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Solar Project Investment Viability in APAC Markets

Asia Clean Energy Forum 2018

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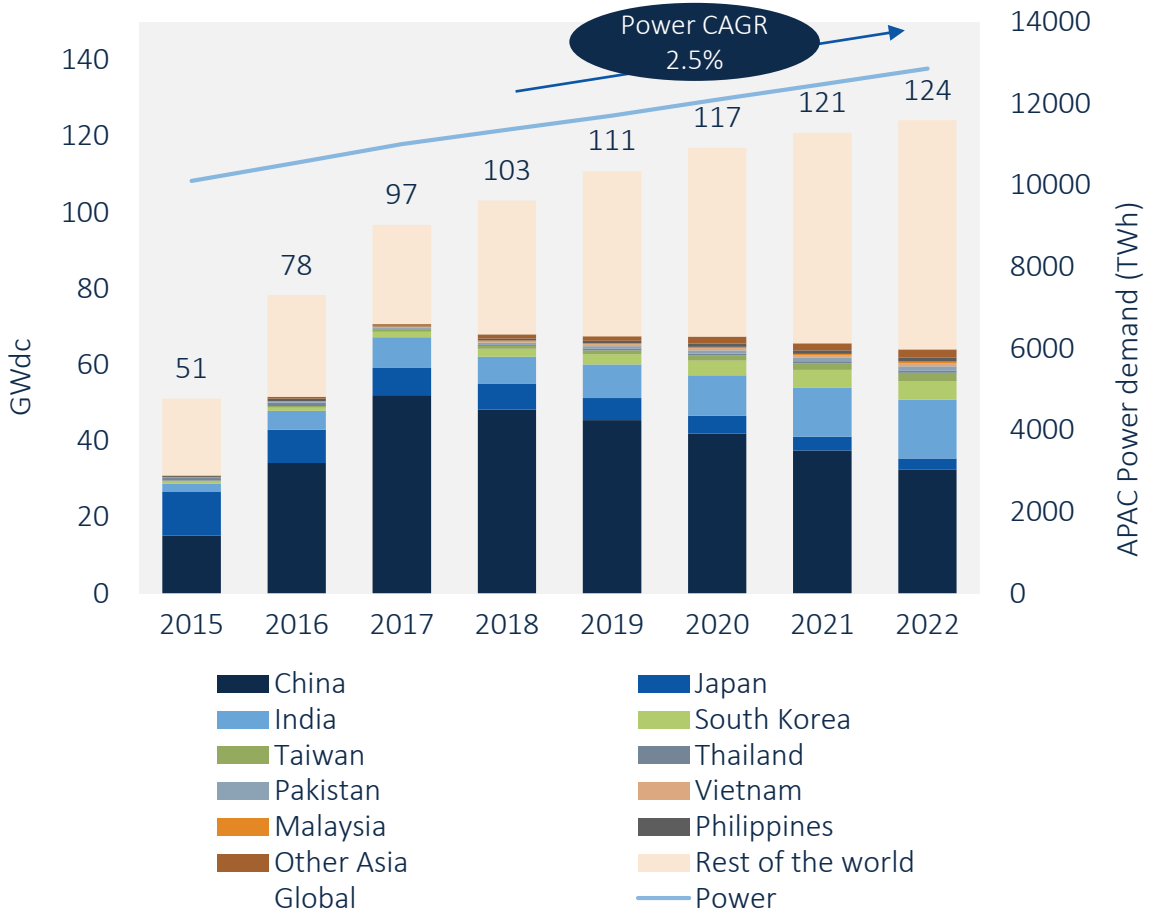
Outline

- **Demand and costs**
- **Challenges**
- **LCOE and cost levers**
- **Market attractiveness**
- **Take aways**

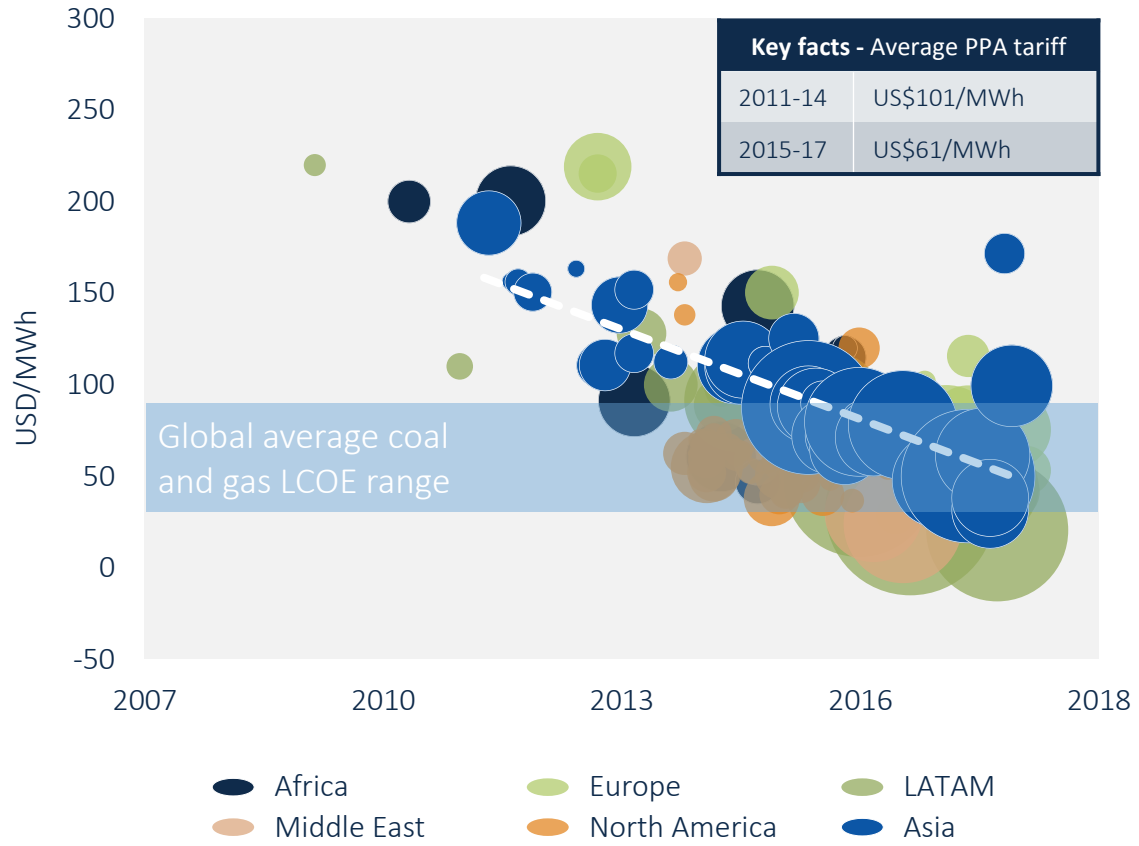
Positive Project Viability Fundamentals – Rising Demand and Reducing Costs – Provide Significant Opportunities for Solar Deployment in APAC Region

~67 GW of annual installs will help meet rising power demand through 2022



Source: GTM Research, Wood Mackenzie

Auctions, whilst reducing prices, also tend to push project viability boundaries



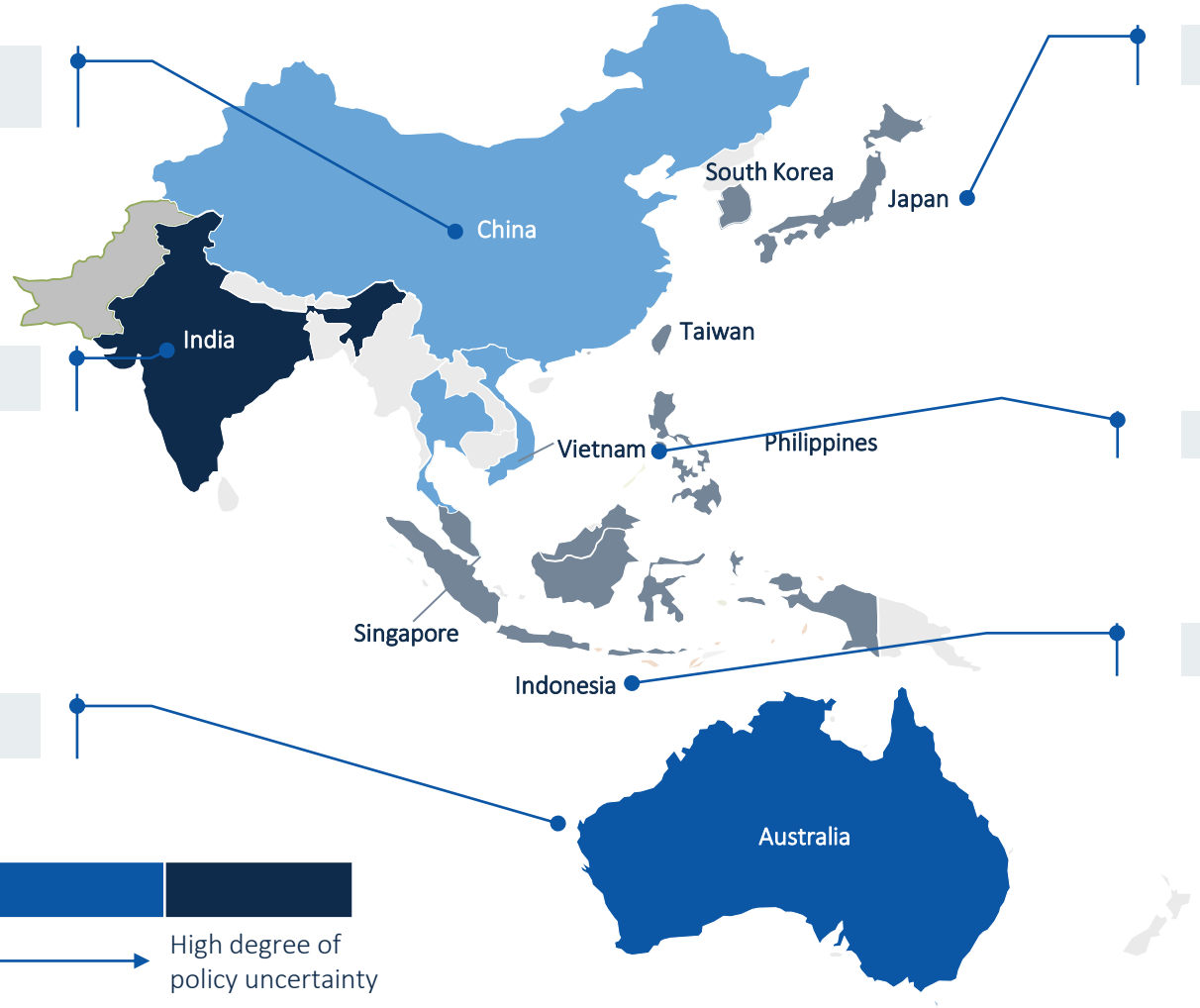
Source: GTM Research

Bankability Concerns Vary Across the APAC Markets

China - subsidy payment / curtailment risk

India - regulatory risk

Australia – policy risk



Japan - returns / interconnection risk

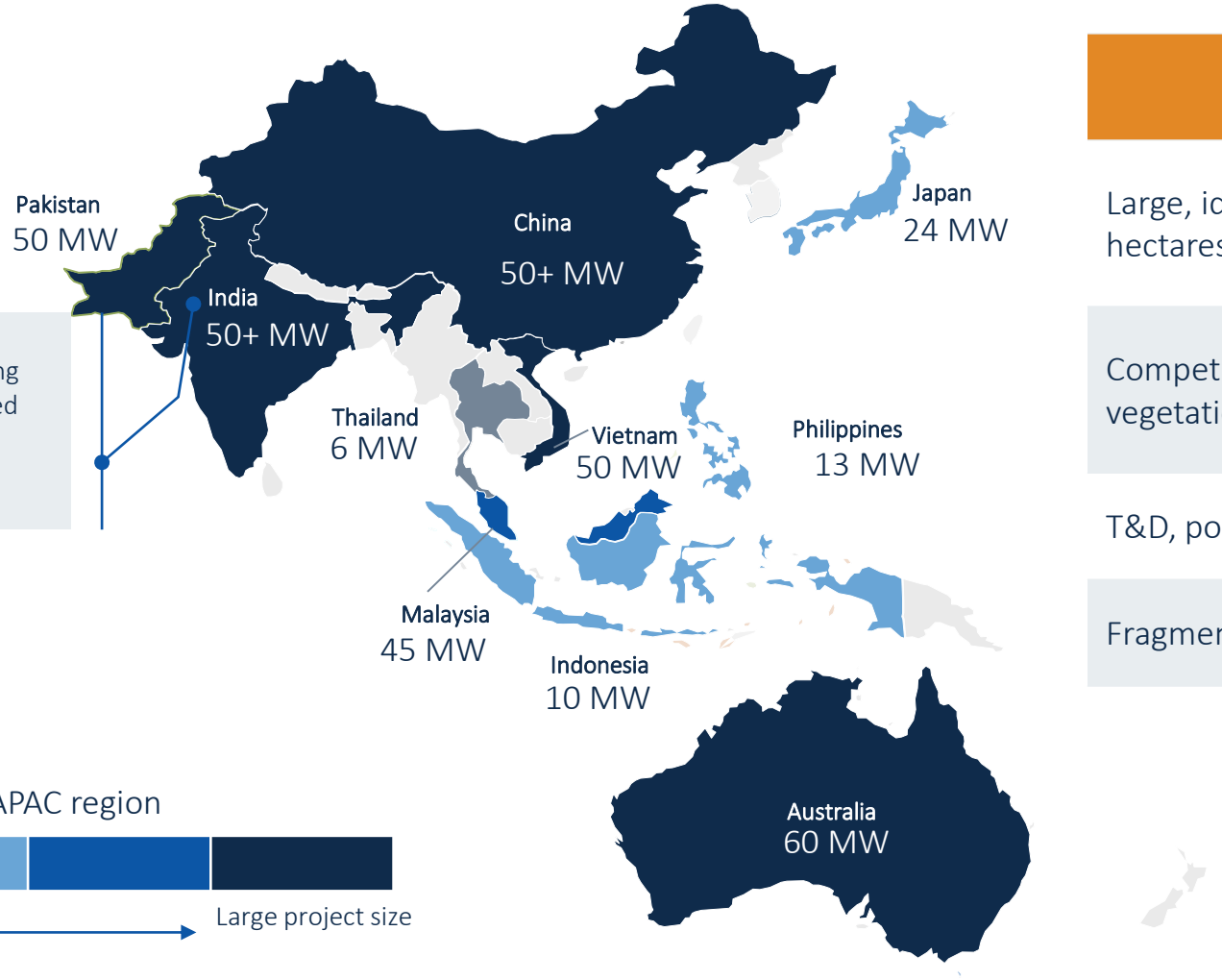
Vietnam - dispatch risk / dispute resolution

Indonesia - returns risk

Low degree of policy uncertainty ⟷ High degree of policy uncertainty

Permitting and Land Acquisition Are Common Challenges in APAC Markets

40 GW+ of solar park in implementation or planning phase and have accelerated permitting and land acquisition process



Median project size in APAC region

Small Project size ⟷ Large project size

Challenges

Large, ideally flat, land requirement (1.5 hectares per MW)

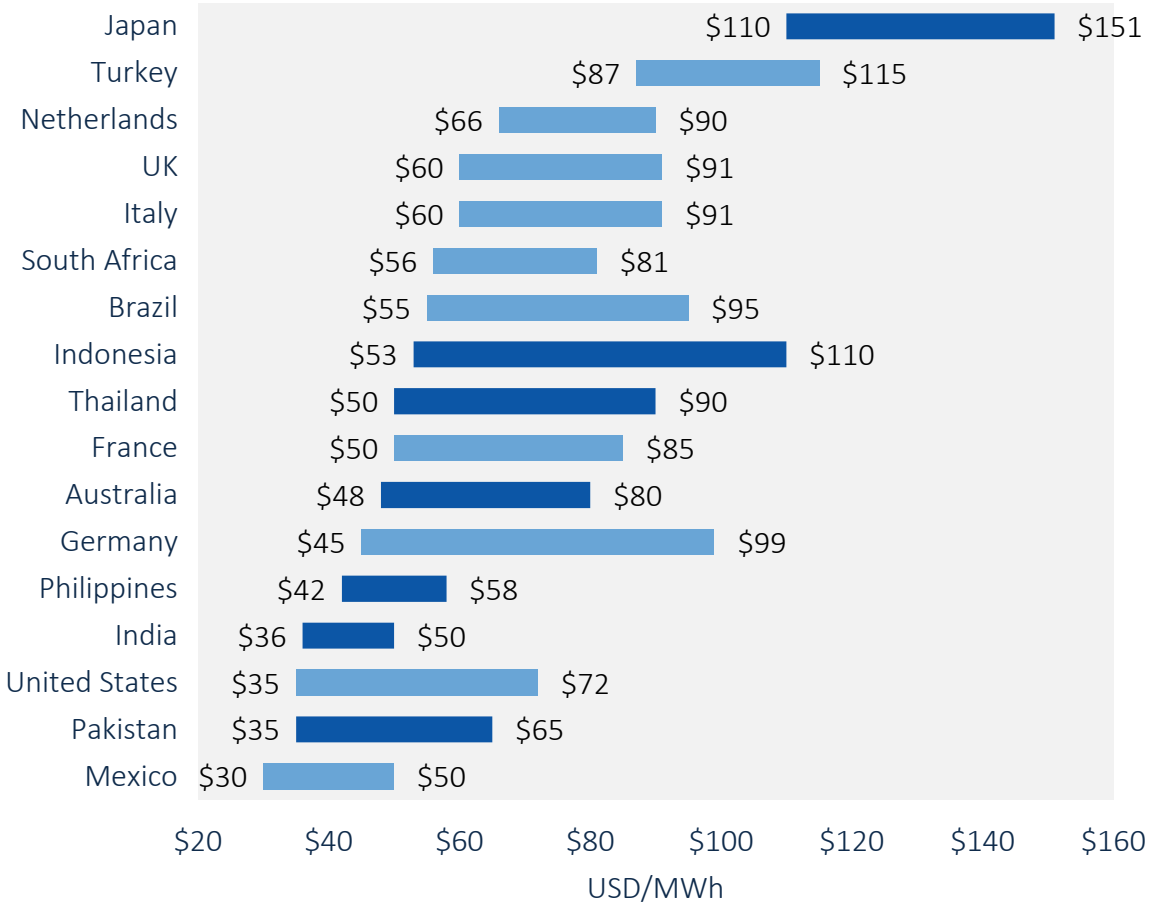
Competing land usage (irrigation, vegetation)

T&D, power evacuation infrastructure

Fragmented land owners

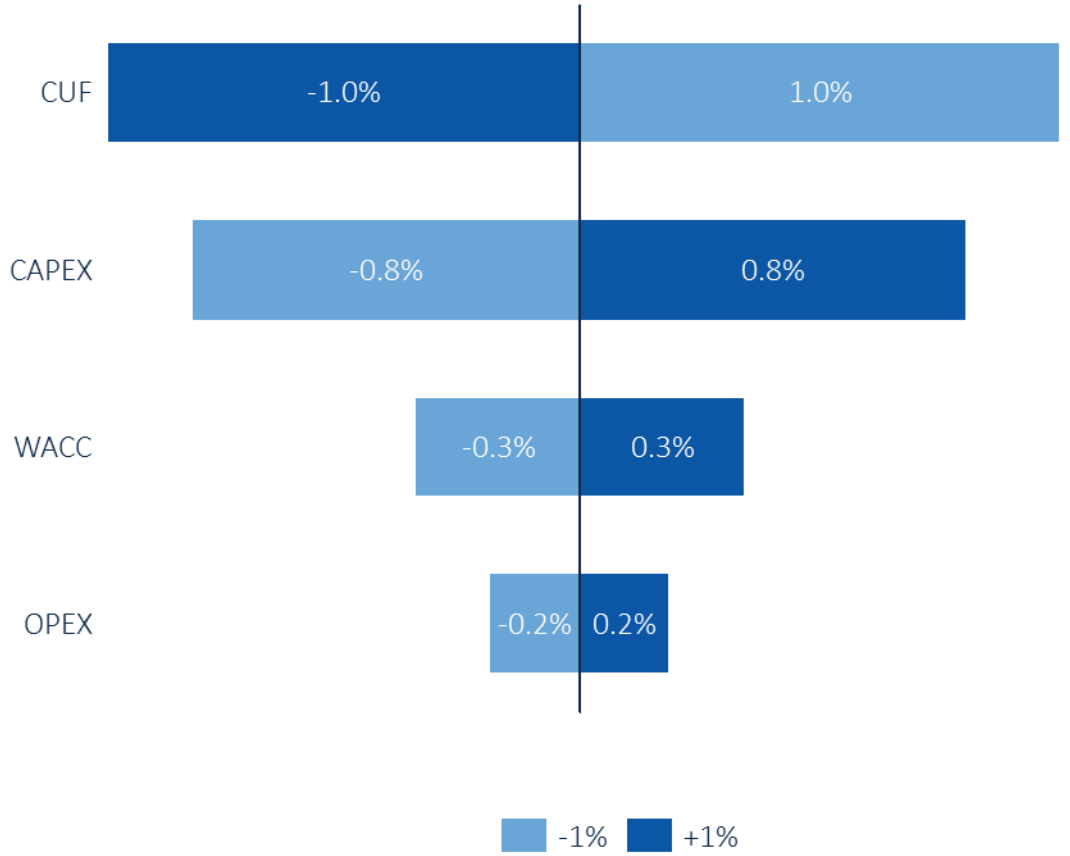
Solar Costs Vary Significantly Across APAC Markets

Utility-Scale Solar LCOE Ranges for Key Countries, 2017



Source: GTM Research, MAKE, Wood Mackenzie

Solar LCOE is most sensitive to capacity utilization factor and CAPEX cost

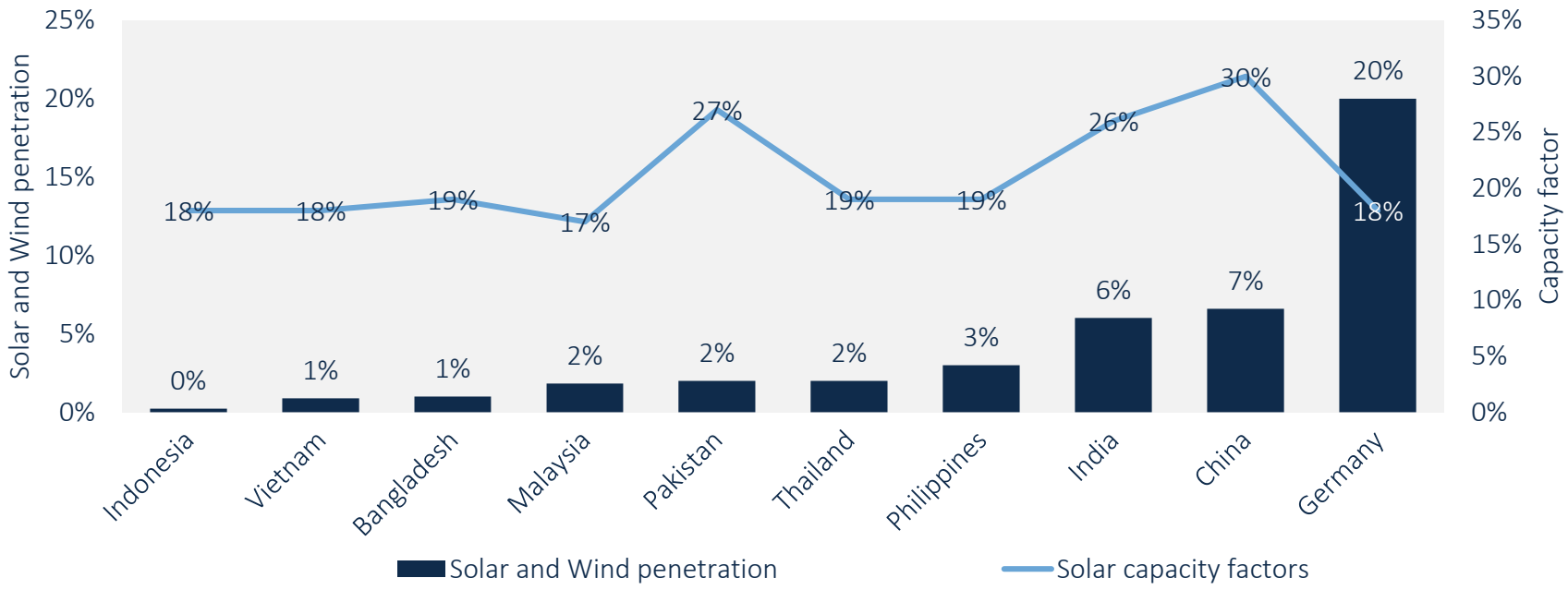


Source: GTM Research, MAKE

Despite Low Renewable Penetration, External Factors Pose Risks for Dispatchability

Grid congestion and weak T&D infrastructure, although improving, are potential risks in the region

Countries	Curtailment compensation mechanism
China	Guaranteed hrs.
India	Guaranteed hrs.
Vietnam	Unclear
Pakistan	Take or pay
Thailand	Take or pay
Philippines	Take or pay
Bangladesh	Take and pay
Malaysia	Take or pay
Indonesia	Take or pay

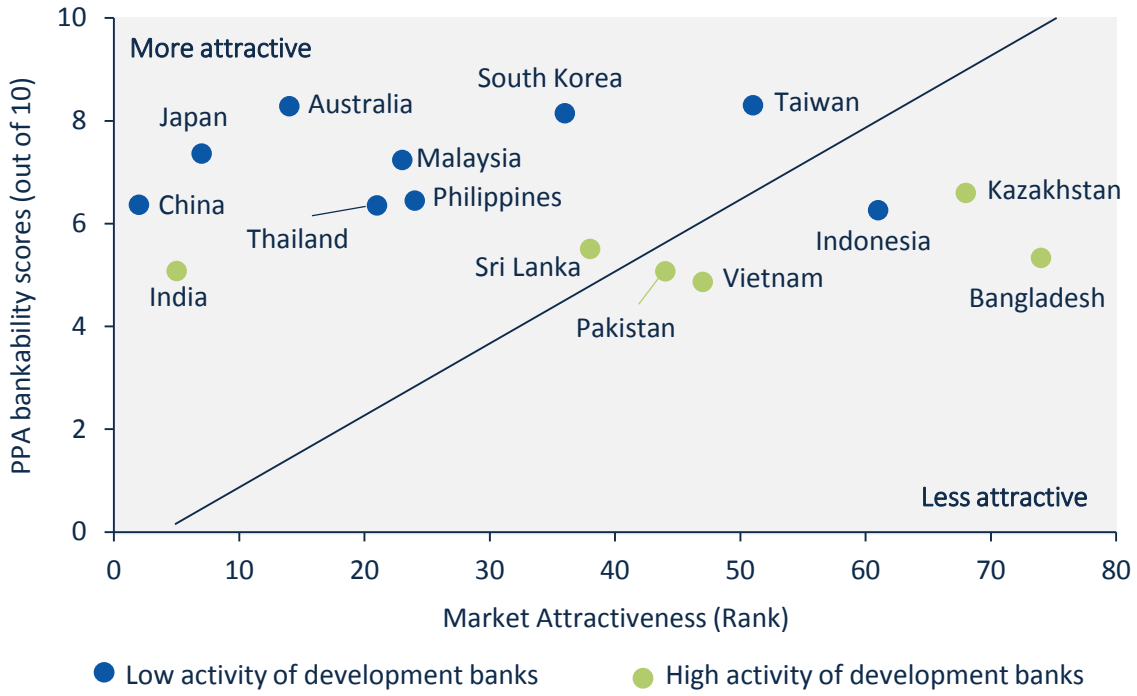


Note: In "take-or-pay" the offtaker provides an assured revenue stream for the project by guaranteeing specific compensation if electricity is not taken. * based on % of power mix

Source: GTM Research

Bankability Is Not Necessarily Correlated to Market Attractiveness

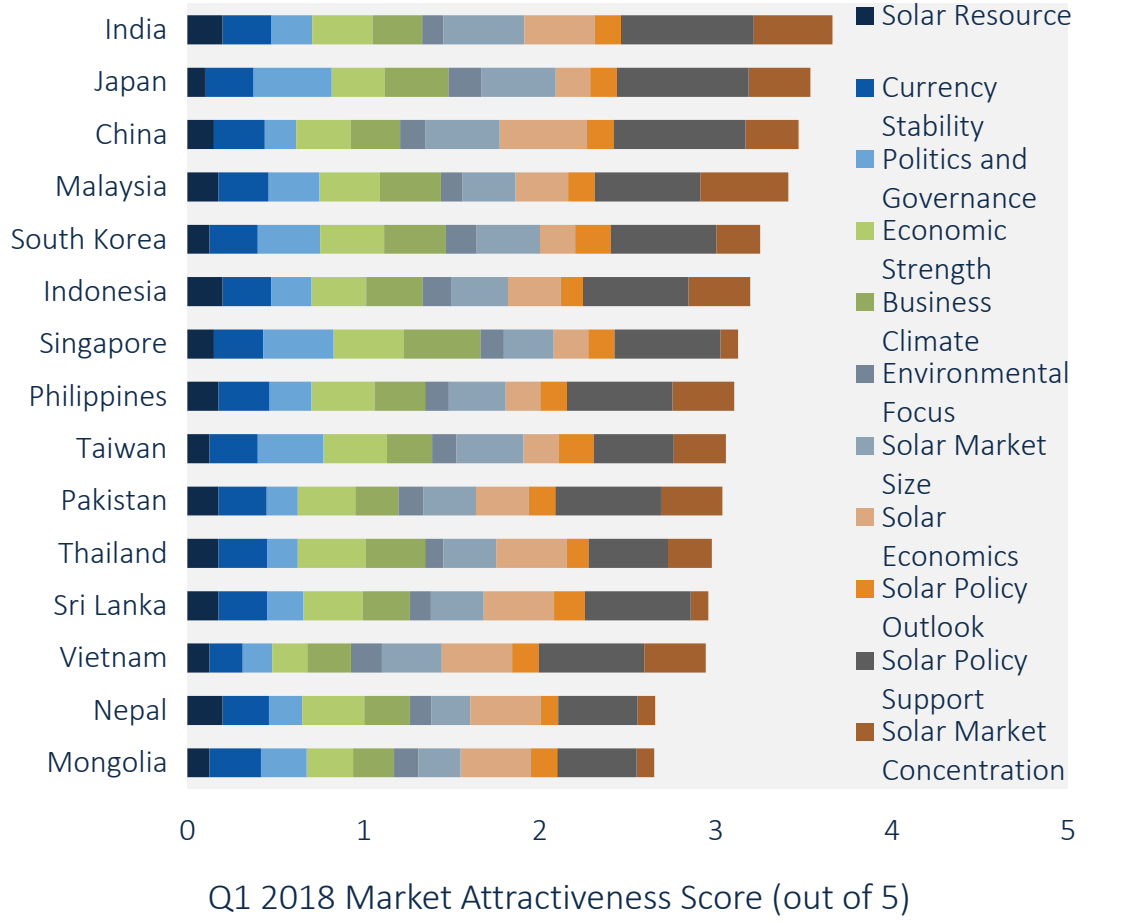
Development Bank Financing Has Been Crucial in Filling the Bankability Gap



Note: Higher bankability scores are better. Bankability scores are calculated for each market based on the risks associated with returns, currency, dispute resolution, offtaker payment support, dispatch regulations, land acquisition and permitting. Market attractiveness includes a broader range of criteria including market size, policy strengths, business competitiveness landscape.

Source: GTM Research

But long-term market attractiveness is dependent on bankability



Source: GTM Research Market Attractiveness Tool

Take Aways

- Positive project viability fundamentals from macroeconomic and financial perspective provide significant opportunities for solar deployment in APAC markets
- Bankability concerns exist but are improving in the APAC region; sharing cross-country learnings will accelerate costs improvements
- Higher margins are necessary to factor in increased risks such as off-taker credit quality
- Bankability is not necessarily correlated to market attractiveness but in the long-term market attractiveness is dependent on bankability
- LCOE is expected to decline by ~13 % in 5 years. As bankability concerns are addressed, further reduction in financing costs will lead to additional reductions in LCOE

Thank You!

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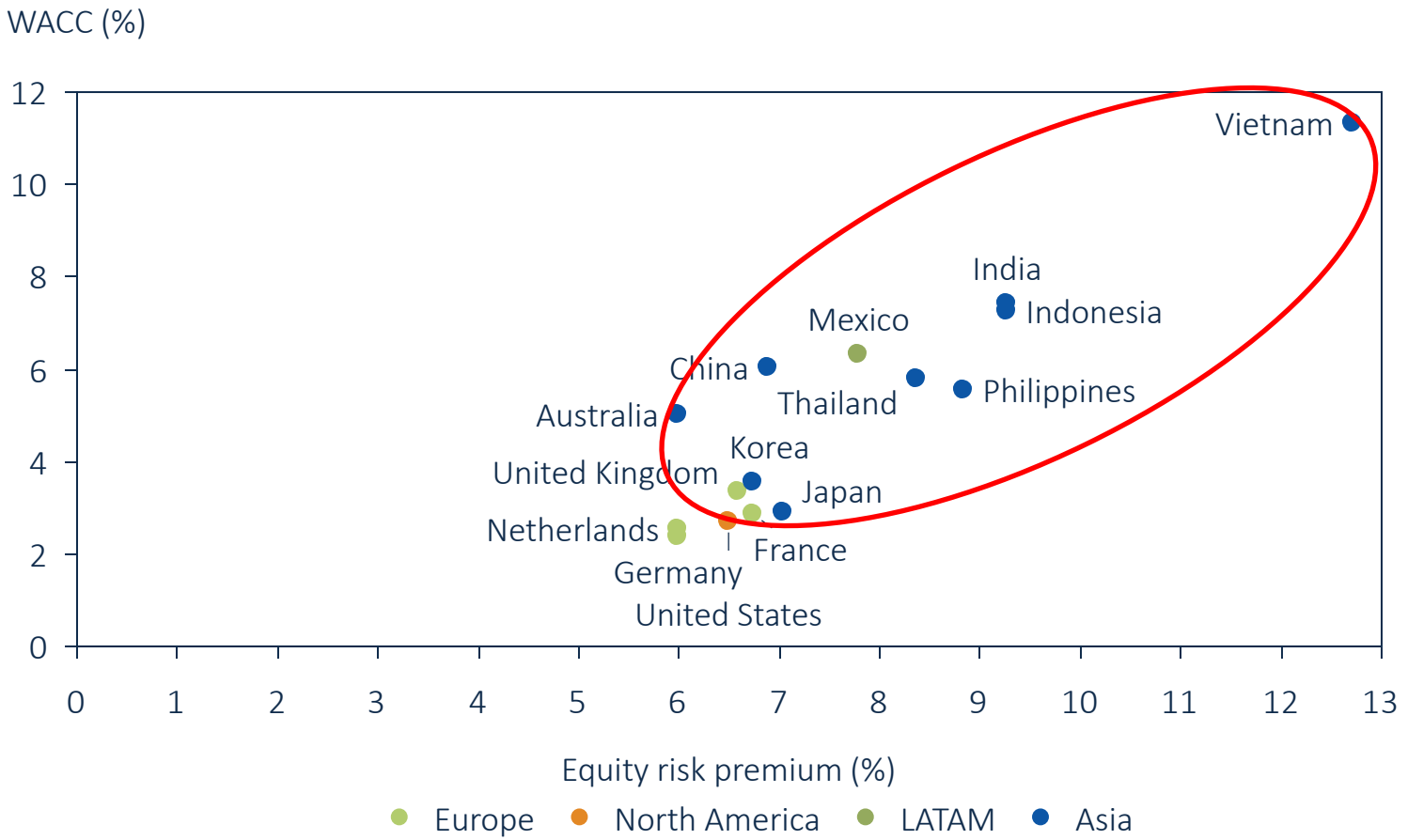
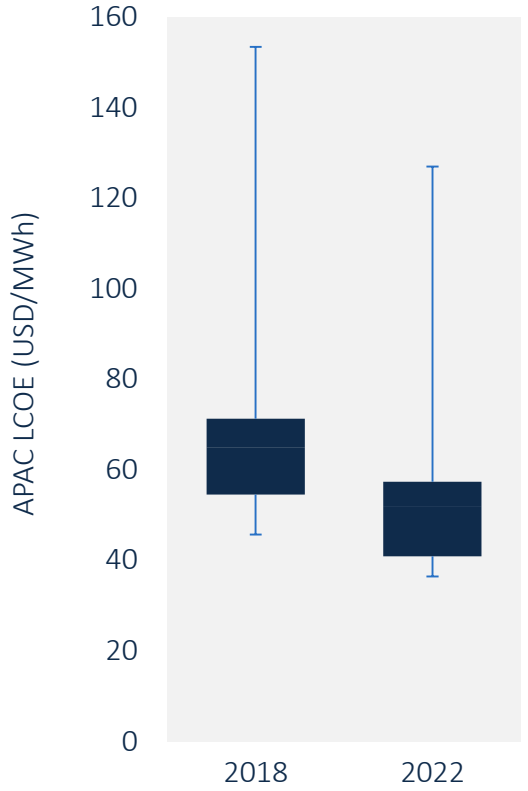
Appendix

Appendix - Cost Reduction Trends Continue to be Promising

IRR-WACC spreads of 200+ basis points will be important for project viability





Source: GTM Research, MAKE

Appendix: India - Developers Without Clear Change-in-Law Clauses in PPAs Risk Suffering Damages

India Case study - Navigating through the uncertainty

Sept. ’16: First Goods and Services Tax (GST) Council meetings held

Feb. ’17: Rewa Solar Park bid of 3.30 INR/kWh

Apr. ’17: Engie Solar bid 3.15 INR/kWh

May ’17: Acme bid 2.44 INR/kWh

July ’17: GST implemented; confusion persists on the rate applicable for solar components. Capital costs on the rise (~4%).

Jan. ’18: Directorate General of Safeguards Customs and Central Excise gives preliminary recommendation of imposing 70% safeguard duty on solar cells and imports from China and Malaysia

Nov. ’17: Port customs officials classify solar as electric motors and generators (which have 7.5% import duties) instead of diodes/semiconductor devices (which have none). Costs increase by an additional ~4%.

Feb. ’18: India auctions more than 5 GW of solar for 2018

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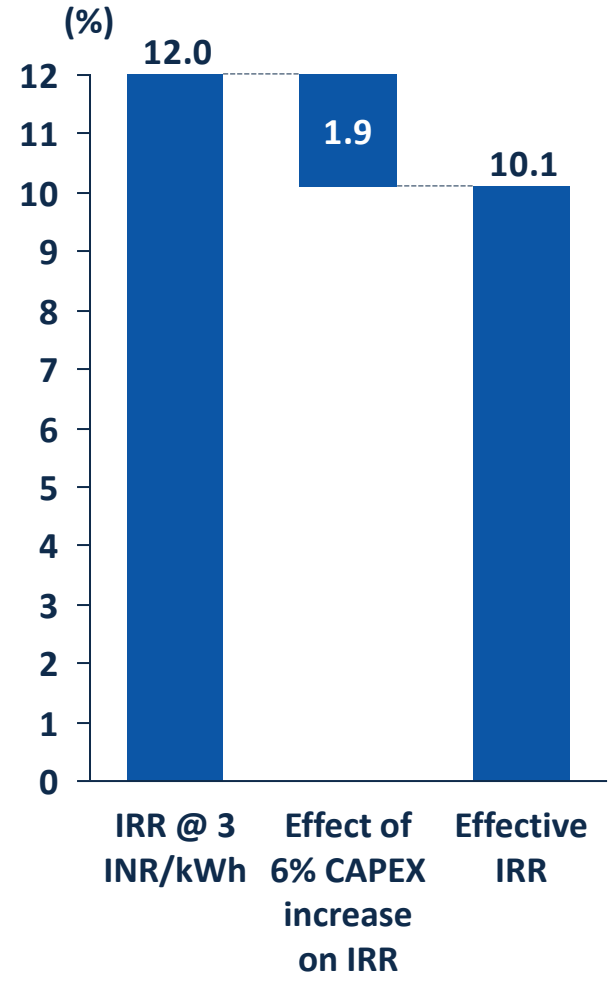
Note: 2017 USD/INR = 64.78

Source: GTM Research, MNRE



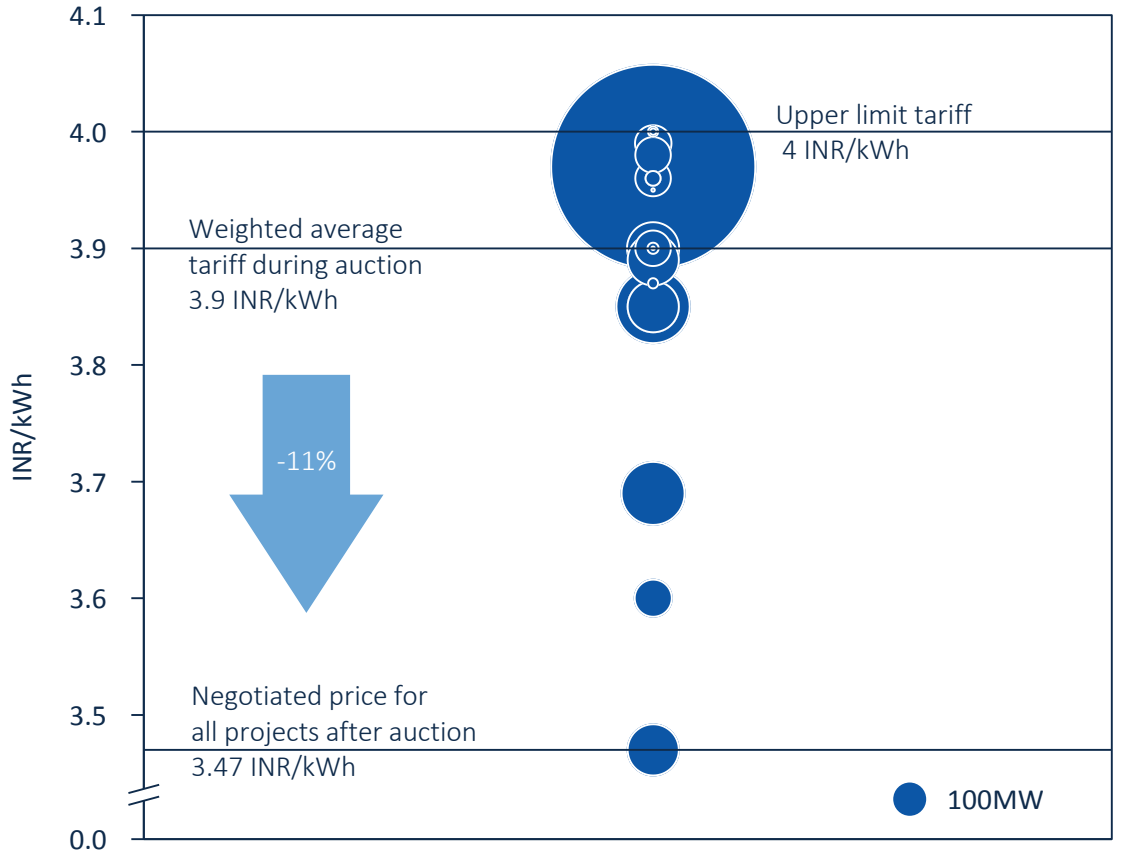
Appendix: Contract Enforcement Can Be Difficult, but Clear Dispute-Resolution Clauses Reduce Risks

Absence of termination payments puts both debt and equity investment at risk

- **India:** State utilities in Tamil Nadu, Jharkhand and Uttar Pradesh have been keen on revisiting the solar PPAs previously signed as a result of plummeting solar tariffs. The central government is tightening PPA terms by including debt payments and 150% equity payments in case of termination.
- Termination clauses vary across the region. Malaysia, for instance, has a clear termination clause providing the option to purchase/sell the project for the counterparty in event of default.
- Bid bonds are generally cheaper in mature markets: current levels are approximately $12,500/MW in India, $33,000/MW in Bangladesh and $96,750/MW in Sri Lanka (all values USD). Despite lower bid bonds in India, project cancellation from the developer side has not been an issue.
- **Vietnam:** Dispute resolution through international arbitration and protection against changes in the law are not specifically provided for under the current PPA; this is a source of grave concern.

Source: GTM Research, TNB, TN ERC, NWPGCL, CEB

Tamil Nadu, India: Price Renegotiations Reduced PPA Prices by 11% in July 2017

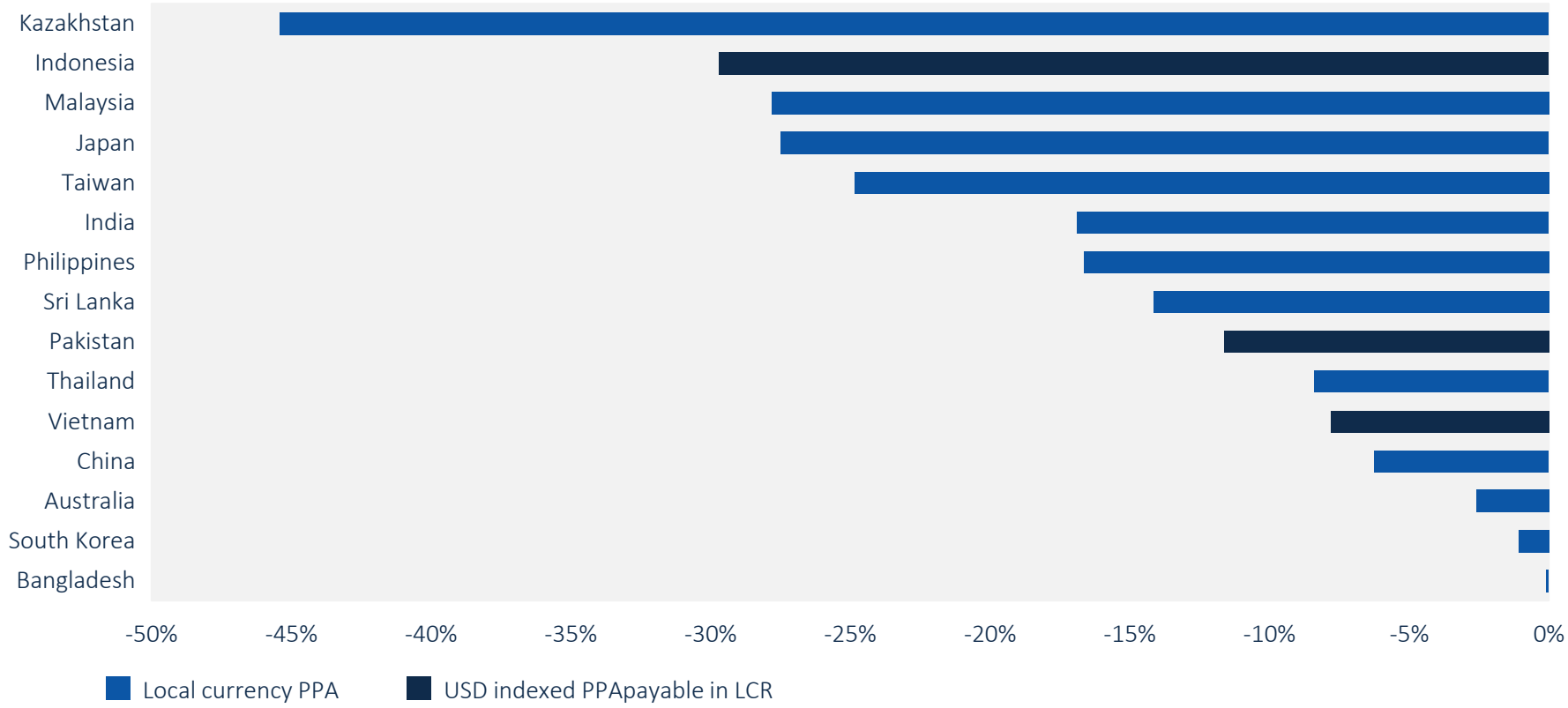


Note: Bubble size refers to individual winning bids, July 2017 USD/INR = 64.45

Source: GTM Research, TN ERC

Appendix: 15 APAC Currencies Have Depreciated an Average of 16% Against USD Over the Past 5 Years

Majority of Markets Have Local Currency-Denominated PPAs

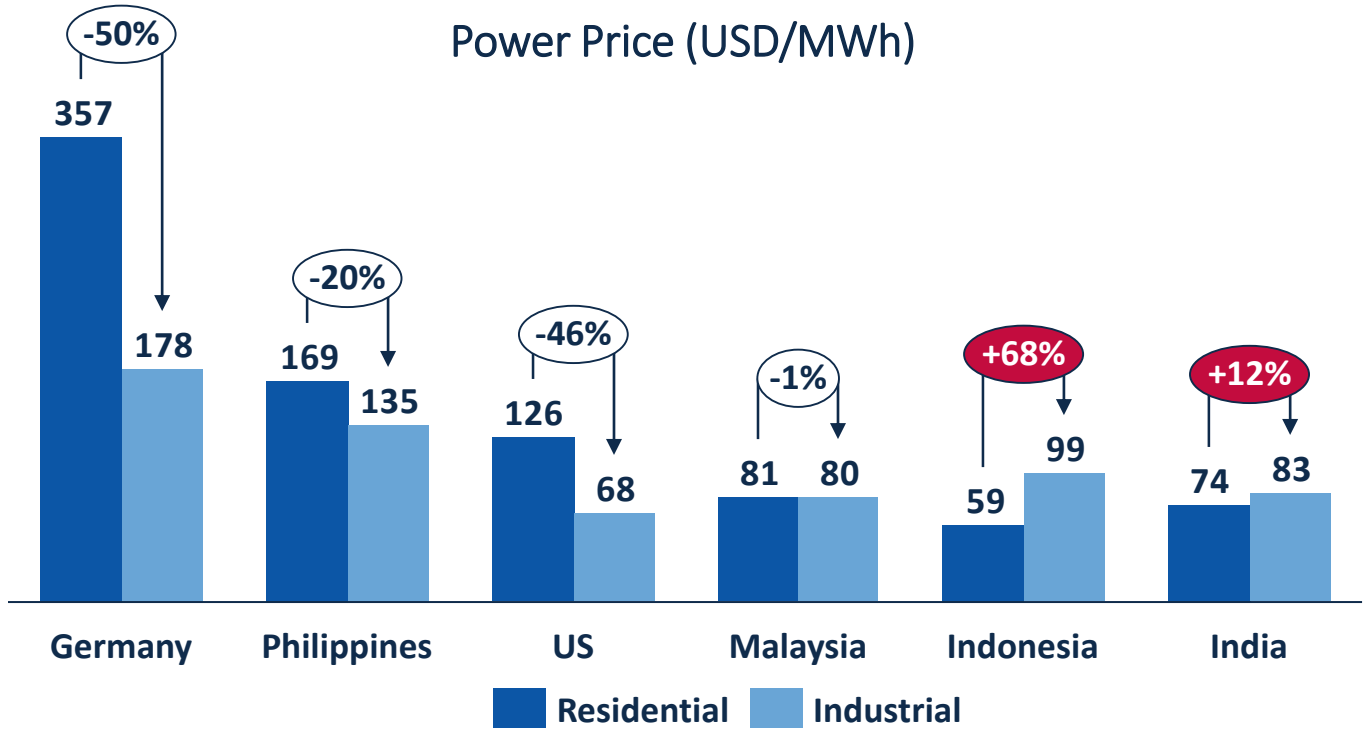


Note: * PLN may be reluctant to offer USD guarantee for small-scale projects

Source: GTM Research

Appendix: Cross-Subsidies and Insufficient Tariff Revisions Have Led to Poor Rates of Cost Recovery for Utilities

Tariffs have implication on credit ratings of the off taker and costs savings offered by solar projects



Source: GTM Research, Wood Mackenzie, state utilities, state electricity regulatory commissions

Appendix: Numerous Bankability Criteria Are Important for Securing Project Finance

Bankability Criteria	Details
Dispatch risk	The risk that the generation plant won't be dispatched by the offtaker. Could be take-or-pay or take-and-pay.
Returns risk	Revenue needs to have fixed PPA (or hedged) for debt and equity return requirements.
Foreign exchange	Risk of volatile currency prices and restriction on transferring funds offshore. PPA should be linked to the currency of the debt issued or hedged. (Only applicable to foreign investors.)
Dispute resolution	Agreement for offshore arbitration should be provided under generally acceptable terms to the international community.
Termination payment	PPA should clearly define the basis on which termination may be carried out and outline clear termination payment mechanism.
Assignment	Collateral assignment for the lenders should be allowed with the right to receive notice of any default and to remedy such default.
Offtaker payment support	Depending on the size of the project, the creditworthiness of the offtaker and the country's energy sector, a short-term payment facility or sovereign guarantee would be required to support offtaker payment obligations.
Transmission/ interconnection	PPAs should clearly indicate the party that bears the risk of connection and interconnection.
Regulatory risk	Risk associated with changes in law and taxes should be clearly allocated in the PPA document.
Force majeure	Power producer's obligations should be excused in a situation which is beyond the reasonable control of the power producer.

Source: GTM Research, World Bank

- PPA bankability is critical for financing renewable energy projects, as well as for lowering the cost of financing renewable energy projects.
- Bankability involves fair allocation of risks among various stakeholders (e.g., power producer, offtaker, policymakers), making key elements such as revenues and responsibilities predictable, providing mechanisms and procedures for addressing risks.
- Disruption of cash flows and the credibility of the offtaker throughout the PPA duration are key concerns of lenders.

Appendix: Methodology

Bankability Scores (Out of 10)

Bankability Criteria	Details
Dispatch risk	Based on solar and wind penetration, curtailment and transmission infrastructure. 10: Guaranteed revenue for deemed generation, 0: Highly prone to curtailment and revenue not guaranteed
Returns risk	10: PV LCOE highly competitive against wholesale power prices and alternative generation technology 0: PV not competitive against wholesale power prices
Foreign exchange	10: Currency hedges available, low volatility/convertibility and pegged exchanged rate 0: Very high degree of currency volatility and convertibility risk and scant or absent hedging options
Dispute resolution	Based on strength of investor protection and offshore arbitration. 10: Option for offshore arbitration according to reasonable international standards 0 : No offshore arbitration available and precedent of unfair practices
Termination payment	Baked into regulatory risk, which is determined by rule of law and policy stability index. 10: Termination payment available and clauses clearly defined, rule of law strongly respected, 0: No provision for termination payment and little respect for rule of law
Credit risk	Based on availability of payment support and credit profile of the offtaker. 10: Market-oriented tariff structure and availability of offtaker payment support, 0: High degree of subsidies and unavailability of offtaker payment support
Transmission/ interconnection	Adjusted based on transmission infrastructure. 10: Very low level of transmission constraint; interconnection responsibility and timeline clearly defined, 0: High levels of transmission bottlenecks and interconnection clauses that are vague and unclear
Regulatory risk	Adjusted based on stability of renewable energy related policy. 10: Stable policy environment, 0: Highly uncertain policy environment with historical precedent of retroactive policy changes
Force majeure	Based on rule of law index. 10: Rule of law strongly respected, force majeure clauses (risk allocation and responsibility for addressing damages clearly specified), 0: Weak rule of law and force majeure clauses
Others	Degree of subsidization is used as a proxy for credit quality of the offtaker, land acquisition and permitting are also taken into account.

Appendix: Bankability Scores for Top 10 Markets