, 2026; AfDB, *Egypt: Kom Ombo solar PV project*, 2021; World Bank, *Morocco: Clean and efficient energy project*, 2025.

7.2. Results

Exhibit 6. Effect of derisking on the cost of capital and the tariff needed



Country benchmarks: RES4Africa (Morocco 7%, Egypt and Tunisia 9%).[36] **Source:** https://solarriskcalculator.netlify.app/RES4Africa (2025); authors' analysis.

All eleven projects reached financial close, so the model, calibrated on them as shown in Appendix Exhibit A2, is not used to judge whether they were bankable; it shows how far that bankability depended on public support. Priced on commercial terms alone at the contracted or reference tariff, every project fails the debt service test: the modelled minimum DSCR ranges from 0.44x to 1.07x against the lender minimum of 1.2x to 1.3x. The modelled cost of capital averages 7.7% in Morocco, 12.8% in Egypt and 13.4% in Tunisia (Exhibit 6). The Moroccan result is close to RES4Africa's benchmark, an external sense check on the calibration; the higher Egyptian and Tunisian results reflect the model pricing every risk at commercial rates rather than at the undisclosed terms DFIs offered.[37]

With the levers added, nine of the eleven projects pass all three tests, at a modelled public cost of about 12 to 15% of project cost in Morocco, 12 to 13% at the two Benban plants, 37% at Kom Ombo and 41 to 42% at Kairouan and Sidi Bouzid II. At Tozeur and Sidi Bouzid I, no tested combination raises the equity return to the required 17.5% at 2.7 US cents/kWh. That both reached financial close suggests their actual terms were more favourable than the model assumes, through cheaper DFI pricing, lower sponsor return requirements, or both.

Comparison with actual structures. The selected instruments are directionally consistent with observed deals, although their sizing differs. Every bankable package relies on a large concessional tranche, while real projects generally used smaller ones.[38] Guarantees enter where sovereign and offtaker premiums are large, as in Egypt and Morocco. Both bankable Tunisian packages also select FX cover, which no Tunisian project publicly discloses. Because the model reports packages rather than instrument level effects, it cannot say which single instrument matters most.

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36. RES4Africa, *Hybrid renewable energy systems in Morocco*, 2025; IRENA, *The cost of financing for renewable power*, 2023. The RES4Africa benchmark is on p. 31, Figure 13; the report is copyright 2025 and the online PDF is stored under April 2026. Its solar benchmarks concern 2021 financing conditions, rather than observed WACC for the eleven projects.

37. RES4Africa, *Hybrid renewable energy systems in Morocco*, 2025.

38. KfW, *Photovoltaikkraftwerk Noor IV*, n.d.

Stress testing. The calculator can apply a currency devaluation, a lower capacity factor and an interest rate shock to any case. In the model, FX and liquidity cover transfers devaluation losses to the public provider rather than eliminating them: currency cover changes who bears currency risk, not its size.

Limits. These are modelled counterfactuals, not estimates of any project's actual cost of capital. Several premiums and instrument terms are assumptions, and treating DFI loans as fully priced commercial debt overstates the support needed where DFIs lend below market. Because each package is chosen to pass the tests at the contracted tariff, the match between modelled and actual tariffs is a design feature, not an independent validation.

7.3. The SolarRisk Calculator

The SolarRisk Calculator publishes the model so that the analysis can be repeated, challenged and applied to new projects. Its primary audience is governments, procurement agencies and DFIs designing tenders and support packages before bids are launched; developers and investors may also use it to test their own assumptions. Users select a reference project or define a new prospective project, stress test it with a devaluation, a lower capacity factor or a rate shock, and compare the project's unsupported financing, the least public cost package tested and their own mix on WACC, DSCR, required tariff and modelled public cost. A recommendation engine then links the binding risks to the 28 instruments identified in the database. The tool is freely available at https://solarriskcalculator.netlify.app/solarriskcalculator.netlify.app.

What it can and cannot show. The calculator shows whether a proposed structure passes the three tests under stated assumptions, which levers restore them at the lowest modelled public cost and how results move under stress. It cannot establish any project's actual cost of capital, the effect of a single instrument or whether a package is affordable for the public budget; its premiums are assumptions to be replaced with market evidence.

8. Recommendations: Enabling the Transition

1. Test bankability before tender, with lenders in the room. Governments and DFIs should test proposed tariffs and financing structures against debt service, equity return, currency exposure and offtaker risk before procurement, with the lenders and investors who will price them, so that public and private views of risk are reconciled before a tender rather than after award. Tender documents should settle payment security, currency treatment, grid connection responsibility and deadlines, whether network capacity and demand can absorb the plant's output, curtailment compensation, termination provisions, and land and environmental and social requirements, including early engagement with local communities. Tools such as the SolarRisk Calculator can support this step.

2. Build reusable templates and public deal capacity. Standard PPAs, concession agreements and direct agreements, agreed once with lenders and reused across rounds, let a second project start where the first ended. The cases are consistent with this: Egypt's Round 2 used revised, standardized documents after its first round stalled, and Tunisia's second-round project closed far faster than its first round. Procurement agencies also need the capacity to prepare projects and negotiate with lenders, a recurring execution constraint across African infrastructure.[39]

3. Target public support at the risks that drive financing costs. Concessional debt can reduce financing cost and extend tenor; guarantees can address sovereign and offtaker risk; FX or liquidity instruments can address currency mismatch; and funded grid works can remove connection risk.

39. BCG, *Africa unleashed: Bridging Africa's infrastructure execution gap*, 2025, pp. 12 and 15.

Packages should be judged not only by whether projects close, but by their funded public cost, the contingent exposure they create, and the private capital that co-invests alongside them.

4. Improve disclosure and use comparable tools. Governments and DFIs should publish, where commercially feasible, a minimum set of financing and risk allocation terms, including tenor, indicative pricing, indexation, payment security, grid connection and curtailment provisions, and key metrics such as base-case DSCR and equity return, so that new projects can be benchmarked against previous transactions before public support is committed.

9. Conclusion

RQ1. Solar resource is abundant and equipment is bought on global markets; what differs is how risks are allocated and priced, and how credible the institutions behind that allocation are. Sovereign, offtaker, currency, contractual, grid connection and curtailment risks shape debt tenor, credit support and time to financial close.

RQ2. Three national models emerge: a state led structure in Morocco, guaranteed IPPs in Egypt and DFI financed concessions in Tunisia. Among the selected projects, Egypt shows the most private co-investment per funded public dollar, although part of its public commitment is a contingent guarantee outside that ratio; key terms such as the cost of debt are not publicly disclosed for any project.

RQ3. Priced on commercial terms at the contracted or reference tariff, every project's modelled minimum DSCR falls below the lender minimum assumed in the model. The least public cost packages tested, built on concessional debt, pass all three bankability tests for nine projects, at a modelled public cost rising from Morocco to Tunisia; for two Tunisian first-round projects, no tested package meets the equity return test.

RQ4. Bankability should be tested before tender, jointly with lenders; reusable templates and public deal capacity should shorten the road to financial close; support should be aimed at the risks that constrain financing and judged by funded cost, contingent exposure and private co-investment; and financing terms should be disclosed so that projects can be benchmarked.

Scaling renewable electricity in North Africa depends substantially on institutional, contractual, financial and market design. The policy challenge is not simply to provide more public finance, but to identify the risks that prevent bankability, allocate them to the parties best able to bear them, make that allocation credible, and use the support needed to mobilize private investment efficiently.

Future research. Five extensions would strengthen this work: a comparable national or European benchmark for private co-investment per public dollar; the return and emissions reduction per euro invested in North Africa compared with Southern Europe; an updated survey of public and private views of risk in the three countries; systematic measurement of development impact, including verified emissions avoided, reliability of supply, and community, land, labour and human rights outcomes, which may increasingly separate bankable from non-bankable projects; and the effect of storage on curtailment and bankability. Including projects that failed to reach financial close would also address the sample's main selection limit.

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Appendix

Exhibit A1. Derisking instruments, risks addressed and use in the eleven case studies

Instrument	Risk addressed and channel	Used in the case studies	Further options
Concessional and long tenor debt	Financing cost and tenor (replace)	CTF/GEF, SEFA, GCF or KfW climate funds in 6 of 11; DFI tenors of 18 to 24 years in 8 of 11	EIB Global; World Bank
Sovereign guarantee	Offtaker and credit (transfer)	Ministry of Finance guarantee of EETC in all 3 Egyptian projects; state guarantee on lender debt in all 4 Moroccan	World Bank or AfDB guarantees; Green Guarantee Company
Political risk insurance	Expropriation, transfer, breach (transfer)	MIGA in 6 of 11: all four Tunisian projects and two Benban plants	ATI
Currency treatment	Exchange rate and convertibility (transfer)	USD tariff or 70% USD indexation in 4; dirham debt against dirham tariff in 2; long dated hedge publicly disclosed in none	TCX; GuarantCo; EBRD local currency pools
Blended guarantees and grants	Credit and preparation cost (transfer, replace)	EU EFSD+ guarantees and EUR 5.5m NIP grant (Sidi Bouzid II); EBRD technical cooperation (Tozeur, Sidi Bouzid I)	EU Global Gateway; GCF readiness
Contract and policy design	Regulatory, grid connection, curtailment and legal (reduce)	Competitive tenders in 8, feed in tariff in 2, take or pay in 4, state land or grid works in 5, offshore arbitration in 2	Standard concession and PPA templates

Source: Authors' analysis of 28 instruments and 87 coded project usage records. Counts reproduce the original inventory; currency-indexation coding for Tunisia is still being reconciled with the project data.

Exhibit A2. How the eleven reference cases set the baseline for assessing new projects

Model component	Taken from the eleven reference cases	How it is applied to a new project
Country risk	Damodaran sovereign default spreads and country risk premiums for Morocco (BB+), Egypt (B) and Tunisia (B minus), with the cost of equity they imply	Sets the starting risk premiums for a project in that country; the user can change the rating or premium
Offtaker, tariff and currency	Single state buyer in each country (ONEE via Masen, EETC, STEG); tariffs in dirham, dollar-linked, or mostly in dinar	The user enters tariff and currency; the tool flags where local-currency revenue would service hard-currency debt
Financing structure	Average debt shares of 67 to 85%; DFI loan tenors of 18 to 24 years in eight of the eleven cases; lender mix by country	Provides default leverage, tenor and lender assumptions, adjustable for the project at hand
Credit support	State-backed debt (Morocco), Ministry of Finance guarantee (Egypt), MIGA cover (six cases), EU guarantees and grant (Sidi Bouzid II)	Ranks candidate levers by what comparable deals actually used in that country
Time to close	About six months for repeat programmes (Noor PV I, Benban Round 2) against about four years or more for first rounds	Signals when preparation, standard documents or grid works should come before a tender
Instruments and providers	28 instruments and policies, coded across 87 uses in the cases	Names the instruments, providers and policy measures used in the closest reference cases

The eleven projects are financed and operating or under construction; they are used to calibrate the calculator, not to propose further support for them. Figures are disclosed values from public sources. **Source:** Damodaran (2026); authors' analysis.