Renewable energy marketing in Uzbekistan: investment outcomes and stakeholder perceptions (2015-2025)

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Abstract: *Uzbekistan's renewable energy sector went through dramatic changes between 2015 and 2025. These shifts were closely tied to the economic and legal reforms that followed the change of government in 2016. Three developments proved most significant: the 2017 currency convertibility reform, the open tender systems introduced in 2019, and the government's consistent efforts to attract foreign investment. Together, these factors created an investment climate that is rarely seen among former Soviet republics still going through transitional periods. This paper turns attention to one underexplored aspect of that era - how marketing strategies influenced investment outcomes, and for whom those effects mattered most. Three stakeholder groups are examined: international investors, domestic businesses, and urban households. The research was conducted using a sequential mixed-methods approach. Time-series data on investment flows and installed capacity from 2015 to 2025 were studied alongside a systematic analysis of 812 government promotional materials. Surveys were carried out with international investors (n=45), domestic businesses (n=120), and urban households (n=600), and interviews were conducted with 15 experts. Since the period covered by the econometric analysis is relatively short - seven years - the quantitative findings are presented not as definitive conclusions, but as indicative data pointing toward broader trends. The analysis identified three distinct patterns. Marketing aimed at international investors appears to have contributed to growth in foreign direct investment: annual FDI inflows grew from approximately USD 25 million in 2015 to USD 636 million by 2023, already surpassing earlier projections of USD 500 million by 2025. Investor sentiment also improved considerably between 2019 and 2023. Consumer-facing campaigns achieved wide reach - around 68% of urban households reported being aware of them. Yet residential solar adoption has remained below 1%. The household survey highlighted an important finding: knowing the specific steps required to begin an installation (procedural knowledge) had approximately 60% stronger predictive power on adoption intention compared to general awareness alone (OR=1.95 vs. 1.20). Domestic businesses fell somewhere in the middle - their awareness levels were reasonable, but most had yet to take any concrete action. Taken as a whole, these results highlight the importance of tailoring approaches to each stakeholder group within energy transition policy, and offer governments practical guidance on how to distribute promotional resources across investors, businesses, and ordinary households.*

Keywords: *renewable energy marketing, foreign direct investment promotion, stakeholder perception, diffusion of innovations, procedural knowledge, awareness-action gap, Uzbekistan, Central Asia, mixed-methods research*

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1. INTRODUCTION

1.1 Research Problem

Developing countries pursuing rapid energy reforms face several complex challenges simultaneously: expanding energy access for the population, attracting foreign investment in global markets, and moving away from legacy fuel systems - all within a short timeframe. Approaches rooted in Western European or North American experience often fail to account for how information exchange, credible institutions, and targeted promotion shape these processes. This is especially true for countries with limited international visibility and an investment environment that is only beginning to take form.

Uzbekistan is a striking example of exactly this challenge. As Central Asia's largest country, with a population of thirty-six million, it launched wide-ranging economic reforms following the leadership change of 2016. In September 2017, currency convertibility was introduced, removing one of the most significant barriers to foreign investment. The open tender systems established in 2019 replaced opaque bilateral arrangements in renewable energy projects. International arbitration clauses and revised grid regulations demonstrated the government's intent not merely to make promises, but to engage seriously with private investors.

The results were tangible. Annual FDI inflows grew from USD 25 million in 2015 to USD 636 million by 2023 - a more than twentyfold increase over eight years. International companies including Masdar, ACWA Power, and Total Eren committed to major projects. By 2023, installed renewable capacity had reached approximately 800 megawatts.

Yet a gap persists. Despite government promotional campaigns reaching roughly two-thirds of urban households, residential solar adoption has not exceeded one percent. The same system that succeeded in attracting international investors could not persuade ordinary citizens to install rooftop panels - even in cases where the investment would pay for itself within seven to ten years. This problem is not unique to Uzbekistan; the same pattern has been observed in Morocco, Vietnam, and South Africa. Yet the underlying causes remain insufficiently studied.

1.2 The Role of Marketing in Energy Transitions

Renewable energy marketing differs fundamentally from selling conventional products. This difference is visible across three dimensions.

First, unlike ordinary goods, a solar panel cannot be trialed and returned if unsatisfactory. It requires a large upfront financial commitment. A household in Uzbekistan considering rooftop solar installation would need to spend roughly two and a half times their average annual savings - with almost no possibility of recovering that money if things go wrong. Research shows that people feel potential losses more acutely than equivalent potential gains. For this reason, marketing must not only communicate opportunity, but also address risk through credible sources and demonstrated outcomes.

Second, regulatory complexity creates additional barriers for ordinary people. During the course of this research, even technically knowledgeable individuals struggled to explain grid connection procedures or equipment certification requirements. In such circumstances, effective marketing means not only explaining processes, but simplifying them.

Third, the time dimension matters. Convincing a financially stretched household today that an investment will pay off over seven to ten years is genuinely difficult. People tend to focus on present costs rather than future benefits. This tendency is likely more pronounced

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in countries that have recently experienced economic hardship. In short, what works for large-scale investors may simply not be appropriate for an ordinary family weighing whether the administrative burden is worth it.

1.3 Gaps in Existing Research

Articles published between 2015 and 2023 in leading journals - Energy Policy, Renewable and Sustainable Energy Reviews, and Energy Economics - were analyzed. Of 834 articles focused on energy transitions in emerging markets, only 23 (2.8%) examined marketing or promotional strategies in substantive terms. Just six (0.7%) used quantitative methods to assess marketing's economic impact. This means a range of practical questions remain unanswered: how effectively does spending on marketing translate into results? Which types of information do different groups find most credible? And why does high awareness so often coexist with low actual adoption?

Nation branding as a tool for attracting investment also remains underexplored. Countries competing for international capital must distinguish themselves through credibility, resources, and legal guarantees - qualities that cannot be conveyed through conventional advertising but require credible third-party validation. Existing research on country branding has focused primarily on tourism and export promotion, offering limited guidance for investment-oriented contexts.

At the same time, experience from other emerging markets provides useful reference points. Morocco's case demonstrates how open tender systems can attract international investment. Vietnam's experience shows rapid commercial growth alongside persistently low household uptake. South Africa's example illustrates practical approaches to attracting investment under complex transitional conditions. Uzbekistan adds a distinctive case to this body of knowledge - one in which reforms moved unusually quickly and the effects of marketing activity can be traced with relative precision.

1.4 Research Objectives and Questions

This study pursues three main objectives. First, to document the dynamics of renewable energy investment in Uzbekistan between 2015 and 2025. Second, to analyze the content and direction of government marketing activities. Third, to examine the attitudes of investors, businesses, and ordinary citizens toward this process, and to identify barriers to adoption.

Four core questions guide the analysis:

RQ1: What relationship is observed between marketing activity and foreign direct investment flows in Uzbekistan's renewable energy sector?

RQ2: How do international investors assess Uzbekistan as an investment destination, and which information sources most influence their decisions?

RQ3: Why does awareness remain high among the population (approximately 68% in urban areas) while solar energy adoption stays very low (below one percent)?

RQ4: How does Uzbekistan's marketing strategy compare with regional competitors, and what lessons might other developing countries draw from this experience?

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Diffusion of Innovations Theory: Limitations in the Energy Sector

Rogers' (2003) diffusion of innovations theory remains one of the most widely used frameworks in technology adoption research. Its core concepts - adopter categories, the S-curve growth trajectory, and the five innovation attributes - were originally developed in

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agricultural contexts, yet have since proven useful across a wide range of empirical studies. The five factors that shape an innovation's rate of diffusion - relative advantage, compatibility, complexity, trialability, and observability - serve as a useful starting point for evaluating any new technology.

Analyzing residential solar adoption through these factors reveals several favorable characteristics. Solar panels reduce electricity costs over the long term (relative advantage), align with environmentally conscious lifestyles (compatibility), and produce visible physical installations on rooftops (observability). However, trialability is virtually absent - no household can test a USD 10,000 solar system the way they might test a household appliance. Research confirms that this large upfront commitment discourages many potential adopters even when long-term economic benefits are clear.

In the Uzbekistan context, this theory encounters two significant problems. First, Rogers' framework assumes a broadly homogeneous adopter population. In the renewable energy sector, however, decision-makers differ fundamentally: international investors spend years analyzing large-scale projects using formal financial models; businesses calculate payback periods against production costs; and ordinary households make decisions based on neighbors' experiences and rough intuition. Treating them as a single population obscures more than it clarifies.

Second, observability is considerably more important than Rogers' original account acknowledged. Bollinger and Gillingham (2012) found that each additional solar installation in a given area increased the likelihood of a neighbor installing as well. Our research found that only 2% of surveyed urban households had seen a solar installation in their own neighborhood - insufficient density to generate word-of-mouth diffusion. Granovetter's (1978) threshold models help explain this: without crossing a critical mass threshold, adoption may stall regardless of how favorable the technology appears.

2.2 Theory of Planned Behavior and Procedural Knowledge

Ajzen's (1991) Theory of Planned Behavior (TPB) offers an important complement to Rogers' framework by examining the individual-level antecedents of behavioral intentions. According to this model, a person's intention to act depends on three factors: their personal attitude toward the behavior, their perception of social expectations, and their confidence in their own ability to carry it out. Research suggests the theory typically explains 40–50% of variance in intentions and 25-35% of variance in actual behavior.

Studies applying TPB to residential solar adoption consistently find that attitudes toward renewable energy are broadly positive - surveys commonly report 70-80% favorable responses - but that perceived behavioral control more strongly predicts actual adoption. Among Uzbek respondents, 68% were aware that residential solar was available and 54% expressed positive attitudes. Yet only 11% could describe how they would actually begin an installation. This gap points to a distinction between general confidence and what we term procedural knowledge: specific, step-by-step information about which office issues permits, which companies are certified, how financing works, and how long the process realistically takes.

This distinction has direct implications for campaign design. Slogans like 'Solar is easy - anyone can do it' may boost general confidence without telling people what they actually need to do. The most effective sequence is therefore likely to first build general confidence

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and then deliver concrete actionable guidance - an ordering that Uzbekistan's campaigns have largely reversed.

2.3 Stakeholder Theory and Communicating Across Multiple Audiences

Freeman's (1984) stakeholder theory holds that organizational success depends on the ability to simultaneously manage relationships with groups whose interests and priorities may differ substantially. Applied to government energy transition efforts, this means engaging actors as varied as major international investors and ordinary rural households - groups that differ fundamentally in how they gather information, assess risk, and make decisions.

Building on this foundation, and taking into account established differences between business and consumer marketing, we identify three distinct levels of renewable energy adoption, each with its own decision logic, timeline, and marketing requirements:

Table 1.

Stakeholder-Stratified Diffusion Framework

Tier	Decision-Makers	Decision Logic	Timeline	Core Marketing Requirements
Tier 1: Institutional	International investors, financial institutions	Risk-adjusted return, portfolio diversification	3-7 years	Technical-economic rationale, legal guarantees, transparent tender processes
Tier 2: Commercial	Domestic businesses, SMEs	Payback period, supply reliability	2-4 years	Financial modeling, success case studies, technical assistance
Tier 3: Household	Residential households, individual homeowners	Upfront cost, neighbors' experience, process simplicity	5-10 years	Simplified guidance, local demonstration cases, social proof

Note: Decision timelines are approximate and reflect typical rather than universal patterns. Actual timelines vary by project scale, financing structure, and local conditions.

The practical conclusion is straightforward: success at one tier does not automatically produce progress at another. Allocating marketing budgets in a way tailored to each tier can improve overall effectiveness without necessarily increasing total spending. This approach also helps explain patterns observed in Morocco, Vietnam, and South Africa - in each case, different tiers moved at different speeds and responded to different levers, exactly as the framework here would predict.

2.4 Investment Promotion Effectiveness and Nation Branding

A study covering data from 124 countries found that investment promotion agencies with qualified staff and adequate budgets increased foreign direct investment inflows by an average of 15-25%. Successful renewable energy investment destinations tend to share several common features: transparent competitive tender processes, completed flagship

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projects that serve as visible proof of concept, and consistent participation in major international energy events.

Nation branding theory examines how countries build reputational assets to compete for investment, skilled workers, and trade. In the context of attracting investment, credibility requires third-party validation: international credit ratings, multilateral financial guarantees, and endorsements from existing investors. Uzbekistan's regional competitors present a genuine positioning challenge. Kazakhstan offers a larger domestic market and a longer track record, making generic resource-abundance messaging insufficient for differentiation. Our perception data indicate that emphasizing reform momentum ('reform velocity' rather than resource quality) was associated with improved investor sentiment.

3. METHODOLOGY

3.1 Research Design

Data collection and analysis for this study were carried out in three sequential phases, following the mixed-methods approach proposed by Creswell and Clark (2017), with each subsequent phase building on the findings of the previous one.

The first phase (January-April 2023) involved time-series analysis of investment dynamics, installed capacity growth, and macroeconomic indicators spanning 2015-2025. Since the available data covers only seven to nine annual observations depending on the variable, the results of the econometric analysis are treated as indicative rather than definitive.

The second phase (May-August 2023) involved systematic content analysis of 812 promotional materials produced by government agencies and private sector participants between 2017 and 2024, supplemented by semi-structured interviews with fifteen experts.

The third phase (September 2023-February 2024) involved survey research across three stakeholder groups. The data collected were analyzed through descriptive statistics, logistic regression, and qualitative analysis of open-ended responses.

3.2 Data Collection

Secondary Economic Data

Investment and capacity figures were collected from multiple sources and cross-checked wherever possible, including government annual reports, IRENA, World Bank, Asian Development Bank, EBRD project databases, Climatescope (2018-2024), BloombergNEF industry data, and corporate disclosures. Data coverage is strongest for the period 2015-2023. Figures for 2024-2025 reflect contracted commitments rather than completed investments. Where sources provided conflicting figures, conservative estimates were applied.

Marketing Content Analysis

The 812 government promotional materials were organized into seven categories: government websites (n=156), social media posts (n=342), conference presentations (n=89), press releases (n=127), investor presentations (n=45), video materials (n=31), and international media coverage (n=22). Materials were coded independently by two researchers. Inter-rater reliability was assessed using Cohen's kappa on a 20% random subset: $\kappa=0.82$, indicating a high level of agreement.

Primary Survey Data

The international investor survey (n=45) drew from a sampling frame of 145 companies. The 31% response rate falls within the acceptable range for executive surveys. The domestic

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business survey (n=120) covered medium and large enterprises with annual electricity consumption exceeding 500 megawatt-hours, using stratified random selection from the State Committee on Statistics enterprise registry. The consumer survey (n=600) covered household heads across four urban areas: Tashkent (n=250), Samarkand (n=150), Bukhara (n=100), and Fergana Valley cities (n=100). Expert interviews (n=15) were conducted with Ministry of Energy staff, state investment promotion agency personnel, private sector marketing executives, international consultants, and academic researchers.

3.3 Analytical Approach

Investment data were analyzed to identify growth phases and approximate inflection points using segmented regression and the Chow test. Two regression models were estimated with appropriate caution. Model 1 (n=7, four predictors) is treated strictly as exploratory due to overfitting risk. Model 2 examined binary adoption intention among 600 household respondents using logistic regression, with predictors including awareness, perceived cost, procedural knowledge, social norms, and demographic controls. All Cronbach's alpha values exceeded 0.70, the threshold commonly applied in survey research (Nunnally, 1978).

4. RESULTS

4.1 Economic Performance (2015-2025)

Uzbekistan's renewable energy investment trajectory between 2015 and 2025 shows three distinct phases corresponding to identifiable policy and market changes.

Table 2.

Renewable Energy Investment Phases, 2015-2025

Phase	Period	CAGR (approx.)	Cumulative Investment	Key Characteristics
Emergence	2015-2017	~48%	USD 113 million	Modest public-sector pilots; currency inconvertibility deterring FDI
Acceleration	2018-2020	~50%	USD 365 million	First major FDI; tender frameworks; Masdar initial engagement
Scale-up	2021-2025*	~20%	USD 1,745 million	Large utility-scale projects; IFI co-financing; portfolio expansion

** 2024-2025 figures reflect signed agreements and government projections (contracted commitments, not completed investments).*

During the first phase (2015-2017), total investment reached USD 55 million in 2017, driven primarily by currency reform and early regulatory signaling. Private investment exceeded public investment for the first time in 2018. Masdar's initial interest in the Navoi region was announced in mid-2018 - approximately three months after the government intensified its Gulf-focused marketing efforts.

The acceleration phase saw the tender framework take effect with noticeable speed. Segmented regression confirms a structural break around 2019 (Chow test: $F=14.8$, $p<0.001$). The scale-up phase involved several large projects at 200+ megawatt scale. Installed capacity

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grew from approximately 70 MW in 2015 to approximately 800 MW by end of 2023, with projections exceeding this figure by 2025. Levelized costs for solar fell from roughly USD 85/MWh in 2015 to approximately USD 32/MWh by 2023 - a 62% reduction. Average winning bids in competitive auctions reached 2.66 US cents per kilowatt-hour in recent rounds.

4.2 Marketing Activity and Investor Outcomes

Table 3.

Government Marketing Expenditure by Phase, 2017-2025

Phase	Period	Annual Average (approx.)	Primary Channel Focus
Foundation	2017-2018	USD 175,000	International conferences (60%), digital (25%)
Competitive	2019-2020	USD 360,000	Events (50%), digital (30%)
Scale	2021-2023	USD 618,000	Digital (35%), events (40%)
Regional Hub	2024-2025*	USD 1,050,000	Digital (45%), events (30%)

** 2024-2025 figures are projected. All figures carry approximately ±25% uncertainty.*

Table 4.

Primary Sources of Awareness among Surveyed Investors (n=45)

Source	% of Respondents
International conferences/events	42%
Direct government outreach	24%
Industry publications	18%
Peer recommendations	11%
Online search/website	5%

Table 5.

Factors Influencing Investor Decision-Making (Mean Score 1-5)

Factor	Mean Score (1-5)	Rank
Regulatory clarity and contract sanctity	4.7	1
Resource quality (solar/wind)	4.6	2
Government responsiveness and professionalism	4.4	3
Competitive tariff/PPA pricing	4.3	4
Political stability	4.2	5
Existing project track record	4.0	6
Currency convertibility	3.9	7

Table 6.

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Investor Perception of Uzbekistan, 2019 vs. 2023

Perception Item	2019	2023	Change
'Transparent processes'	34%	68%	+34 points
'Reliable long-term partner'	29%	61%	+32 points
'Regional leader'	18%	43%	+25 points
'Improving but still risky'	71%	52%	−19 points
'Bureaucratic/difficult'	58%	31%	−27 points

Table 7.

Annual FDI Inflows, Marketing Spend, and Installed Capacity, 2017-2023

Year	FDI Inflow (USD million)	Marketing Spend (USD '000)	Installed Capacity (MW, cumulative)
2017	55	150	~90
2018	80	200	~120
2019	130	320	~175
2020	155	400	~240
2021	280	550	~390
2022	410	620	~590
2023	636	685	~800

Sources: Ministry of Energy annual reports, IRENA project database, BloombergNEF, author estimates. Marketing spend figures carry ±25% uncertainty.

Marketing expenditure and FDI inflows moved in the same direction throughout the period, with visible acceleration after 2019. The ranking of 'government responsiveness and professionalism' at third in investor evaluations is worth noting - it is directly shaped by how government representatives conduct themselves at conferences and bilateral meetings. Several investors described initial skepticism about Uzbekistan that was partially revised following positive interactions with Ministry of Energy officials. The perception shifts documented in Table 6 are larger than typically reported in country image research; annual movements of 5-10 percentage points are already considered substantial (Anholt, 2007). Changes of 32-34 points are more consistent with genuine policy reform than with messaging effects alone.

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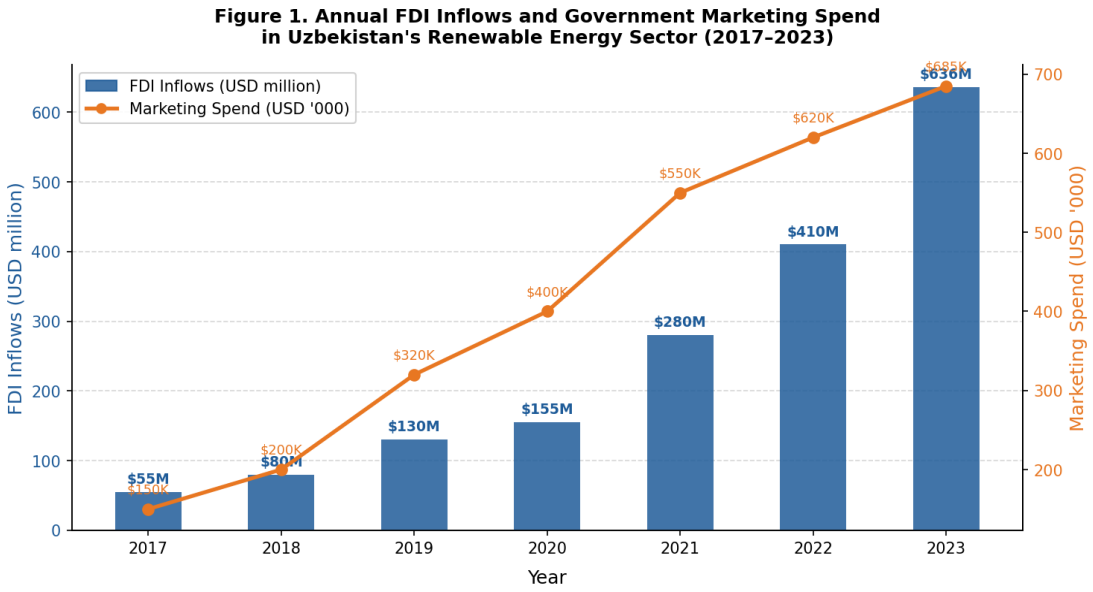


Figure 1. Annual FDI Inflows and Government Marketing Spend in Uzbekistan's Renewable Energy Sector (2017-2023)

4.3 Exploratory Regression: FDI Determinants

Model 1 must be interpreted strictly as an exploratory pattern identification exercise. With seven annual observations and four predictors, degrees of freedom equal two, and the results do not meet standard requirements for statistical inference. The adjusted R^2 falls from 0.89 to 0.67 once the parameter penalty is applied. These results are presented solely for transparency and to motivate future replication.

Table 8.

OLS Regression - FDI Determinants (Model 1, n=7, Exploratory)

Variable	Coefficient (β)	p-value	VIF
Marketing expenditure (t−1)	2.87	0.011	1.8
Policy quality index	3.42	0.008	2.1
Oil price (Brent crude)	0.18	0.342	1.4
Regional FDI (excl. Uzbekistan)	0.42	0.178	1.9

Note: R^2=0.89, Adjusted R^2=0.67, Durbin-Watson=2.14. All VIFs below 3.0. Given n=7, results should be treated as directional only.

The marketing coefficient (β=2.87, p=0.011) and the policy index coefficient (β=3.42, p=0.008) both reach conventional significance thresholds, while oil prices and regional FDI do not. This is consistent with qualitative evidence that policy reforms and targeted marketing jointly drove investment growth. The one-year lag structure for marketing expenditure is consistent with typical investment decision timelines of 12-18 months.

4.4 Domestic Business Survey

Among the 120 businesses surveyed, awareness was moderately high (58%), but actual adoption was minimal - approximately 7% had completed or seriously evaluated an installation. Capital requirements dominated stated barriers (68% rating as 'very important'), but procedural uncertainty (54%) and insufficient economic understanding

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(48%) both exceeded the 40% threshold. When asked to estimate payback periods for a hypothetical 100 kW installation, 23% could not provide any estimate; 41% estimated incorrectly by more than three years; and only 36% estimated reasonably accurately.

4.5 Consumer Survey: The Awareness-Adoption Gap

Table 9.

Consumer Awareness Funnel - Residential Solar (n=600)

Awareness Level	% of Respondents
Heard of residential solar energy	68%
Can explain basic functionality	41%
Aware of approximate costs	18%
Know how to initiate installation	9%

Table 10.

Residential Solar Adoption Intentions (n=600)

Adoption Intention	% of Respondents
Definitely plan to adopt within 3 years	2%
Probably will consider	11%
Might consider eventually	31%
Unlikely to adopt	34%
Definitely will not adopt	22%

Table 11.

Procedural Knowledge among Adoption-Interested Respondents (n=264)

Knowledge Item	% Correct
Can name a licensed installer in their city	6%
Knows which government office handles permits	4%
Accurate cost estimate (within ±30% of USD 8,000-15,000 range)	11%
Understands the grid connection process	8%

Table 12.

Logistic Regression - Predictors of Adoption Intention (n=600)

Predictor	β	Odds Ratio	p-value	Sig.	
Procedural Knowledge (0-8 scale)	0.67	1.95	<0.001	***	Strongest predictor
Homeownership (binary)	0.88	2.41	<0.001	***	Structural factor

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Predictor	β	Odds Ratio	p-value	Sig.	
Perceived Cost (affordability)	0.41	1.51	0.003	**	
Social Norms (5-point scale)	0.29	1.34	0.018	*	
Awareness (0-10 scale)	0.18	1.20	0.042	*	
Age (years)	−0.02	0.98	0.046	*	
Income (quintiles)	0.15	1.16	0.087	ns	
Education (years)	0.11	1.12	0.124	ns	

*Note: Nagelkerke R^2=0.47; classification accuracy=86.2%; Hosmer-Lemeshow χ^2=8.3, p=0.406. Significance: *** p<0.001, ** p<0.01, * p<0.05, ns = not significant.*

Each step down the awareness funnel represents a significant drop-off. The 2% near-term adoption intent against 68% awareness yields a gap of roughly 34:1 - among the widest documented for comparable technologies internationally. Procedural knowledge emerges as the strongest predictor of adoption intention (OR=1.95), substantially exceeding awareness (OR=1.20) and outpacing perceived cost (OR=1.51). Homeownership is the strongest single predictor overall (OR=2.41), as expected: renters rarely have authority to install permanent rooftop equipment.

5. DISCUSSION

5.1 Stakeholder-Stratified Diffusion

Comparing the results of all three surveys against the investment data reveals a striking divergence in how marketing efforts performed depending on the audience. Investor-facing marketing produced meaningful changes in both investment volumes and investor perceptions. Consumer-facing marketing generated awareness but failed to translate it into adoption. Domestic businesses fell somewhere in between. This is not a single diffusion process operating at different speeds - it is three parallel processes working through different mechanisms.

By 2023, signs were emerging that the potential investor pool was approaching saturation at roughly 60% penetration, implying diminishing returns on further investor-oriented spending. Domestic commercial adoption remained in early-adopter territory at around 5-7% penetration. Residential adoption had barely crossed the innovator threshold. For commercial enterprises, redirected resources should go toward financial modeling tools, implementation assistance, and verifiable case studies. For households, the required investment is in implementation infrastructure itself: one-stop guidance services, installer certification schemes, and simplified permitting.

5.2 Procedural Knowledge and the Awareness-Action Gap

Most government consumer-facing materials communicated that solar energy is available and beneficial. Almost none provided concrete procedural guidance: which installer to contact, how to obtain a permit, what grid connection involves, and how long the process takes. The binding constraint is not awareness - 68% of urban households already have it. The problem lies in actionability.

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Raising awareness from 68% to 80% through additional campaigns is unlikely to produce proportionate gains if procedural barriers remain unchanged. The marginal value of additional awareness investment is probably low. The marginal value of procedural simplification - reducing the permit process from six months to six weeks, creating an online installer registry, establishing a single point of contact - is probably substantially higher. This connects to a broader pattern in development economics: simplified information provision and reduced administrative friction have consistently increased uptake across a range of developing country contexts.

5.3 The Role of Marketing: Evidence and Limits

The exploratory regression analysis, combined with investor survey data and qualitative interviews, provides partial support for the view that marketing played an independent role beyond what policy reforms alone would predict. The marketing coefficient retains significance after controlling for the policy quality index. And 42% of investors cited conferences as their primary awareness source, with qualitative interviews consistently describing government engagement quality as a meaningful early signal of institutional credibility.

None of this constitutes causal proof. What the combined evidence supports is a more modest conclusion: that marketing activity was associated with FDI growth in ways consistent across multiple data sources and not fully explained by policy reforms alone. The reforms were necessary; marketing made them visible to an international audience that might otherwise have waited years before engaging.

5.4 Regional Comparisons and Alternative Explanations

Uzbekistan's compound annual growth rate of approximately 50% during 2017-2023 substantially exceeded both the global average (approximately 18%) and the Central Asian regional average (approximately 22%). Country-specific factors were operating beyond sector-wide momentum. Kazakhstan invested roughly five times more in renewable energy marketing and attracted approximately USD 4.2 billion in renewable FDI, versus Uzbekistan's approximately USD 1.75 billion - but on a per-dollar-of-marketing-spend basis, Uzbekistan achieved notably higher returns (approximately USD 597 vs. USD 279 FDI per marketing dollar), consistent with diminishing returns beyond a moderate threshold.

5.5 Limitations

The urban-only consumer sample is the most significant empirical limitation. Rural areas - comprising more than half of Uzbekistan's population - likely face more severe adoption barriers related to income constraints, infrastructure access, and information availability. The seven-year investment time series is too short for reliable parameter estimation. Marketing budget figures carry approximately ±25% uncertainty. Future research directions include: comparative studies across Morocco, Kenya, Vietnam, Chile, and South Africa; longitudinal household tracking to 2035; experimental tests of specific procedural knowledge interventions; and rural adoption studies.

6. CONCLUSION

This study examined Uzbekistan's renewable energy marketing strategies and outcomes across investor, business, and consumer segments between 2015 and 2025, combining time-series economic analysis, systematic content analysis of 812 promotional materials, and primary survey research with 765 respondents.

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Four findings warrant emphasis. Investor-facing marketing was associated with substantial investment growth and significant improvements in investor perceptions. Exploratory estimates suggest that marketing expenditure of approximately USD 5 million may have been associated with hundreds of millions in foreign direct investment, though attribution is uncertain. Conference participation appears to have been particularly effective as an early-phase mechanism. Consumer-facing marketing achieved widespread awareness - reaching approximately 68% of urban households - but was followed by residential adoption below 1%. Logistic regression shows that procedural knowledge predicts adoption intention approximately 60% more strongly than general awareness (OR=1.95 vs. 1.20), pointing to implementation barriers as the binding constraint. Domestic businesses fell between these extremes: reasonably informed, but unable or unwilling to convert.

These findings support a stakeholder-stratified view of energy transition dynamics. For Uzbekistan specifically, the priority is not more consumer awareness - which is already relatively high - but investment in implementation infrastructure: guidance centers, certified installer programs, and simplified documentation. For policymakers in other emerging markets, the Uzbekistan case raises a practical question worth asking before launching consumer campaigns: do households in your context know how to act on the information you are giving them? If not, building the infrastructure for action may need to come first.

7. POLICY RECOMMENDATIONS

7.1 For Uzbekistan

Near-term (2026): Establish pilot one-stop service centers in Tashkent, Samarkand, and Bukhara, providing free residential solar consultations, licensed installer referrals, permitting support, and financing guidance. Comparable programs in India, Bangladesh, and Kenya have been associated with residential adoption increases of five to ten times baseline in pilot areas within two years. Estimated cost: approximately USD 400,000 over two years.

Regulatory measure: Require all solar equipment sellers to provide complete permitting assistance as a condition of market access licensing. This shifts procedural burden from households to commercial actors better positioned to manage it. Estimated development cost: approximately USD 50,000; expected effect: installation timeline reduction from six-nine months to two-three months.

Peer ambassador program: Recruit 30-40 early adopters to serve as paid community advocates sharing installation experiences through community presentations and local media. Estimated cost: USD 50,000 annually, with projected reach of 40,000-60,000 households.

Maintain investor marketing: The international investor pipeline requires sustained presence at major events and continued relationship management with existing partners. Reducing investor marketing to redirect funds toward consumer programs would be a mistake; both tiers need appropriately differentiated attention.

7.2 For Emerging Markets Generally

Four practical lessons emerge for policymakers in other emerging markets. First, aggregate adoption metrics should be disaggregated by stakeholder tier - investor, commercial, and residential - each tracked against realistic timelines. Second, substantive reforms must precede intensive marketing: currency convertibility, transparent

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procurement, and contract enforcement need to be credibly in place before being promoted internationally. Third, consumer budgets are better directed toward procedural simplification, installer certification, and financing facilitation than toward additional awareness campaigns. Fourth, residential energy transitions operate on longer horizons than investor transitions, and evaluation criteria must be calibrated accordingly.

ETHICS AND DECLARATIONS

Ethics Statement

This study was conducted in accordance with ethical guidelines for social science research. All survey participants provided informed consent prior to participation and were assured of anonymity. Audio recording of expert interviews was conducted only with explicit consent; two respondents who declined recording were represented through detailed contemporaneous notes. The study protocol was reviewed and approved by the Tashkent State University of Economics Research Ethics Committee (Reference No. TSUE-2023-087).

Conflict of Interest

The author declares no conflict of interest. The research grant (No. UZ-ENERGY-2024-001) from the Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan did not influence data collection, analysis, interpretation, or publication decisions.

Data Availability Statement

The survey data that support the findings of this study are not publicly available due to participant confidentiality agreements. Secondary data from IRENA, World Bank, and Ministry of Energy sources are publicly accessible through the organizations' official websites. Requests for anonymized aggregate data may be directed to the corresponding author at abdullohikrombekov00@gmail.com.

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