

Low solar tariffs coexist with public participation and uneven disclosure in Saudi Arabia and the United Arab Emirates

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Abstract

Exceptionally low solar electricity prices attract attention, but their interpretation depends on contractual, ownership and financing information that is unevenly disclosed. We compared 23 utility-scale photovoltaic independent power projects in Saudi Arabia and the United Arab Emirates using public project records. The dataset links reported prices to procurement vintage, power purchase agreements, direct public equity, financing milestones and seven risk categories. Prices were available for 21 projects, ranging from 1.04 to 2.3417 US cents per kilowatt-hour in Saudi Arabia and from 1.35 to 5.84 in the United Arab Emirates. The respective country means were 1.550 and 2.550; restricting awards to the common 2018–2025 window reduced the latter to 1.520, illustrating sensitivity to sample composition. Direct public equity was disclosed for 18 projects, including seven UAE projects with a 60% share. Financing-close years were available for 18 projects, whereas detailed contractual risk allocation remained largely unresolved. These descriptive findings show that low prices coexist with public participation and long-term contracts. They do not identify a causal ownership effect or demonstrate realised cash-flow sustainability. Price benchmarks become more interpretable when disclosure distinguishes procurement terms, financing events and operational outcomes.

Introduction

Utility-scale solar photovoltaic (PV) deployment is expanding in the Gulf, where resource conditions and electricity demand make solar generation relevant to power-sector diversification [1]. The low prices announced for projects in Saudi Arabia and the United Arab Emirates (UAE) are often treated as benchmarks for affordable decarbonisation. A reported procurement price, however, does not describe the financing conditions under which a plant is built or the revenue protection available after commissioning. Project-finance structures and changes in financing conditions can materially affect renewable-energy investment [2, 3]. Understanding low-price procurement therefore requires evidence about the contractual and institutional setting as well as the price itself. Research on renewable-energy finance identifies policy conditions and investment risk as determinants of capital mobilisation [4]. Financing costs also affect the levelised cost of electricity (LCOE), which combines costs and electricity production over a specified lifetime [5]. Auction studies show that procurement design, bidder participation and implementation requirements shape price outcomes [6, 7, 8]. Analyses of financing conditions and auction rules further indicate that a price-only comparison can omit factors relevant to project delivery [9, 10]. These studies motivate a distinction between an announced price and the ability of a project to secure financing and maintain sufficient cash flows.

For Gulf solar projects, public equity and public procurement can operate together. An independent power producer (IPP) may have a public shareholder, a public offtaker and a long-term power purchase agreement (PPA), while retaining construction and operating responsibilities within the project company. These arrangements are conceptually distinct. A direct equity stake is not a sovereign guarantee, and a long PPA does not by itself establish protection against curtailment, nonpayment or termination. Developer guidance accordingly treats offtake terms, completion risk and grid connection as separate components of project assessment [11]. Public announcements provide only partial access to these components, making the observability of each variable part of the research problem. We examine which elements of the price-to-financing relationship can be established from public records for 23 PV IPPs. The analysis connects prices to project vintage, PPA duration, direct public participation, financing milestones and observable risk-related provisions (Fig. 1). It asks whether low prices coexist with similar ownership and contract structures, how country comparisons change when award periods are aligned, and where public disclosures cease to support a bankability assessment. We use descriptive summaries, an explicit missing-data audit and bounded project comparisons. The contribution is a reproducible account of co-occurring project characteristics and disclosure limits, rather than an estimate of the causal determinants of tariffs or a model of realised investment returns.

Results

Project coverage and reported prices

The sample comprised 15 Saudi projects and eight UAE projects awarded between 2015 and 2025, with unequal follow-up periods and different recorded operational stages. Eight Saudi projects were operational, three were under construction and four were awarded or under development. The UAE sample contained five operational projects, two under construction and one partly operational project with continuing construction. Reported prices were available for 21 of 23 projects (91.3%), PPA duration for 19

(82.6%) and direct public equity for 18 (78.3%; Table 1). A corporate-history record established Sakaka's financial-close year as 2018, increasing year-level financing coverage from 17 to 18 projects (78.3%) [12]. Ten projects had day-level operational-event dates, but these included inaugurations and a conflicting milestone record, rather than ten independently verified contractual completion dates. The cost field was populated for 16 projects (69.6%), although cost definitions and reporting scopes varied. Four projects had bid counts (17.4%), and only Sakaka had a project-level local-content observation (4.3%). Public records therefore supported a broader description of procurement prices and sponsor structures than of bidding intensity, realised localisation or cash-flow performance. Supplementary Data 1 retains all 23 project records, source identifiers, raw event descriptions and analytical revisions. These coverage measures describe the selected evidence snapshot and should not be interpreted as comparable observation periods or complete assessments of individual projects.

Table 1
Availability of core project fields in the revised analytical dataset.

Field	Saudi Arabia	UAE	Total	Coverage
Recorded capacity	15/15	8/8	23/23	100.0%
Reported price	14/15	7/8	21/23	91.3%
PPA duration	12/15	7/8	19/23	82.6%
Direct public equity	11/15	7/8	18/23	78.3%
Financial-close year	11/15	7/8	18/23	78.3%
Recorded cost	9/15	7/8	16/23	69.6%
Day-level operational event	5/15	5/8	10/23	43.5%
Submitted bid or proposal count	2/15	2/8	4/23	17.4%
Project local content	1/15	0/8	1/23	4.3%
Coverage is a nonmissing-value count, not a completeness or validity score. The financial-close count includes the verified Sakaka year. Day-level dates include inauguration and conflicting records; costs may have different scopes. Local content preserves the greater-than-30% wording for Sakaka. Percentages use n = 23.				

Country price comparisons depended on the procurement window and the basis of the reported price (Table 2; Fig. 2a). Across 14 observations, Saudi prices ranged from 1.04 to 2.3417 US cents kWh⁻¹, with a mean of 1.550 and a median of 1.547. The seven UAE prices ranged from 1.35 to 5.84 US cents kWh⁻¹, with a mean of 2.550 and a median of 1.695. Earlier UAE awards widened this range. Mohammed bin Rashid Al Maktoum (MBR) Solar Park Phases II and III recorded 5.84 and 2.99 US cents kWh⁻¹, respectively. Phases V and VI recorded 1.6953 and 1.6215, while Al Dhafra's award-stage LCOE was 1.35. Al Dhafra's local-currency price subsequently changed at financial close, illustrating the importance of price vintage [13, 14]. Khazna's selected announcements disclosed neither a tariff nor a sponsor-equity percentage, leaving both fields missing [15, 16]. Restricting awards to the common 2018–2025 window retained all 14 priced Saudi projects and four priced UAE projects. The UAE mean became 1.520 and its median 1.517 US cents kWh⁻¹; the UAE–Saudi mean difference changed from approximately + 1.000 to – 0.030. This shift demonstrates sensitivity to cohort composition, rather than a calendar-year-adjusted country effect. The samples still differed in award-year distribution, technology, scale and contract terms. Their prices also combined source-labelled tariffs, LCOEs and a weighted-average tariff, precluding interpretation as a harmonised generation-cost measure.

Table 2
Descriptive price summaries and sensitivity to the award-year window.

Award cohort	Country	n	Mean	Median	Range
2015–2025 sample	Saudi Arabia	14	1.550	1.547	1.0400–2.3417
2015–2025 sample	UAE	7	2.550	1.695	1.3500–5.8400
2018–2025 window	Saudi Arabia	14	1.550	1.547	1.0400–2.3417
2018–2025 window	UAE	4	1.520	1.517	1.3500–1.6953
All prices are in US cents kWh ⁻¹ and are unweighted. The full sample contains country-specific award-year distributions. The common-window comparison retains all 14 priced Saudi projects and four priced UAE projects. Price bases remain heterogeneous; these are not matched estimates or causal country effects.					

Public participation and project milestones

Low reported prices coexisted with several forms of direct public participation and long-term offtake. Equity information covered 11 Saudi projects and seven UAE projects. All seven observed UAE shares were 60%, encompassing the four selected MBR phases, Noor Abu Dhabi, Al Dhafra and Al Ajban; Khazna remained excluded. Saudi shares ranged from 20.0% for Al Rass 1 to 65.0% for Sudair. The Shuaibah projects recorded 64.99% for Badeel and Saudi Aramco Power Company combined. Ar Rass 2, Saad 2 and Al Kahfah recorded 49.9%, whereas Haden, Al-Muwaihi and Al-Khushaybi recorded 64.9%, and Samtah recorded 50.01% [17, 18, 19, 20]. Only 17 projects had both price and ownership information (Fig. 2b), because Shuaibah 2 disclosed ownership but lacked a price. Al Rass 1 combined approximately 1.50 US cents kWh⁻¹ with a 20% public share, while Sudair combined 1.239 with 65%. These contrasts describe directly disclosed project structures, without tracing ultimate state ownership or estimating an ownership coefficient, subsidy rate or public cost of capital. Missing ownership was not coded as zero or interpreted as private-only financing. PPA duration supplied a related contractual characteristic: ten projects recorded 25 years, four recorded 30 years and five recorded 35 years. The Shuaibah project page identified a 35-year offtake contract [21]. Terms were retained at the source's reported stage, rather than assumed to represent uniform award-date versions. Long revenue horizons may matter for financing, but duration alone does not establish enforceable or complete payment protection.

Financing and operational records described distinct milestones, which could not be collapsed into a single measure of successful delivery (Fig. 3). Sudair's 2021 announcement described limited-recourse financing, a 28-year soft mini-perm structure and equity-bridge facilities [17]. The Shuaibah disclosure reported US\$1.63 billion of senior debt and US\$2.37 billion of investment for two projects [18]. These portfolio totals were neither allocated to individual plants nor counted twice. For Ar Rass 2, Saad 2 and Al Kahfah, the master table recorded financial close in 2023. A separate event recorded satisfaction of senior-loan drawdown conditions on 14 February 2024, alongside portfolio debt of US\$2.3 billion and investment of US\$3.4 billion [22, 23]. Khazna's financial close followed its October 2025 award on 19 January 2026, with seven lenders and planned commercial operation in 2028 [15, 16]. Operational records likewise distinguished initial production, full operation, contractual operation and inauguration. Sudair's full-operation certificate was reported in January 2024, while MBR Phase V's 18 June 2023 event was an inauguration [24, 25]. Shuaibah 1 retained an unresolved conflict between a November 2024 investor-record entry and the project-page date of 28 February 2025 [22, 21]. The latter appears in the timeline with a conflict marker; the earlier record remains in the event log. The log also records post-commissioning dispatch limitations for Ar Rass 2 and Al Kahfah from an issuer report [26], without quantifying curtailed output or losses. Together, these distinctions prevent an unqualified comparison of delivery speed or an equation of financial close and physical completion with unconstrained electricity sales.

Contractual evidence and procurement requirements

Public summaries identified specific support features more readily than complete contractual risk allocations. The audit covered 161 project-category records across seven categories for each of the 23 projects. Three of the original 11 non-UNKNOWN entries inferred curtailment allocation from take-or-pay or net-energy payment descriptions without explicit compensation clauses. Conservative recoding changed these entries to UNKNOWN while retaining their evidence text. Eight support or payment-

mechanism entries remained, alongside 153 UNKNOWN entries (95.0%; Fig. 4). Retained evidence comprised six Saudi land or site-predevelopment entries, one UAE grid-support entry and one UAE payment-mechanism entry. Five Saudi site entries came from programme- or round-level descriptions and did not independently establish complete land-risk transfer. Sudair offered a project-specific description of public site selection and preliminary studies [17], and Al Dhafra identified a public grid-connection role [27]. Noor Abu Dhabi's bond framework described a take-or-pay PPA, supporting a payment-mechanism code [28]. Khazna's announcement specified payment for net electrical energy supplied [15]; Al Ajban's corresponding description came from a secondary project-finance account in the source log. Such wording identifies a payment basis but does not establish responsibility for every grid-curtailement event or the availability of deemed-energy compensation. None of the revised curtailment, indexation, change-in-law or termination entries established a complete allocation. Table 3 therefore separates observable support from unsupported contractual inference: UNKNOWN marks the limits of the reviewed record, rather than evidence that protection is absent.

Table 3
Interpretation rules for observable support and contractual risk evidence.

Category	Revised observation	Interpretive boundary
Land and site	6 PUB entries	Public site selection or predevelopment is observable. Five entries have round or programme scope; complete land-risk transfer is unestablished.
Grid connection	1 PUB entry	Public grid-connection support is described. Construction boundaries, delay liability and compensation remain unresolved.
Payment	1 TAKE_OR_PAY entry	Noor Abu Dhabi has an explicit take-or-pay description. Exceptions and compensation formulas are not fully disclosed.
Curtailement	All 23 UNKNOWN	Net-energy and take-or-pay wording alone do not identify dispatch rights, deemed energy or complete compensation. Three earlier allocations were withdrawn.
Indexation	All 23 UNKNOWN	Currency conversion is not evidence of a contractual inflation or foreign-exchange adjustment.
Change in law	All 23 UNKNOWN	No sufficiently specified allocation was established in the coded records.
Termination	All 23 UNKNOWN	No sufficiently specified compensation or lender step-in allocation was established in the coded records.
The revised matrix contains 161 project-category records: eight retained support or mechanism entries and 153 UNKNOWN entries. These counts measure recorded evidence, not the prevalence of legally absent protections. PUB and TAKE_OR_PAY represent different types of information and are not combined into a bankability score. Original codes, evidence text and revision reasons are retained in Supplementary Data 1.		

Competition and localisation evidence depended on the stage and scope of each disclosure (Fig. 5). Project bid-count entries were eight for Sakaka, three for Al Rass 1, five for MBR Phase III and four for Al Ajban. Project or procurement announcements supported the Sakaka, Al Rass 1 and Al Ajban observations [29, 30, 31]. The secondary reconstruction for MBR Phase III described a funnel of 97 expressions of interest, approximately 40 invitations to prequalify and 24 responses. It then recorded 14 prequalified consortia and five final proposals [32]. A separate MBR Phase VI announcement reported 23 expressions of interest [33], which were not pooled with submitted bids. Local-content evidence similarly distinguished procurement requirements from reported project outcomes. Saudi Round 3 documents specified a 17% minimum at the request-for-qualification stage and an 18% minimum at the request-for-proposal stage [34, 35]. Sakaka's construction-stage disclosure reported contractual local content above 30% [36]. Its database value of 0.30 was retained as a threshold with the greater-than qualifier, rather than an exact achieved percentage. Each participation count thus represented a particular tender stage, while the local-content observations differed between round-level requirements and project-level reporting. The records supported comparison of disclosure practices, but neither an estimate of achieved localisation across projects nor a relationship between localisation and price.

Discussion

Low solar prices coexisted with direct public participation and long-term offtake, while detailed cash-flow protections remained poorly observable. The common-window comparison also showed that the apparent country price gap depended on early UAE

awards. This sensitivity does not establish equivalent procurement performance; it demonstrates how cohort composition can change a country mean before financing or contractual differences are considered. Equipment costs, solar resources, project scale, financing-market conditions and procurement rules may all influence announced prices [5, 6, 10]. Public participation may supply equity, coordinate counterparties or signal institutional commitment, but the present evidence cannot isolate these channels. A project-company stake does not reveal whether public capital earns a concessional return, whether lenders rely on a state guarantee, or the public sector's ultimate exposure. The direct-equity measure therefore describes sponsor composition rather than the financial value of public support. It includes only stakes explicitly assigned to public or state-linked entities in selected records, without tracing listed developers or intermediate holding companies. Missing observations cannot form a control group representing zero public involvement. Likewise, Al Rass 1's low price alongside a relatively small disclosed public share provides a descriptive contrast, not an estimate of public equity's marginal contribution. Interpreting such contrasts requires separating the observed ownership structure from the financing terms and institutional arrangements that the available announcements do not fully disclose.

A bankability assessment requires distinctions that the financing, operational and risk records jointly reveal. Financial close documents a transaction reaching a financing milestone under prevailing conditions, rather than establishing lifetime debt-service capacity, realised generation or freedom from refinancing risk. An inauguration can corroborate a facility's existence and public presentation as complete without identifying its contractual commercial operation date. The date conflict and dispatch-constraint entries similarly prevent an operational label from establishing unconstrained revenue generation. Payment descriptions require comparable care. Net-energy wording does not prove that developers bear all curtailment risk, and take-or-pay wording does not establish compensation for every output loss. Clause-level assessment requires definitions of eligible energy, grid unavailability, dispatch instructions, deemed generation, exceptions and compensation. The high UNKNOWN share reflects public disclosure granularity and the conservative coding rule, rather than measured contract quality. These limitations favour a reporting unit that links each project to dated, clearly classified events. Prices should retain their original units, tariff basis and procurement stage, while ownership records should identify the disclosed direct share and applicable date or contract version. Financing disclosures should distinguish close, drawdown and refinancing; operational disclosures should distinguish plans, initial production, full operation and inauguration. Public agencies could support these comparisons through concise project statements at each milestone. Such statements would organise observable information, while full contractual documents would remain necessary to establish the detailed allocation of cash-flow risks.

The study has several limitations. The sample is purposive and does not enumerate all eligible projects or failed procurements in either country. Selection depends on accessible public records, creating possible disclosure and survivorship bias. Projects differ in award year, capacity definition, technology and financing conditions, and some observations share a procurement round or financing portfolio. Reported prices are not harmonised for inflation, indexation, time-of-day remuneration or contract changes. Some source records are secondary, and the original source grades are not applied consistently enough to serve as a quantitative quality score. Risk coding was not independently duplicated, and the conservative recoding is an interpretive audit rather than a validated inter-rater exercise. Most importantly, the dataset lacks a comparable series of realised generation, debt pricing, debt-service coverage ratios and equity returns. It cannot establish the financial sustainability of the sampled projects or estimate the fiscal value of public support. These outcomes require contract documents and operating financial data. Within the present boundary, the defensible conclusion is that low reported prices can be described alongside substantial public participation and long PPAs, while missing contractual and operational evidence limits stronger claims about bankability. Transparent project-level disclosure is a prerequisite for testing those claims in future research.

Methods

Study design and data provenance

We conducted a descriptive comparison of utility-scale solar PV IPPs in Saudi Arabia and the UAE, using a project or independently identified procurement lot as the observation unit. Co-located plants with distinct capacities or contractual identities were retained separately. The list comprised 15 Saudi and eight UAE projects awarded between 2015 and 2025. It was a purposive sample based on available evidence, rather than a census or systematic review with a complete denominator of screened projects. The original compilation contained 59 source records linked to a project master table, financial and local-

content events, execution outcomes and a risk-codebook matrix. Its source log recorded access dates of 30 August 2026. Targeted verification on 6 September 2026 added the corporate-history record establishing Sakaka's 2018 financial close [12], without systematically refreshing every project status. Procurement notices, government and utility announcements, exchange filings, issuer reports, developer disclosures and explicitly identified secondary publications supplied the evidence. Source identifiers linked observations to their records, and Supplementary Data 1 preserves raw values and event descriptions alongside the revised analytical tables. Because inherited letter grades differed in definition across workbook sheets, assessment relied on source type, stated scope and supporting text rather than a calibrated evidence score. We do not claim independent duplicate extraction or measured inter-rater reliability for this compilation.

Price and ownership definitions

The price variable was the reported value in US cents kWh⁻¹. The source-specific basis was retained, including awarded tariff, published LCOE, weighted-average tariff and a value converted from local currency. Award-year labels represented the year of the recorded procurement award, rather than financial close or commissioning. Award-stage and financing-stage price revisions were not substituted for one another. The analysis did not adjust prices for inflation, indexation, time-of-day weighting, technology configuration or financing costs.

For a value in Saudi halala kWh⁻¹, the conversion was:

$$T_{US\ cents/kWh} = T_{halala/kWh} / 3.75$$

1

For a project cost in local-currency millions, the conversion was:

$$C_{USD\ million} = C_{local\ million} / e$$

2

Here, *e* is local-currency units per US dollar: 3.75 for Saudi riyals and 3.6725 for UAE dirhams [37, 38]. The first conversion yields US cents because both halala and cents are hundredths of their respective currencies. Published US-dollar costs and mechanically converted costs were retained as different observations when they disagreed. No portfolio cost was divided among projects without an explicit allocation source, and no cost-per-megawatt ranking was calculated from these heterogeneous values.

Direct public equity was defined as the sum of project-level shares explicitly assigned in the selected record to public or state-linked entities, such as utilities, sovereign-fund subsidiaries and designated public sponsors. Workbook fractions were multiplied by 100 for presentation as percentages. The measure did not trace ultimate beneficial ownership through all intermediate entities and did not treat developer nationality, procurement responsibility or offtaker identity as equity evidence. A missing share remained missing. PPA duration was recorded in years at the stage described by its source, with amendments retained as separate events where reported.

Milestone and procurement-stage definitions

Financial close, satisfaction of conditions for debt drawdown and refinancing were separate event types. Portfolio financing amounts were retained at portfolio level. The calendar-year timeline used award year and financial-close year, while the event data preserved the finer precision and original descriptions available in the source. Missing month or day components were not imputed.

Operational records distinguished planned commercial operation, initial production, full operation and inauguration. Day-level entries in the master table were counted for field completeness but were not assumed to be equivalent contractual commercial operation dates. Conflicting Shuaibah 1 records were retained; its project-page date was displayed with an explicit conflict marker.

Month-level confirmations for Sudair, Ar Rass 2 and Al Kahfah were displayed at year-level resolution only. The timeline was not used to calculate delays or financing durations.

Participation counts retained their tender stage: expression of interest, prequalification, submitted bid or final proposal. The MBR Phase III funnel remained labelled as secondary evidence. Local-content requirements and reported outcomes were separate observations. Round 3's 17% and 18% thresholds were assigned to their respective procurement stages, and Sakaka's greater-than-30% qualifier was retained. Neither a round-level minimum nor an expression-of-interest count was treated as a realised project outcome.

Conservative coding of risk-related evidence

Seven categories were examined: land and site preparation, grid connection, payment, curtailment, indexation, change in law and termination. The matrix contained one record for each project-category pair, giving $23 \times 7 = 161$ records. The revision retained the original evidence text and added revised codes and evidence-scope notes. PUB denoted an explicitly described public support role; TAKE_OR_PAY denoted an explicitly described payment mechanism; UNKNOWN denoted insufficient evidence for the proposed category-level conclusion. Other allocation labels were not assigned without supporting clauses.

Three original curtailment allocations were withdrawn because they were inferred from take-or-pay or net-energy payment language alone. Their payment descriptions were preserved, but the curtailment allocation became UNKNOWN. Public site-predevelopment descriptions were retained as observable support, with programme- or round-level scope clearly indicated. They were not interpreted as complete transfers of land acquisition, clearance or construction risk. The retained non-UNKNOWN count therefore measures explicit support or mechanism observations under this rule, not a bankability score or the number of comprehensively reviewed contracts (Table 3).

Descriptive analysis and reproducibility

Field coverage was calculated as the count of nonmissing project values divided by 23. Country-specific counts used 15 and eight as denominators. Price means, medians and ranges used available observations and were unweighted by capacity. The ownership-price scatterplot included only the 17 projects with both values; marker area represented recorded AC capacity. Capacity definitions and source discrepancies remained in the underlying records.

An exploratory sample-composition check restricted prices to projects awarded during 2018–2025, the intersection of the two countries' observed award windows. This retained 14 Saudi and four UAE prices. The calculation was descriptive and did not match individual years or estimate a counterfactual. No regression, hypothesis test, causal effect or confidence interval was calculated. Portfolio clustering, nonrandom selection, heterogeneous definitions and extensive missingness limit inferential use. Reproducible summary calculations and figure inputs are supplied in Supplementary Data 1. Figures 2–5 were generated with Python 3.12 and Matplotlib 3.11.1.

Data availability

The project-level data, source log, event records, original and revised risk coding, and descriptive summary calculations are provided in Supplementary Data 1. Public-source URLs and access dates are recorded in the source log. Blank values indicate information not established from the selected records. The compilation includes public summaries rather than the full underlying PPAs or loan agreements.

Declarations

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References

1. International Renewable Energy Agency & Renewable Energy Markets GCC 2023. IRENA: Abu Dhabi, UAE, (2023). https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2023/Dec/IRENA_Rnewable_energy_markets_GCC_2023.pdf
2. Steffen, B. The Importance of Project Finance for Renewable Energy Projects. *Energy Econ.* **69**, 280–294. <https://doi.org/10.1016/j.eneco.2017.11.006> (2018).
3. Egli, F., Steffen, B. & Schmidt, T. S. A Dynamic Analysis of Financing Conditions for Renewable Energy Technologies. *Nat. Energy.* **3**, 1084–1092. <https://doi.org/10.1038/s41560-018-0277-y> (2018).
4. Polzin, F., Egli, F., Steffen, B. & Schmidt, T. S. How Do Policies Mobilize Private Finance for Renewable Energy?—A Systematic Review with an Investor Perspective. *Appl. Energy.* **236**, 1249–1268. <https://doi.org/10.1016/j.apenergy.2018.11.098> (2019).
5. Ondraczek, J., Komendantova, N. & Patt, A. WACC the Dog: The Effect of Financing Costs on the Levelized Cost of Solar PV Power. *Renew. Energy.* **75**, 888–898. <https://doi.org/10.1016/j.renene.2014.10.053> (2015).
6. Dobrotkova, Z., Surana, K. & Audinet, P. The Price of Solar Energy: Comparing Competitive Auctions for Utility-Scale Solar PV in Developing Countries. *Energy Policy.* **118**, 133–148. <https://doi.org/10.1016/j.enpol.2018.03.036> (2018).
7. Gephart, M., Klessmann, C. & Wigand, F. Renewable Energy Auctions—When Are They (Cost-)Effective? *Energy Environ.* **28**, 145–165. <https://doi.org/10.1177/0958305X16688811> (2017).
8. Haufe, M. C. & Ehrhart, K. M. Auctions for Renewable Energy Support—Suitability, Design, and First Lessons Learned. *Energy Policy.* **121**, 217–224. <https://doi.org/10.1016/j.enpol.2018.06.027> (2018).
9. Đukan, M. & Kitzing, L. The Impact of Auctions on Financing Conditions and Cost of Capital for Wind Energy Projects. *Energy Policy.* **152**, 112197. <https://doi.org/10.1016/j.enpol.2021.112197> (2021).
10. Anatolitis, V., Azanbayev, A. & Fleck, A. K. How to Design Efficient Renewable Energy Auctions? Empirical Insights from Europe. *Energy Policy.* **166**, 112982. <https://doi.org/10.1016/j.enpol.2022.112982> (2022).
11. World Bank Group. *Utility-Scale Solar Photovoltaic Power Plants: A Project Developer's Guide* (World Bank, 2015). <https://ppp.worldbank.org/library/utility-scale-solar-photovoltaic-power-plants-project-developer-s-guide>
12. ACWA Power. Our history. <https://www.acwapower.com/en/who-we-are/our-history/>. Accessed 6 September 2026.
13. DEWA. MBR Solar Park phases of energy production. August (2026). <https://www.dewa.gov.ae/en/about-us/strategic-initiatives/mbr-solar-park/phases-of-energy-production>. Accessed 30.
14. Renewables, E. D. F. EDF Renewables—Jinko Power consortium reaches the financial closing of the world's largest solar project and launches its construction. (2020). <https://www.edf.fr/en/the-edf-group/dedicated-sections/journalists/all-press-releases/edf-renewables-jinko-power-consortium-reaches-the-financial-closing-of-the-worlds-largest-solar-project-and-launches-its-construction>
15. Abu Dhabi Media Office / EWEC. EWEC awards ENGIE and Masdar contract for Khazna Solar PV. (2025). <https://www.mediaoffice.abudhabi/en/energy/emirates-water-and-electricity-company-awards-engie-and-masdar-contract-to-develop-khazna-solar-photovoltaic-independent-power-project/> Accessed 30 August 2026.
16. Masdar / E. N. G. I. E. Financial close for Khazna Solar PV. (2026). <https://masdar.ae/en/news/newsroom/masdar-and-engie-achieve-financial-close> Accessed 30 August 2026.
17. ACWA Power. Financial close for Sudair Solar Plant. (2021). <https://acwapower.com/en/media-center/latest-news/acwa-power-announces-financial-close-for-1500-mw-sudair-solar-plant-and-aramco-joining-the-consortium-under-pif-renewables-program/> Accessed 30 August 2026.

18. ACWA Power. Financial close for Shuaibah 1 and 2. August (2026). <https://acwapower.com/en/media-center/latest-news/consortium-of-acwa-power-pif-subsi-dary-badeel-and-aramco-subsi-dary-sapco-reach-financial-close-for-al-shuaibah-1-and-al-shuaibah-2-solar-pv-projects/>. Accessed 30.
19. Saudi Exchange. PPAs for Ar Rass 2, Saad 2 and Alkahfah. (2023). <https://www.saudiexchange.sa/wps/portal/saudiexchange/newsandreports/issuer-news/issuer-announcements/issuer-announcements-details/?anCat=91&anId=73802&cs=2082&locale=en> Accessed 30 August 2026.
20. Saudi Exchange / Saudi Electricity Company. Samtah solar PV PPA announcement. (2025). <https://www.saudiexchange.sa/wps/portal/saudiexchange/newsandreports/issuer-news/issuer-announcements/issuer-announcements-details/?anCat=91&anId=90991&cs=5110&locale=en> Accessed 30 August 2026.
21. ACWA Power. Shuaibah PV IPP project page. August (2026). <https://www.acwapower.com/en/what-we-do/projects/shuaibah-pv-ipp/>. Accessed 30.
22. ACWA Power. Integrated Annual Report 2024 / financial review. (2025). <https://iar2024.acwapower.com/en/performance-review/financial-review> Accessed 30 August 2026.
23. Saudi Exchange. Senior loan drawdown for Ar Rass 2, Saad 2 and Al Kahfah. (2024). <https://www.saudiexchange.sa/wps/portal/saudiexchange/newsandreports/issuer-news/issuer-announcements/issuer-announcements-details/?anCat=64&anId=78247&cs=2082&locale=en> Accessed 30 August 2026.
24. ACWA Power. Annual report 2024 CFO message / Sudair operation. (2025). <https://iar2024.acwapower.com/en/performance-review/cfo-message> Accessed 30 August 2026.
25. Solar Park Phase, D. E. W. A. M. B. R. V inauguration. (2023). <https://www.dewa.gov.ae/en/about-us/media-publications/latest-news/2023/06/mohammed-bin-rashid-inaugurates-5th-phase-of-the-mohammed-bin-rashid-al-maktoum-solar-park> Accessed 30 August 2026.
26. ACWA Power. Investor report containing 2025 commissioning and dispatch-constraint records. (2026). https://www.saudiexchange.sa/Resources/fsPdf/23875_2362_2026-05-10_03-00-27_en.pdf Source record S26 in Supplementary Data 1.
27. Abu Dhabi Media Office. Hazza bin Zayed inaugurates Al Dhafra Solar PV project. (2023). <https://www.mediaoffice.abudhabi/en/energy/hazza-bin-zayed-inaugurates-al-dhafra-solar-pv-project/> Accessed 30 August 2026.
28. EWEC / Sweihan PV Power Company. Noor Abu Dhabi Green Bond Framework. (2024). <https://www.ewec.ae/public/uploads/mediakit/0.77861900%201718970514/Noor%20Abu%20Dhabi%20Green%20Bond%20Framework.pdf> Accessed 30 August 2026.
29. Power, A. C. W. A. August. ACWA Power wins Sakaka PV IPP. (2026). <https://acwapower.com/en/media-center/latest-news/acwa-power-wins-the-first-ever-utility-scale-renewable-energy-project-in-saudi-arabia/>. Accessed 30.
30. Saudi Power Procurement Company / Ministry of Energy. Round 3 shortlisted bidders. (2021). https://powersaudi-arabia.com.sa/web/attach/news/R3_SHORTLISTING_ENGLISH.pdf Accessed 30 August 2026.
31. Abu Dhabi Media Office / EWEC. EWEC receives 4 bids for Al Ajban 1,500 MW Solar PV IPP. (2023). <https://www.mediaoffice.abudhabi/en/energy/emirates-water-and-electricity-company-receives-4-bids-for-1500mw-al-ajban-solar-photovoltaic-independent-power-project/> Accessed 30 August 2026.
32. Griffiths, S. Renewable energy policy trends and recommendations for GCC countries. *Energy Transit.* **1**, 3. <https://doi.org/10.1007/s41825-017-0003-6> (2017).
33. DEWA. DEWA selects preferred bidder for MBR Phase VI. (2023). <https://dewa.gov.ae/en/about-us/media-publications/latest-news/2023/08/dewa-selects-preferred-bidder> Accessed 30 August 2026.
34. Saudi Press Agency. NREP Round 3 RFQ and local-content requirement. (2020). <https://www.spa.gov.sa/2020780> Accessed 30 August 2026.
35. Saudi Ministry of Energy / NREP. Round 3 RFP press release. (2020). https://powersaudi-arabia.com.sa/web/attach/news/Round%203%20RFP_Press%20release_EN.pdf Accessed 30 August 2026.

36. ACWA Power. Sakaka PV IPP connected to the national grid. (2019). <https://acwapower.com/en/media-center/latest-news/acwa-power-connects-the-first-renewable-energy-project-in-the-kingdom-sakaka-pv-ipp-to-the-national-electricity-grid-commencing-initial-production/> Accessed 30 August 2026.
37. Saudi Central Bank. SAMA Affirms Commitment to Exchange Rate Policy. August (2026). <https://www.sama.gov.sa/en-US/MediaCenter/News/Pages/news-557.aspx> (accessed on 30.
38. UAE Government. UAE fact sheet: currency. (2026). <https://u.ae/en/about-the-uae/fact-sheet> Accessed 30 August 2026.

Figures

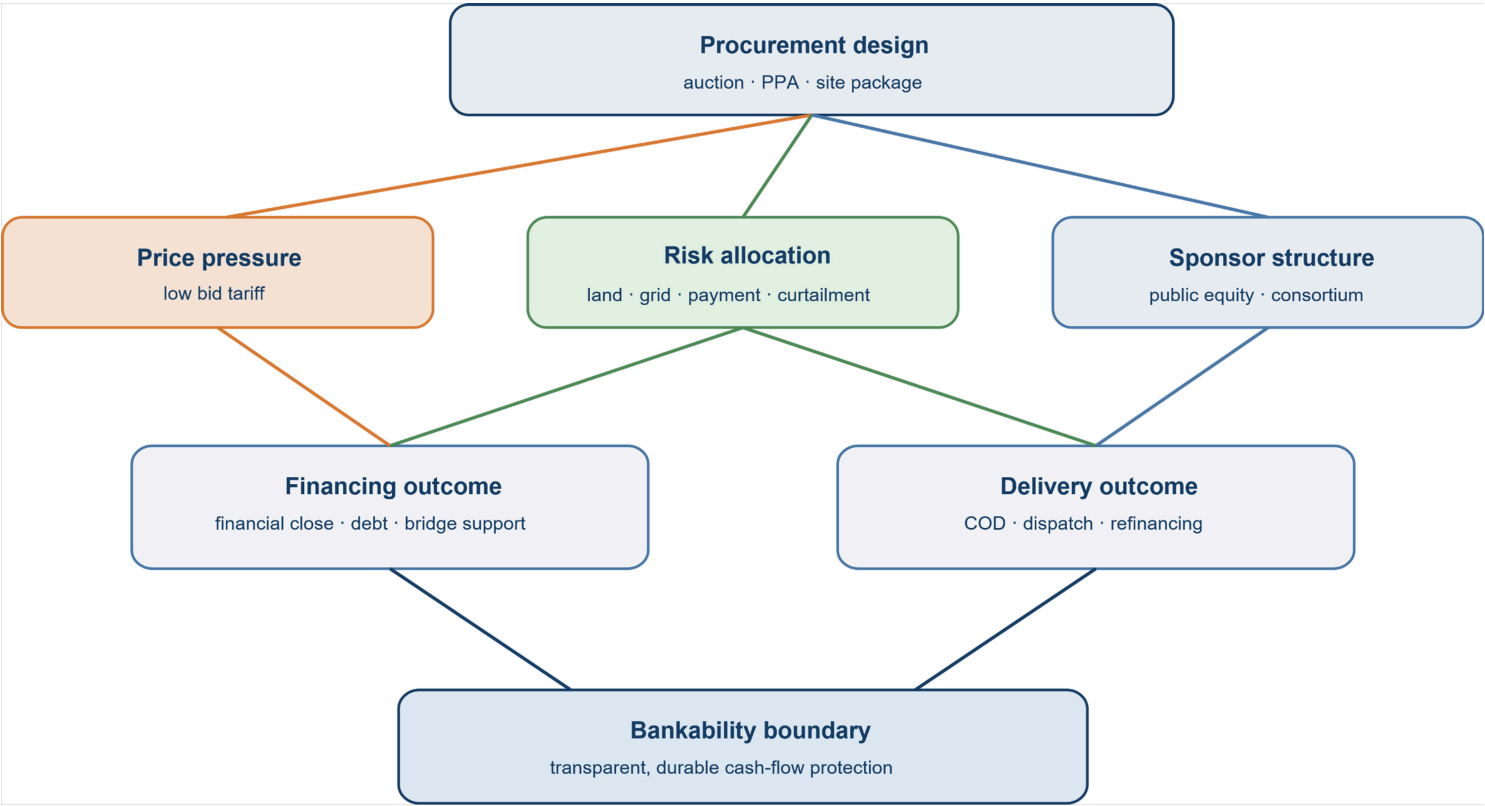


Figure 1

Analytical framework linking solar procurement to financing and delivery. The original conceptual framework connects procurement design, reported price, risk allocation and sponsor structure with financing and delivery outcomes. Connecting lines represent analytical relationships to examine; they are not estimated causal paths. PPA, power purchase agreement; COD, commercial operation date. Dispatch and refinancing are framework dimensions with incomplete empirical coverage, rather than outcomes observed for every project.

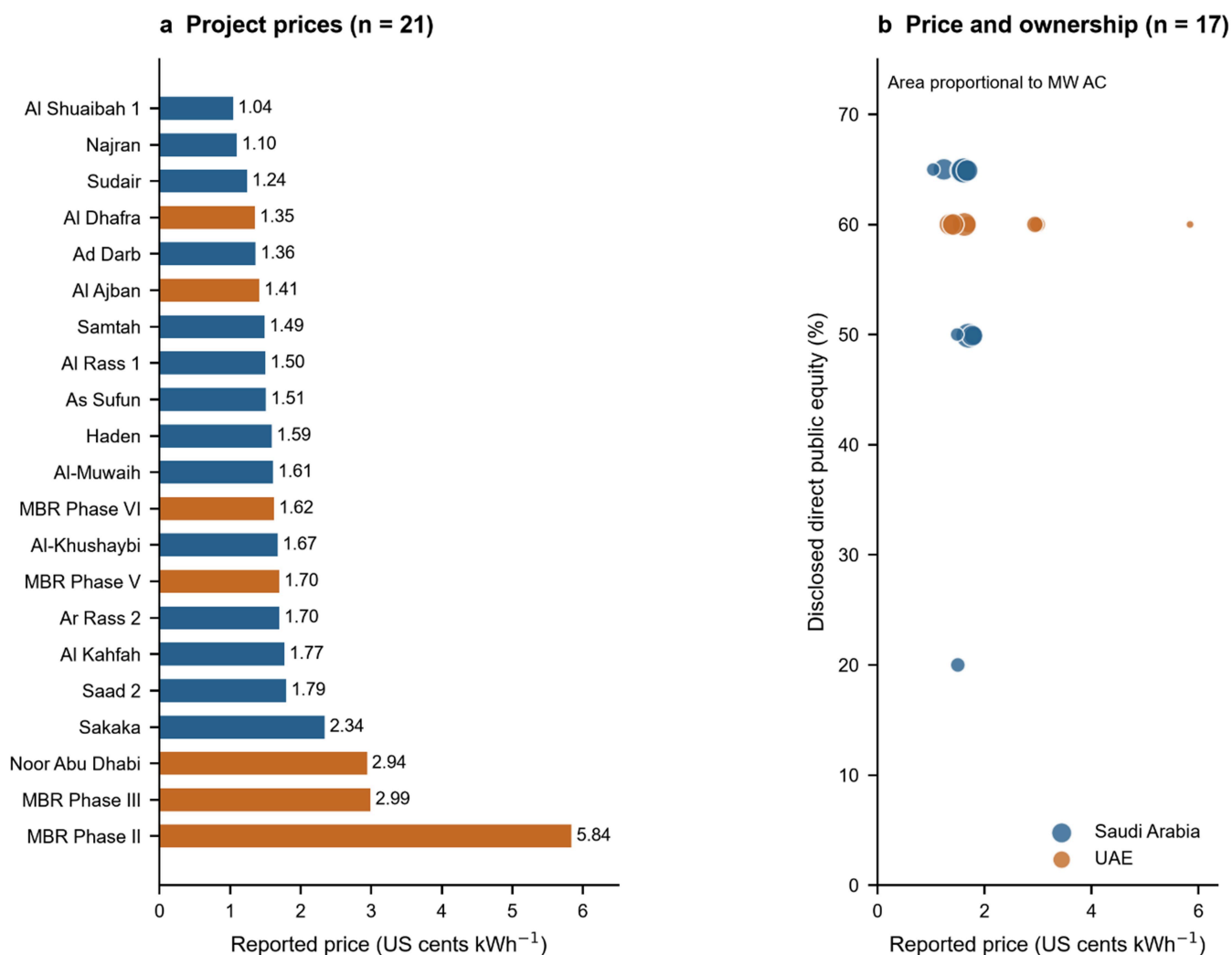


Figure 2

Reported project prices and disclosed direct public participation.(a) All 21 nonmissing price observations, ordered by price; labels are rounded to two decimal places. Blue indicates Saudi Arabia and orange the UAE. (b) The 17 projects with both price and ownership information. Marker area is proportional to the recorded AC capacity; the axis includes the full observed price range. Missing shares are excluded, not set to zero. The source-specific price bases include tariffs, published LCOEs and a weighted-average tariff. Shuaibah 2 lacks a price and Khazna lacks both fields in the selected records. Points may overlap. No fitted relationship or inferential uncertainty is shown.

Award, financing and operational milestones

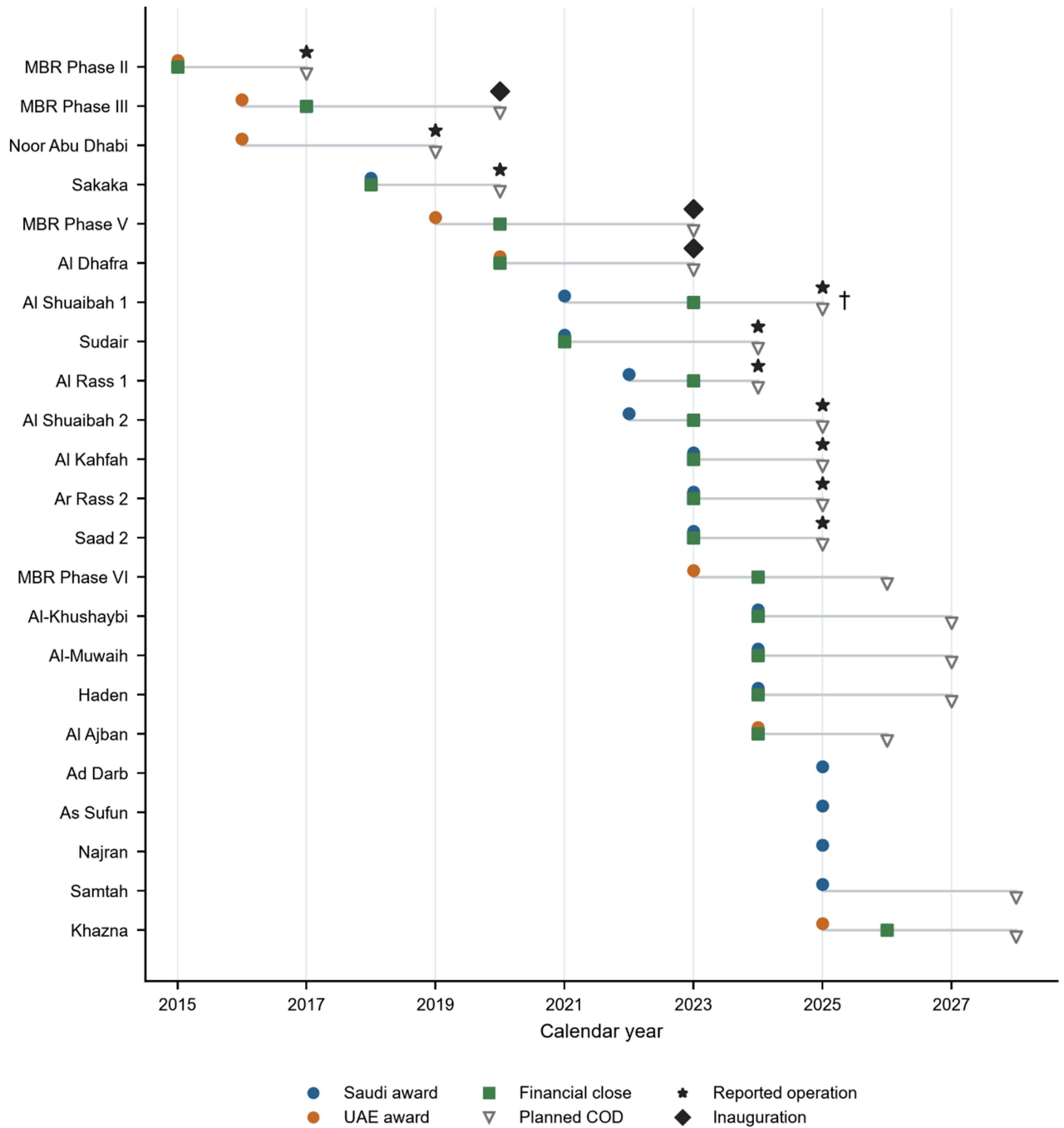


Figure 3

Recorded procurement, financing and operational milestones for all 23 projects. Circles denote award years, squares financial-close years, open downward triangles planned commercial-operation years, stars reported operational events and diamonds inauguration dates. Marker offsets distinguish events within a project row and do not encode subannual time. Month- and day-level events are displayed by year, with raw precision retained in Supplementary Data 1. Absent symbols indicate missing records. Grey lines span recorded milestone years and are not delay estimates. The dagger marks Shuaibah 1, for which a November 2024 investor-table entry conflicts with the project-page date of 28 February 2025; the latter is displayed. Sakaka financial close is corrected to 2018. Shared financing dates need not represent independent transactions. Plans are source-specific expectations and may coexist with actual events.

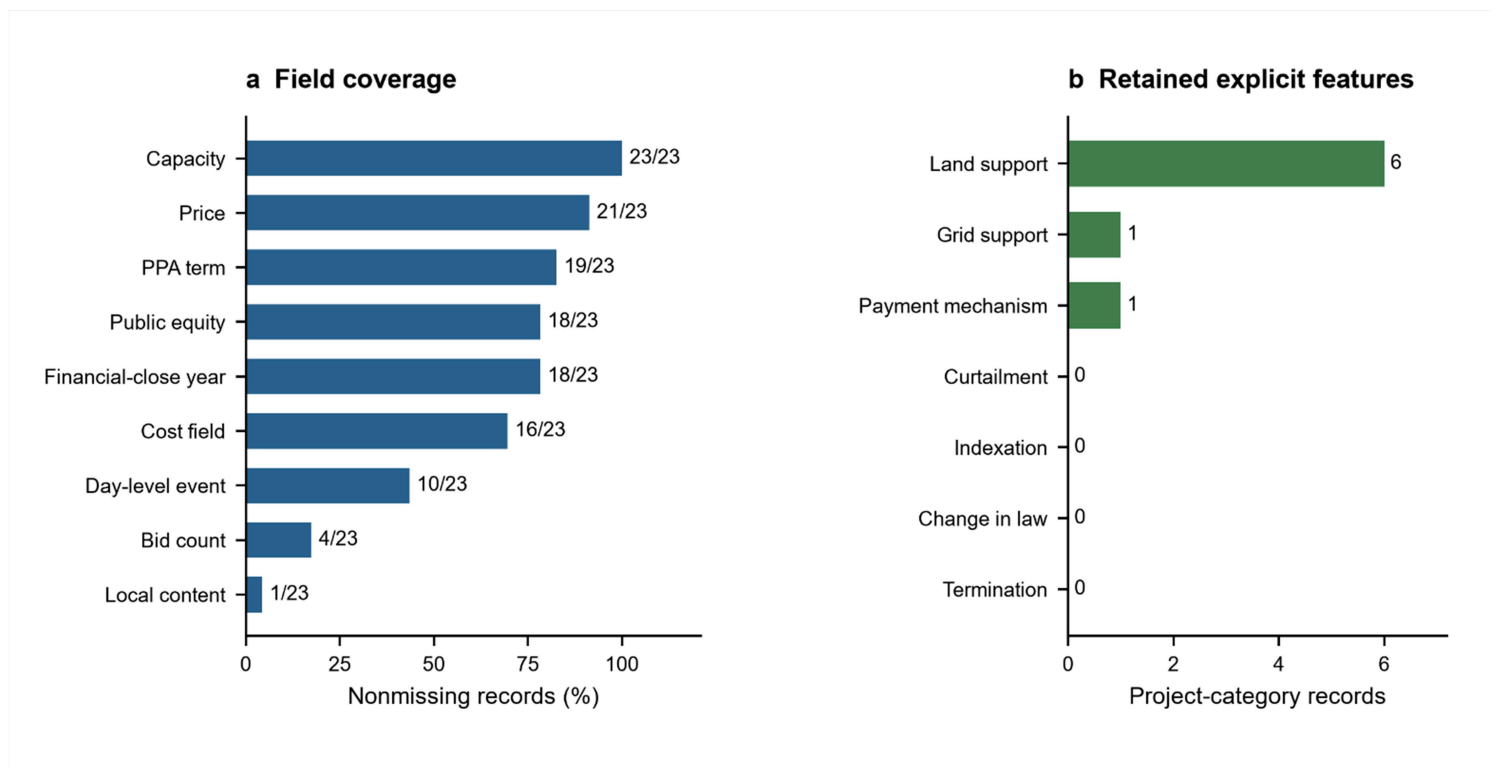


Figure 4

Coverage of project fields and conservatively retained risk-related observations. (a) Nonmissing counts divided by 23. Day-level events include inauguration dates and do not form a harmonised COD series; cost-field coverage does not establish comparable project costs. (b) Counts of retained explicit support or mechanism records across the seven risk categories. Six land entries, one grid entry and one take-or-pay payment entry are retained. Five land entries are programme- or round-level observations. Three curtailment allocations based only on payment wording are recoded UNKNOWN. Zero bars mean no sufficiently supported retained category code, not zero contractual protection. Counts are descriptive; no inferential error bars apply.

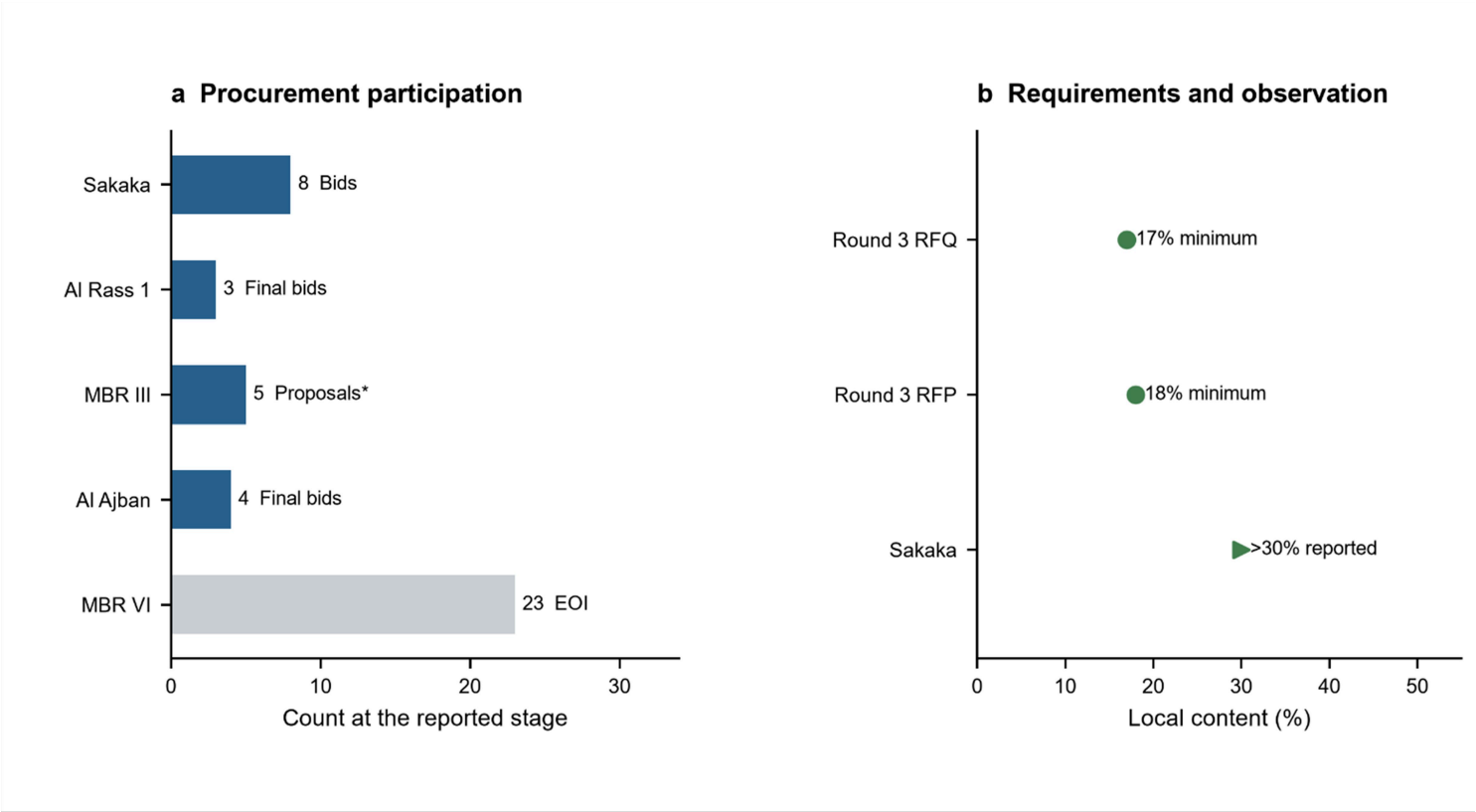


Figure 5

Stage-specific evidence on competition and local content. (a) Participation counts retain the stage reported by each source. EOI denotes expressions of interest and is shaded separately from submitted bids or proposals. The asterisk identifies the MBR Phase III count from a published secondary reconstruction. These values are not pooled into an index. (b) Saudi Round 3 minimum requirements at the request-for-qualification (RFQ) and request-for-proposal (RFP) stages, alongside Sakaka’s reported construction-stage contractual local content. The right-facing marker denotes a value greater than 30%, not an exact 30% estimate. Round-level requirements and project-level observations have different scopes. No cross-project average or statistical comparison is calculated.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryData1.xlsx](#)