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Financial Feasibility of Energy-Efficient Local Content Development in Saudi Arabia's Power Generation Industry: Opportunities for Sustainable Economic Growth under Vision 2030

MUHAMMAD ANAS
ORCiD: 0009-0001-3794-6620

Abstract- ***Saudi Arabia's power-sector transition entails major challenges related to infrastructure, industrial development, and financing. Energy-efficient generation can improve lifecycle economics, while local content supports value retention, capability development, and economic development. However, these objectives may conflict. Mandatory or premature localisation can increase capital costs, reduce bankability, or introduce inefficiencies. In contrast, an exclusive focus on cost minimisation may constrain domestic learning and resilience. This review assesses the financial viability of integrating energy efficiency with local-content development in Saudi Arabia's power generation sector under Vision 2030. A structured integrative review synthesises peer-reviewed evidence on generation economics, localisation, value chains, investment risk, project finance, and green finance. The evidence shows that effective localisation depends less on maximising local-content percentages and more on targeting value-chain segments where Saudi capabilities, demand, and quality systems are competitive. Energy efficiency improves feasibility by lowering operating costs and fuel exposure, increasing output, and strengthening debt-service capacity, but these benefits must be weighed against financing conditions and localisation premiums. Evidence indicates that local-content policies can increase short-term costs if requirements exceed domestic capability. However, enduring benefits arise when policies prioritise technologically adjacent industries, supplier learning, and exportable capabilities. This paper proposes a risk-adjusted, stage-gated framework linking technical efficiency, local value creation, and bankability. It concludes that Vision 2030 objectives are best achieved through adaptive localisation thresholds, performance-based procurement, credible revenue structures, supplier-development finance, and transparent lifecycle metrics, rather than uniform domestic-content mandates.***

Keywords: ***energy efficiency; local content; project finance; power generation; Saudi Arabia; Vision 2030; financial feasibility; industrial policy***

I. INTRODUCTION

Saudi Arabia's power generation industry faces three key policy priorities: reliable electricity supply, effective energy use, and increased domestic participation in strategic value chains. While these priorities are interconnected, they are not always compatible. Utility-scale power assets require considerable upfront investment and long operating lives, so even small changes in efficiency, construction risk, cost of capital, or reliability may significantly affect project economics. Local-content policy adds complexity. Domestic manufacturing, engineering, construction, and maintenance can retain spending and build capabilities, but may also increase costs if local suppliers lack scale, certification, technology, or experience. The main financial question is not whether localisation is desirable, but when an energy-efficient local-content strategy delivers enough lifecycle value to justify its additional cost and risk.

Saudi-focused scholarship has developed several pieces of this problem but has not fully integrated them. Studies of photovoltaic localisation identify opportunities across the value chain and emphasise the importance of industrial capability and technology transfer (AlOtaibi et al., 2020; Almarshoud and Adam, 2021). More recent assessment suggests that Saudi solar ambitions may confront capacity constraints in particular domestic inputs, strengthening the need to distinguish feasible localisation from nominal content targets (Alghamdi et al., 2025). Techno-economic studies, meanwhile, show that resource quality, technology configuration, capacity factor, storage, hybridisation, and plant design can materially change electricity costs and investment performance under Saudi conditions (AlKassem, 2021; Imteyaz et al.,

2021; Marouani et al., 2023; Ghaithan et al., 2024). These studies clarify technology economics, but generally do not trace how localisation choices influence financing terms, supplier risk or lifecycle efficiency.

The international local-content literature provides a second missing perspective. Evidence from renewable-energy auctions shows that local-content requirements can stimulate domestic activity, yet their effect depends strongly on pre-existing industrial capabilities and the complexity of targeted components (Hansen et al., 2020; Scheifele et al., 2022). Empirical work also documents short-term generation-cost penalties when local-content rules force procurement from higher-cost domestic sources (Probst et al., 2020). Conversely, input-output and value-chain studies show that greater local participation can expand domestic value added when the supply chain can deliver competitively (Allan et al., 2020; van der Loos et al., 2022). Thus, financial feasibility must include both project-level cash flows and economy-level capability formation, while eschewing the error of treating all local expenditure as economically equivalent.

A third body of literature concerns bankability. Renewable and low-carbon projects are capital intensive, making financing costs a major component of lifecycle electricity cost. Country risk, technology risk, earnings stability, counterparty quality and debt structuring can change the cost of capital and therefore the viability of otherwise efficient technologies (Steffen, 2020; Egli, 2020; Breitschopf and Alexander-Haw, 2022; Gohdes et al., 2022). In Saudi Arabia, finance and innovation have also been linked to low-carbon development, while green-finance regulation is evolving within the wider transformation agenda (Samargandi and Sohag, 2022; Alhejaili, 2024). Consolidating these strands is essential because a local-content decision that raises perceived completion or operating risk may increase financing costs enough to offset expected domestic-value benefits.

This review considers energy-efficient local content as an integrated investment design challenge in power generation. It defines local content as capabilities in manufacturing, engineering, construction, digital systems, operations, and maintenance, and links lifecycle efficiency, local value creation, and risk-adjusted finance toward strategic economic outcomes under Vision 2030.

II. AIM OF THE STUDY

This study assesses when and how energy-efficient, local-content development is financially feasible in Saudi Arabia's power generation industry. It translates the literature into a decision framework that reconciles project bankability with domestic value creation, industrial learning, and long-term growth under Vision 2030. The focus is on risk-adjusted lifecycle economics rather than maximising local-content percentages alone.

III. RESEARCH OBJECTIVES

1. To synthesise recent evidence on the techno-economic performance and investment economics of power-generation technologies relevant to Saudi Arabia.
2. To evaluate how local-content requirements, domestic capability and global value-chain structure affect capital cost, operating cost, competitiveness and industrial learning.
3. To examine how energy efficiency interacts with project-finance variables, including revenue quality, financing cost, debt-service capacity and technology risk.
4. To identify conditions under which localisation can generate sustainable domestic value without undermining project bankability or electricity affordability.
5. To develop practical assessment criteria for investors, developers and decision-makers creating energy-efficient local-content strategies under Vision 2030.

IV. RESEARCH QUESTIONS

RQ1. Which technical, financial and industrial variables most strongly determine the feasibility of energy-efficient local content in Saudi power-generation projects?
RQ2. How can lifecycle energy-efficiency gains offset, or fail to offset, the capital and risk premiums associated with localisation?

RQ3. What does international evidence imply about the design of local-content requirements that create durable capabilities rather than short-lived procurement effects?
RQ4. How should project-finance structures and risk allocation be adapted when local suppliers, new technologies and domestic manufacturing are introduced?
RQ5. Which policy and managerial mechanisms can align bankability, local value creation and sustainable economic growth under Vision 2030?

V. REVIEW METHODOLOGY

A structured integrative review was chosen because the research spans engineering economics, industrial policy, global value chains, and project finance. A single-disciplinary search could miss relevant evidence, while a purely narrative review would lack transparency. Therefore, the protocol combined structured searching, explicit eligibility criteria, quality appraisal, and thematic synthesis.

Literature discovery concentrated on peer-reviewed journal articles published from 2020 to 2025, with emphasis on studies directly relevant to Saudi Arabia and complementary international evidence where local research was lacking. Searches covered ScienceDirect, SpringerLink, Wiley Online Library, MDPI, Google Scholar, and Crossref. Scopus and Web of Science coverage was used as a quality indicator when available. No database-specific retrieval totals are reported, as the review did not retain auditable exports from all proprietary indexes, intentionally avoiding artificial screening counts. DOI metadata and bibliographic details for the final references were verified against publisher sites, Crossref, or institutional repositories. Localisation: “local content”, “localisation”, “localization”, “domestic manufacturing”, “value chain”, “industrial development” and “supplier development”. The third represented efficiency and economics: “energy efficiency”, “techno-economic”, “LCOE”, “lifecycle cost”, “capacity factor”, “combined cycle”, “solar”, “wind” and “hybrid power”. The fourth represented finance: “project finance”, “cost of capital”, “WACC”, “bankability”, “investment risk”, “debt service”, “PPA”, “green finance” and “renewable energy auctions”. We adapted Boolean combinations to each platform. We used backwards and forward citation chaining to identify influential peer-reviewed studies that linked these themes.

Inclusion criteria required peer-reviewed journal articles published mainly between 2020 and 2025, with clear relevance to at least one concept group and sufficient methodological detail for critical synthesis. Saudi-specific studies were prioritised for conclusions on technology, regulation, localisation, or investment context. International studies were included only if they addressed mechanisms relevant to Saudi decisions, such as local-content premiums, supplier selection, cost of capital, auction design, or project-finance risk. Exclusion criteria removed conference abstracts, theses, editorials, non-peer-reviewed reports, descriptive news, studies lacking financial or industrial-development relevance, and papers without verifiable bibliographic identity or DOI. Older sources were not required because sufficient recent evidence was available.

Screening was conducted in stages rather than using a numerical funnel. Titles were checked for relevance, abstracts were reviewed for empirical, modelling, or review contributions, and full texts or detailed abstracts were examined for findings and methodology. Thirty references were retained, covering Saudi localisation, techno-economics, international local-content evidence, and project-finance risk.

Quality assessment considered five factors: peer review and journal standing, clarity of research design, appropriateness of data or modelling, transparency of assumptions, and transferability to the Saudi power-generation context. Econometric studies were evaluated for identification strategy and sample relevance. International local-content evidence was treated as mechanism evidence, not direct prediction. Review papers mapped recurring findings yet did not replace primary empirical evidence where available. The synthesis used thematic coding in five categories: strategic localisation capability, lifecycle energy efficiency, local-content cost and value, bankability and financing risk, and economy-wide growth effects. Findings were compared for agreement, contradiction, and boundary conditions. The framework is interpretive rather than meta-analytic, as heterogeneity

in technologies, financial assumptions, and outcomes makes statistical pooling inappropriate. Limitations comprise non-exhaustive database coverage, lack of quantified publication bias, and inability to aggregate case studies into a single Saudi localisation premium. These are addressed by transparent source verification, conservative inference, and separation of project-level and economy-level evidence.

VI. THEMATIC LITERATURE REVIEW AND CRITICAL ANALYSIS

6.1 Strategic localisation capability and value-chain fit

The Saudi localisation literature consistently supports domestic participation but does not justify uniform localisation across every component. AlOtaibi et al. (2020) map a broad photovoltaic value chain and argue that several activities can be built on domestic resources and existing industrial capacity. Almarshoud and Adam (2021) similarly emphasise upstream and downstream opportunities, technology transfer and socioeconomic gains. However, Alghamdi et al. (2025) add an important constraint: ambitious deployment is able to strain in-country capacity for certain material inputs and production stages. Taken together, these studies imply that financial feasibility depends on sequencing. Localisation is strongest where demand is sufficiently predictable, quality standards can be met, industrial inputs already exist, and learning can reduce unit costs before procurement obligations become binding.

International evidence reinforces this capability-based interpretation. Hansen et al. (2020) find wide variation in the effectiveness of local-content requirements across developing-country renewable auctions. Bazilian et al. (2020) show that rules alone do not guarantee sophisticated manufacturing and may increase project costs. Scheifele et al. (2022) further demonstrate that export competitiveness is more likely when targeted renewable components are technologically adjacent to capabilities already present in the economy. Van der Loos et al. (2022) show that supplier selection also depends on value-chain governance and the role of lead firms, indicating that local participation is not simply a procurement percentage but a relationship between capability, contracting structure and technological complexity.

For Saudi Arabia, this suggests a portfolio approach. Civil works, structural steel, electrical balance-of-plant, selected fabrication, digital monitoring, maintenance and engineering have different learning curves and capital requirements than cells, advanced power electronics or specialised turbine components. The financially relevant test is the marginal cost of localising each segment relative to domestic value retained and capability created. Figure 1 links localisation depth and energy efficiency to financing conditions, project metrics and national outcomes, rejecting a single local-content ratio as an adequate decision variable.

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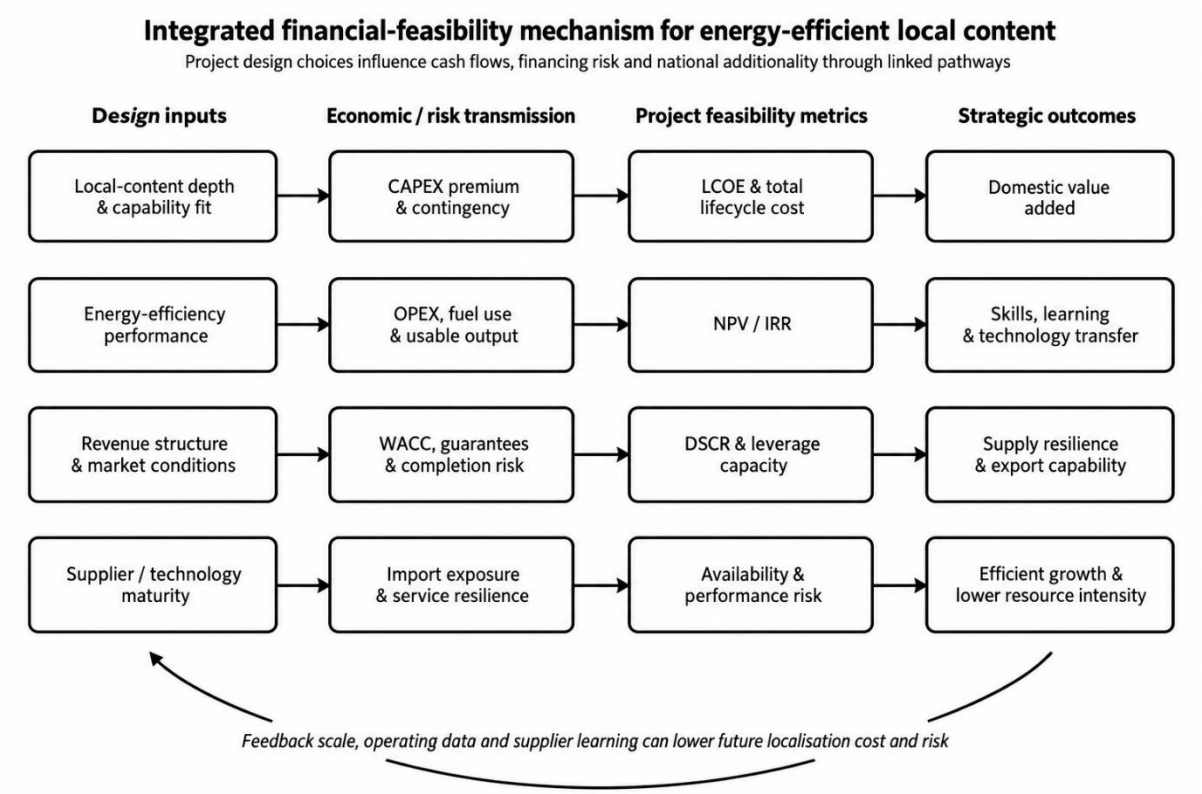

Figure 1. Integrated financial-feasibility mechanism for energy-efficient local content in Saudi power generation. Source: authors' synthesis of the reviewed evidence.

6.2 Energy efficiency as a lifecycle financial lever

Energy efficiency influences financial feasibility through both the numerator and denominator of project value. Higher conversion efficiency, lower parasitic consumption, improved availability or more accurate operating control can reduce fuel and operating costs or increase saleable electricity from a given asset base. Saudi techno-economic research demonstrates the importance of configuration and site conditions. AlKassem (2021) finds that solar-tower hybridisation can improve the performance case for integrated solar combined-cycle generation under Saudi conditions. Imteyaz et al. (2021) show that photovoltaic plant configuration and policy assumptions materially affect cost outcomes. Marouani et al. (2023) illustrate the sensitivity of wind generation cost to turbine and site parameters, while Ghaithan et al. (2024) demonstrate that concentrated-solar technologies differ materially in energy yield and levelised cost across Saudi locations.

These conclusions matter because a local component should not be evaluated only by purchase price. If a cheaper domestic substitute reduces efficiency, availability or durability, its lifecycle penalty can exceed the initial saving. Conversely, local maintenance, analytics or balance-of-plant improvements may create recurring savings with relatively low localisation risk. Al-Shetwi et al. (2023) show that hybrid-system choice changes net present cost, energy cost and environmental performance, supporting system-level rather than component-level appraisal. Lucio et al. (2023) show that storage and operating strategy alter advanced-solar economics. Alharbi and Alaboodi (2023) demonstrate that Saudi regulatory and tariff conditions also shape photovoltaic techno-economics.

Efficiency also has an information dimension. Asghar et al. (2023) demonstrate how predictive analytics can support power-plant performance assessment, suggesting a localisation opportunity in digital operations, condition monitoring and optimisation. Such capabilities can be embedded domestically without immediately replicating capital-intensive global manufacturing. The critical point is that energy-

efficient local content should be defined functionally: domestic value that preserves or improves lifecycle technical performance. This prevents procurement policy from rewarding nominal domestic expenditure that degrades operating economics.

6.3 Local-content premiums, domestic value and competitiveness

The strongest caution in the literature concerns the assumption that more local content always improves welfare. Probst et al. (2020) present empirical evidence that local-content requirements in Indian solar auctions increased short-run generation costs relative to comparable projects without the requirement. Bazilian et al. (2020) similarly warn that domestic-content rules can encourage oversupply or expensive manufacturing when markets are too small, or capabilities are weak. These outcomes are directly relevant to Saudi project finance: higher engineering, procurement and construction costs increase funding needs, and uncertain supplier performance can add contingencies, guarantees and lender scrutiny.

However, project cost is not the complete social objective. Allan et al. (2020) show, through input-output modelling of offshore wind, that local content can increase domestic value added. Swilling et al. (2022) argue more broadly that energy transitions in the global South should be analysed jointly with economic development, including the role of multinational firms, auctions and local industrial linkages. The apparent contradiction is resolved by distinguishing financial feasibility from economic additionality. A local-content measure can be privately more expensive but socially valuable if it creates durable productivity, skilled employment, knowledge or future exports. Yet that justification weakens when the same premium merely protects structurally uncompetitive production.

Saudi evidence points to this distinction. Alghamdi et al. (2025) identify gaps between deployment ambition and some domestic production capacities; Almarshoud and Adam (2021) stress capability building and value-chain development rather than simple import substitution. Kerrouche and Zehri (2024) associate renewable investment with wider economic outcomes in Saudi firm-level data, while Selim and Alshareef (2025) emphasise the strategic role of renewable investment under Vision 2030. These studies support an economic-growth case for investment, but they do not prove that every local-content increment has a positive net present value. A rigorous assessment therefore needs two ledgers: the project ledger, measuring cash costs and risks, and the national ledger, measuring retained value, capability formation and spillovers.

Table 1 summarises this evidence by separating recurring conclusions from unsettled issues. The literature is most consistent on three points—first, capability proximity matters. Second, local-content policy can impose near-term premiums. Third, long-run benefits depend on learning and competitive upgrading rather than procurement volume alone. The unresolved question for Saudi Arabia is the threshold at which a temporary premium becomes an investment in capability rather than a permanent cost burden.

Table 1. Critical synthesis of evidence relevant to energy-efficient local-content feasibility.

Evidence theme	Representative peer-reviewed evidence	Critical synthesis	Saudi decision implication / unresolved issue
Localisation capability	AlOtaibi et al. (2020); Almarshoud & Adam (2021); Alghamdi et al. (2025)	Domestic participation is feasible in selected PV and power-value-chain activities, but material and manufacturing capacity is uneven.	Sequence localisation by capability, scale and quality readiness; quantify component-specific premiums rather than relying on one headline percentage.

Evidence theme	Representative peer-reviewed evidence	Critical synthesis	Saudi decision implication / unresolved issue
Local-content requirements	Hansen et al. (2020); Bazilian et al. (2020); Probst et al. (2020); Scheifele et al. (2022)	Requirements can stimulate local activity but can also raise near-term project costs and may not create export competitiveness without related industrial capabilities.	Use adaptive thresholds, bid credits and learning targets; test whether temporary premiums create productive capability.
Value-chain governance and domestic value	van der Loos et al. (2022); Allan et al. (2020); Swilling et al. (2022)	Lead-firm sourcing, governance mode and local industrial linkages determine how much deployment expenditure becomes durable domestic value added.	Pair procurement rules with supplier development, partnerships and measurement of additional value rather than gross local spend.
Lifecycle efficiency and system design	AlKassem (2021); Imteyaz et al. (2021); Marouani et al. (2023); Al-Shetwi et al. (2023); Ghaithan et al. (2024)	Technology configuration, site, capacity factor and lifecycle performance materially change electricity cost and investment outcomes.	Qualify local content against total cost of ownership, availability, degradation, energy yield and maintenance performance.
Project finance and risk	Steffen (2020); Egli (2020); Breitschopf & Alexander-Haw (2022); Gohdes et al. (2022); Benavides-Franco et al. (2023); Firouzi & Meshkani (2021)	WACC, revenue quality, technology risk, governance and debt structuring can dominate small equipment-price differences.	Measure localisation's effect on completion risk, guarantees, leverage, DSCR and financing margins, not only EPC price.
Saudi investment and green finance	Samargandi & Sohag (2022); Almulhim & Al Yousif (2023); Alhejaili (2024); Kerrouche & Zehri (2024); Selim & Alshareef (2025)	Finance, innovation, investment criteria and regulatory development are integral to Saudi low-carbon growth and diversification.	Develop bankable, transparent support mechanisms that connect verified efficiency and capability creation to finance.

6.4 Bankability, cost of capital and risk allocation

Power-generation feasibility is especially sensitive to financing because large capital outlays precede revenues. Steffen (2020) shows that renewable cost of capital varies systematically across countries and technologies, making generic discount-rate assumptions unreliable. Egli (2020) finds that investment risks evolve as technologies mature and policy credibility improves; technology and policy risk can decline while price and curtailment risks become more prominent. Breitschopf and Alexander-Haw (2022) similarly show that financing costs reflect country, technology and remuneration risks, not auction design alone. These studies imply that localisation policy should be assessed through its effect on perceived risk as well as direct procurement cost.

Local suppliers can strengthen resilience through shorter supply chains, service availability and reduced import exposure, but early-stage suppliers may also introduce completion, warranty, quality and performance risk. Lenders respond to such risks through pricing, covenants, reserve requirements, guarantees and leverage. Gohdes et al. (2022) demonstrate the importance of revenue quality and counterparty credit for capital structure and WACC. Benavides-Franco et al. (2023) find that broader governance and financial-development conditions influence project-finance success. Firouzi and Meshkani (2021) show that debt-service schedules can be optimised against cash-flow uncertainty and default risk, while Đukan and Kitzing (2023) demonstrate that de-risking financing conditions can reduce the support needed for renewable investment.

For Saudi local-content projects, these conclusions support risk separation rather than risk concealment. A project should distinguish technology risk, localisation execution risk, supplier credit risk, revenue risk and

policy risk. Where a local component is technically mature but the supplier is financially young, performance bonds, parent guarantees, warranty insurance, phased qualification or development-finance support may be more efficient than requiring sponsors to absorb the entire risk premium. Where the technology itself is immature, localisation should proceed through demonstration and learning stages before it becomes a hard procurement condition.

Saudi financial research adds a domestic dimension. Samargandi and Sohag (2022) find that finance and innovation interact in the transition toward a low-carbon economy, suggesting that financial depth is not simply a funding channel but can support technological change. Alhejaili (2024) identifies the emerging role of green-finance regulation and sustainable development goals in Saudi financial policy. Almulhim and Al Yousif (2023) show that Saudi renewable-investment decisions depend on economic, environmental, social and risk criteria, supporting a multi-criterion rather than single-metric feasibility test. Together, these studies justify incorporating local-content as well as efficiency variables directly into investment appraisal rather than treating them as post-financing policy add-ons.

6.5 Integrated feasibility and sustainable economic growth

The synthesis indicates that sustainable growth emerges when project-level efficiency and economy-level localisation reinforce one another through learning. Energy-efficient assets reduce lifecycle resource use and can strengthen cash flow; competitively chosen local suppliers retain expenditure and develop capabilities; credible contracts and risk allocation reduce financing premiums; repeated deployment then creates scale, data and supplier experience. This feedback can lower future localisation costs and expand the feasible set of domestic activities. The reverse loop is also possible: aggressive local-content mandates increase capital cost and delay projects, weak performance raises lender risk, deployment slows, and suppliers never reach scale.

Figure 2 translates this logic into a stage-gated decision process. The first gate tests capability fit; the second tests lifecycle efficiency; the third tests risk-adjusted bankability; the fourth tests domestic additionality; and the fifth selects the appropriate localisation route. The route may be immediate domestic sourcing, a joint venture, phased supplier development, or continued imports combined with a capability-building programme. This is consistent with international evidence that lead-firm relationships and technological proximity shape successful industrial development (van der Loos et al., 2022; Scheifele et al., 2022).

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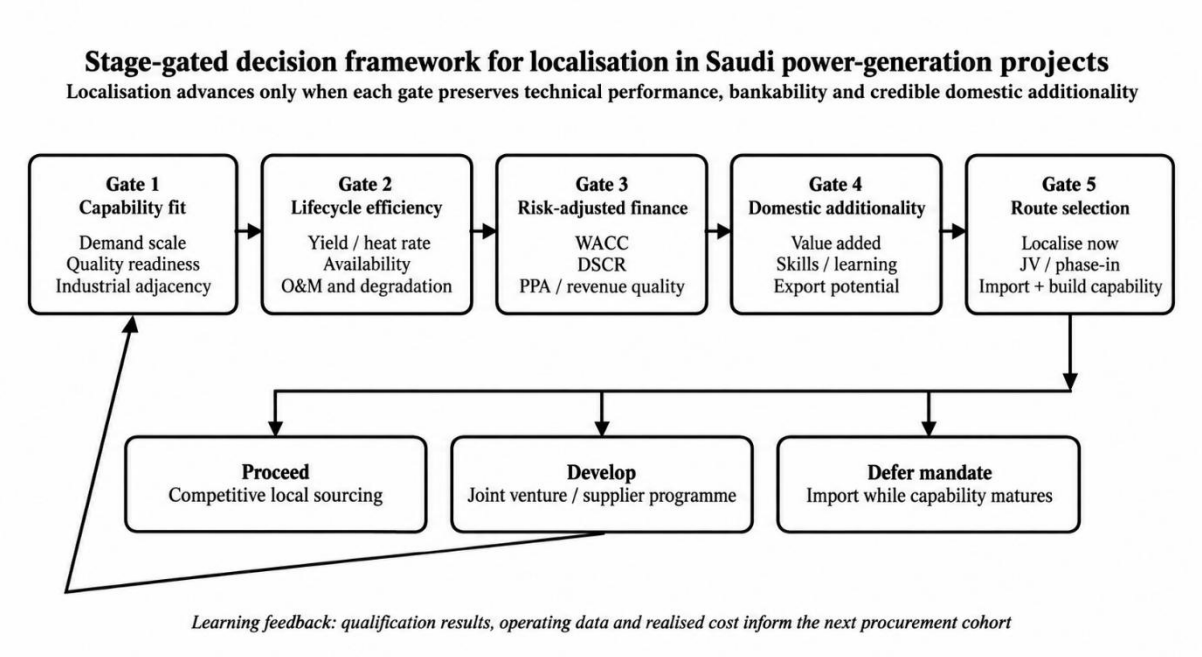

Figure 2. Stage-gated decision framework for local-content route selection in Saudi power-generation projects. Source: authors' synthesis of the reviewed evidence.

The framework also clarifies the role of economic growth. Renewable investment can support output, employment and diversification, as reflected in Saudi empirical studies (Kerrouche and Zehri, 2024; Selim and Alshareef, 2025), but the quality of growth depends on productivity. Local content that creates repeatable engineering, manufacturing or digital capabilities can generate benefits beyond a single power plant. By contrast, local content that survives only through permanent price protection transfers cost to electricity consumers or project sponsors. Financial feasibility and enduring growth are therefore aligned when domestic capability reduces lifecycle cost or risk over successive project cohorts, not simply when procurement is geographically domestic.

VII. DISCUSSION

The evidence supports a conditional rather than maximalist view of energy-efficient localisation. Saudi Arabia has strong strategic motives to deepen domestic participation in power generation. Still, the financially optimal path is unlikely to be a uniform percentage applied across technologies and project stages. The critical variable is capability-adjusted local content: the share of project value that can be delivered domestically at acceptable quality, lifecycle performance and risk. This interpretation is consistent with Saudi value-chain research and with international evidence showing that industrial proximity and market structure shape localisation outcomes (AlOtaibi et al., 2020; Hansen et al., 2020; Scheifele et al., 2022).

A second finding is that energy efficiency should be treated as a financing variable. Traditional localisation debates frequently compare domestic and imported capital costs, while techno-economic studies compare technologies using LCOE or net present cost. The synthesis shows that these comparisons should be integrated. Efficiency affects operating cash flow, output, fuel exposure, and maintenance; these variables influence debt-service resilience and, therefore, financing terms. A localisation premium can be financially rational if the domestic option improves availability, service response or operating efficiency enough to lower lifecycle risk. The opposite is true when nominally cheaper local inputs reduce performance.

Third, risk allocation is central. The literature on WACC and project finance demonstrates that perceived uncertainty can materially alter costs even

when engineering economics appear attractive (Steffen, 2020; Gohdes et al., 2022). Localisation policy should therefore create mechanisms that reduce supplier and completion risk rather than transfer it to project companies. Standardised qualification, transparent warranties, bankable revenue contracts, phased localisation and targeted credit enhancement can preserve competitive pressure while enabling domestic entrants.

Finally, the national-benefit case must be evaluated separately from the project business case. Local content can create value added, skills and learning, yet these benefits should be measured against support cost and opportunity cost. A two-ledger approach blocks hidden cross-subsidies: project sponsors can assess bankability, while government officials can decide whether any temporary localisation premium is justified by credible additionality. This distinction is necessary for upholding both electricity affordability and industrial-development discipline.

VIII. RESEARCH GAPS AND FUTURE RESEARCH

Several research gaps limit precise Saudi decision-making. First, no sufficiently granular, public, project-level dataset links local-content shares by component to EPC cost, operating performance, warranty claims, and financing terms. Future studies should construct anonymised portfolios that allow estimation of localisation premiums and technology-specific learning curves. Second, Saudi techno-economic models rarely endogenise supplier localisation or WACC changes. Integrated models should combine component sourcing, efficiency degradation, exchange-rate exposure, debt structure and revenue contracts in stochastic cash-flow analysis.

Third, economy-wide benefits require stronger causal evidence. Input-output studies can estimate domestic multipliers, but future Saudi work should distinguish gross local expenditure from additional value created through productivity, skills, technology transfer and exports. Fourth, the distributional effects of localisation deserve attention: supplier development may benefit regions, SMEs and labour categories unevenly. Fifth, research should compare policy instruments, including local-content thresholds, bid credits, contracts for difference, supplier-development funds, tax incentives and joint-venture requirements. Longitudinal analysis is needed to identify when temporary support produces competitive capability and when it creates persistent dependence. Finally, digital energy-efficiency services, predictive maintenance and power-plant analytics are underexplored as relatively asset-light localisation opportunities that may offer high learning value with lower manufacturing risk.

IX. PRACTICAL, MANAGERIAL AND POLICY IMPLICATIONS

For developers, feasibility models should report a localisation-adjusted lifecycle case rather than a simple domestic-versus-import purchase comparison. Core metrics should include incremental CAPEX, LCOE, NPV, IRR, DSCR, availability, degradation, maintenance response, warranty risk, foreign-exchange exposure and local value added. Table 2 provides a compact assessment matrix. Procurement teams should qualify local suppliers on total cost of ownership and performance, not only on local-content certification.

Table 2. Risk-adjusted financial-feasibility assessment matrix for energy-efficient local content.

Assessment dimension	Illustrative indicators	Decision logic	Risk if ignored
Technical efficiency	Heat rate or conversion efficiency; capacity factor; availability; degradation; auxiliary consumption	Local option must preserve or improve expected lifecycle performance relative to the benchmark technology.	A low purchase price can conceal higher fuel use, lost output, maintenance cost or early replacement.

Assessment dimension	Illustrative indicators	Decision logic	Risk if ignored
Localisation economics	Component-level local-content share; incremental CAPEX; total cost of ownership; learning curve; warranty cost	Accept a premium only where capability development has a credible path to cost, quality or export improvement.	Permanent protection, overcapacity or non-competitive supply can increase electricity cost.
Bankability	WACC; debt tenor; leverage; DSCR; PPA coverage; counterparty credit; contingency	Assess how local sourcing changes lender perception, guarantees and cash-flow resilience under downside cases.	Financing premium can outweigh nominal local-cost savings or efficiency gains.
Supply-chain resilience	Import exposure; lead time; spare-part availability; service response; FX exposure; supplier concentration	Value resilience where local supply reduces downtime or import risk without reducing quality.	Single-source dependence or immature suppliers can create completion and operating risk.
National additionality	Domestic value added; skilled employment; supplier productivity; technology transfer; export potential	Maintain a separate policy ledger so support is justified by measurable additional outcomes beyond the project cash flow.	Gross local expenditure may be mistaken for genuine productivity or economic additionality.
Governance and review	Qualification standards; verification rules; staged thresholds; sunset dates; periodic benchmarking	Adjust support as suppliers mature and compare realised performance against international benchmarks.	Rigid thresholds can lock in inefficiency and obscure the true cost of industrial policy.

For lenders and investors, local-content risk should be decomposed. Supplier financial weakness, technology immaturity and revenue uncertainty require different mitigants. Credit enhancement, reserve accounts, performance security, staged drawdowns and supplier guarantees can support bankability without suppressing domestic participation. Financing documentation should also preserve incentives for efficiency by linking acceptance and warranty tests to measurable plant performance.

For decision-makers, localisation thresholds should be adaptive to capability and technology maturity. Bid evaluation can reward domestic value, efficiency and knowledge transfer simultaneously, while sunset clauses and periodic benchmarking prevent permanent protection. Supplier-development finance should prioritise segments with adjacent Saudi capabilities and credible regional export potential. Green-finance frameworks can additionally support projects where verified efficiency improvements and domestic capability creation are both measurable. The most important governance requirement is transparent separation between project support and industrial-policy support so that the cost of localisation remains visible and can be compared with realised economic benefits.

X. LIMITATIONS

This review is limited by heterogeneity across technologies, countries and financial assumptions. International local-content evidence offers mechanisms rather than direct Saudi effect sizes, and Saudi techno-economic studies often use case-specific tariffs, sites, or simulation inputs. The review does not report database screening counts because it did not retain auditable proprietary exports. It also does not perform a meta-analysis, since outcomes such as LCOE, WACC, value added and supplier capability are not measured on a common statistical basis. Conclusions should therefore guide structured appraisal rather than substitute for project-specific due diligence.

XI. CONCLUSION

The financial feasibility of energy-efficient local-content development in Saudi power generation depends on the interaction of technical performance,

industrial capability, and financing risk. The reviewed evidence does not support maximising local content as an independent objective. It supports localisation where domestic suppliers can preserve or improve lifecycle efficiency, where temporary cost premiums are linked to credible learning, and where contracts allocate execution risk without unnecessarily increasing the cost of capital.

Vision 2030 can therefore obtain greater economic value from power-sector investment by treating localisation as a staged capability strategy. Select high-potential segments based on technological adjacency, market scale, quality readiness, and export potential. Incorporate energy-efficiency gains into cash-flow and debt-service analysis, and assess national benefits in a separate ledger that measures value added, skills, and productivity. Adaptive procurement rules, supplier-development finance, credible revenue structures and transparent performance measures can connect these two ledgers. This approach shifts policy from counting domestic expenditure to building bankable domestic capability, aligning electricity-sector efficiency with sustainable economic diversification.

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