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Perceptions and conditions for sustainable energy and tourism development in Bali's villages, Indonesia

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Abstract

Purpose - This study aims to examine community-level conditions and perceptions related to sustainable energy and tourism development in four Balinese villages—Banjarasem, Blimbingsari, Bongan, and Bantas. It seeks to identify how local demographics, economic sectors, and attitudes toward renewable energy influence sustainable rural development.

Methodology/Design/Approach - Using community-level survey data, the study analyzes local perspectives on tourism engagement, renewable energy preferences, energy stability, financial considerations, and the perceived importance of green areas. Descriptive and comparative analyses were conducted to reveal trends and contextual differences among the four villages.

Findings - Results show a strong community interest in adopting renewable energy, particularly Solar PV, though cost and limited technical understanding remain major barriers. Energy instability affects both public facilities and productive sectors such as agriculture and tourism. Despite these challenges, residents express a willingness to pay more for green energy and show interest in accessing credit facilities to support sustainable initiatives.

Originality/Value - This study provides empirical insights into the intersection of rural energy transition and tourism development in Bali. By integrating community-level perceptions with sectoral energy needs, it offers valuable input for public administration strategies that aim to design inclusive, context-sensitive policies for sustainable rural transformation.

Keywords: Rural Development, Sustainable Energy, Renewable Energy, Tourism, Community Perception, Public Administration

Introduction

Rural development in regions like Bali, Indonesia, presents complex challenges, requiring integrated approaches that balance economic growth, environmental sustainability, and social well-being (Paramitha, 2024; Sutawa, 2012). Two critical sectors often central to such development are energy and tourism. The transition to sustainable energy sources is vital for environmental protection and energy security, while tourism, a significant economic driver in Bali, necessitates reliable energy infrastructure and community participation for long-term viability (Daniarta & Farasi, 2015; Arifin et al., 2022; Astawa & Sudibia, 2021; Nugraha et al., 2024; Suarta et al., 2022). Understanding local conditions, community perceptions, and specific needs is paramount for effective public administration and policy implementation (Nugraha et al., 2024; Suarta et al., 2022; Rizkikaddhuhani & Bratayasa, 2023).

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This study examines survey data from four villages – Banjarasem, Blimbingsari, Bongan, and Bantas – to shed light on these factors, informing potential public administration interventions in sustainable energy and tourism development (Nugraha et al., 2024). The objective is to synthesize the provided data excerpts to describe the current state and community outlook regarding these interconnected sectors within the surveyed villages.

Method

This study utilizes descriptive data obtained from excerpts of a survey document titled "data-desa.pdf". The data represents responses collected from individuals in four distinct villages: Banjarasem (n=34), Blimbingsari (n=37), Bongan (n=41), and Bantas (n=26). The survey instrument, as presented in the excerpts, covered various aspects including: Demographic information (gender, education level, age), Roles within the village structure and occupation, Tourism awareness and participation, homestay ownership and willingness to modify rooms for healthy homestay standards, Awareness and potential of renewable energy sources (water, wind, solar, livestock waste, organic waste), Participation and barriers in energy development, Preferences for specific renewable energy technologies (like Solar PV), Current energy sources and stability issues affecting public facilities and productive sectors, Energy needs for businesses and household energy costs, Awareness and impact of energy subsidies, Perceived additional energy needs, Dominant economic sectors and their energy requirements, Perceived economic opportunities from renewable energy, Preferences for Solar PV installation models (rooftop vs. utility-scale), Willingness to pay for Solar PV installation and desired credit terms, and preferred credit institutions, Community reception to renewable energy programs and potential implementation barriers (cost, lack of understanding, maintenance, village politics, adat traditions), History of energy incentives and inter-agency collaboration on energy development, Preferences for electricity sources (private solar vs. utility/company managed solar farm). Land and building sizes, and presence and perception of green areas. The analysis involves extracting and presenting the reported frequencies and percentages for each question across the four villages as documented in the provided source material.

Results

Demographics and Village Roles

The surveyed populations across the four villages showed variations in gender distribution, educational attainment, and age profiles. In Banjarasem (n=34) and Bongan (n=41), males constituted the majority (73.53% and 73.08% respectively), while Blimbingsari (n=37) and Bantas (n=26) had a more balanced split, with males at 59.46% and 59.46%, and females at 40.54% and 40.54% respectively. Educational backgrounds varied, with SMA/SMK being the most common highest level across villages, although Blimbingsari showed a higher percentage of Sarjana/Diploma holders (40.54%) compared to others (Banjarasem 8.82%, Bongan 38.46%, Bantas 19.23%). The dominant age group (>45 years) represented over half the respondents in Banjarasem (58.82%), Blimbingsari (64.86%), Bongan (48.8%), and Bantas (34.62%). Respondents held various roles, with "General Community" being the largest group in Blimbingsari (48.65%) and Bongan (46.15%), while Banjarasem and Bantas had larger proportions involved in village governance roles like 'Aparat Pemerintah Desa' (29.41%) and 'Pengurus Organisasi Desa' (38.24%) respectively. Key occupations included private employees, farmers/gardeners/fishermen, and housewives, with variations in their prevalence across villages.

Tourism Awareness and Participation

Awareness of the village being a tourism destination varied significantly, indicating diverse local perceptions of tourism development (Astawa & Sudibia, 2021; Dewi, 2020). As shown in Figure 2, In Blimbingsari, 100% of respondents were aware, compared to only 44.12% in Banjarasem. Bongan reported 100% awareness, and Bantas 84.62%. Participation in tourism development was high in Blimbingsari (86.49%) and Bongan (90.24%), moderate in Banjarasem (64.71%), and also high in Bantas (88.46%) (Suarta et al., 2022). Interest in making homes into homestays was low in Banjarasem (38.24% said Yes) and Blimbingsari (40.54% said

Yes). Bongan showed higher interest (60.98% said Yes), while Bantas was lower (34.62% said Yes). Willingness to modify rooms to meet healthy homestay standards was split in Banjarasem (50% Yes, 50% No). Blimbingsari (45.95% Yes), Bongan (29.27% Yes), and Bantas (11.54% Yes) showed lower willingness to modify. Actual homestay ownership was very low across all villages, ranging from 2.94% in Banjarasem to 13.51% in Blimbingsari.

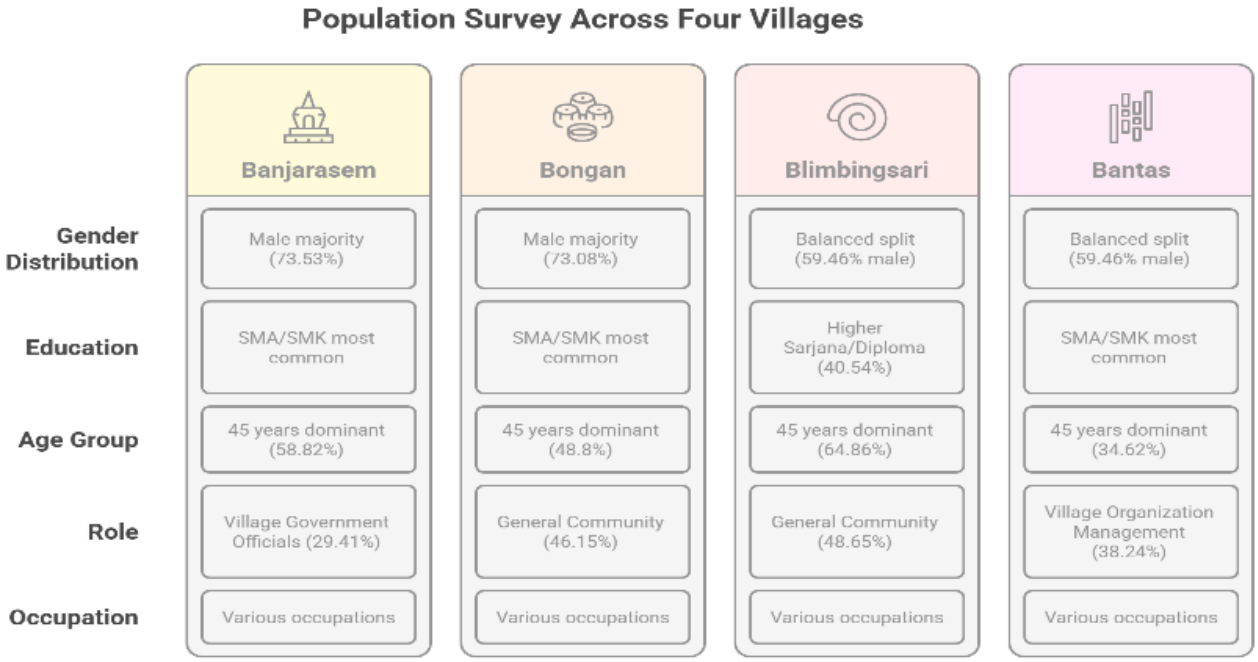

Figure 1. Demographics and Village Roles. Source: Authors field work, 2025

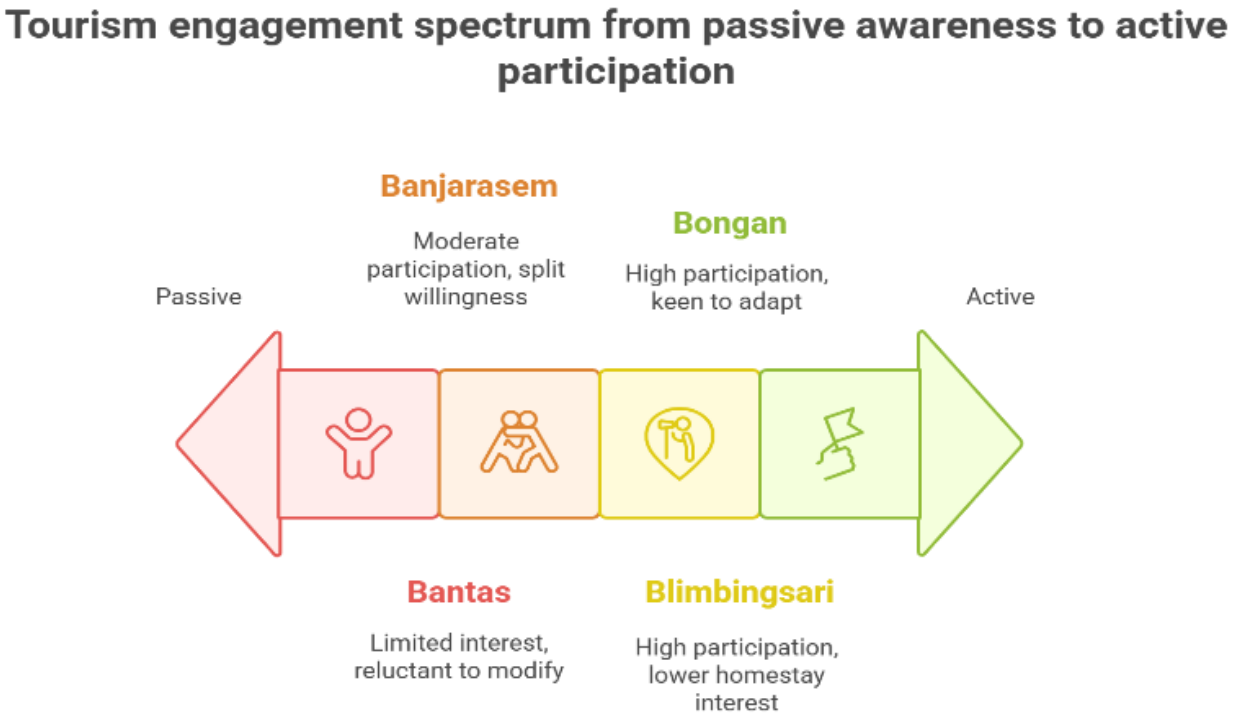

Figure 2. Tourism Awareness and Participation. Source: Authors field work, 2025

Renewable Energy Potential and Preferences

As shown in Figure 3, Awareness of the village having potential renewable energy sources (water, wind, solar, livestock waste, organic waste) was present in the majority of respondents: Banjarasem (64.71%), Blimbingsari (59.46%), Bongan (70.73%), and Bantas (57.69%). Sunlight was consistently identified as the most abundant and potential renewable resource across all villages (Arifin et al., 2022): In Figure 4, Banjarasem (50%), Blimbingsari (62.16%), Bongan (56.1%), and Bantas (84.62%). Water was the second most cited resource in Banjarasem (23.53%) and Bongan (19.51%). Regarding preferred renewable energy technology, Solar PV (Panel Surya) was the overwhelming choice in Banjarasem (76.47%) and the most selected in Blimbingsari (48.65%), Bongan (60.98%), and Bantas (73.08%). Other technologies like Biogas and Biomass received limited support, and Hydro and Wind Turbines received almost none.

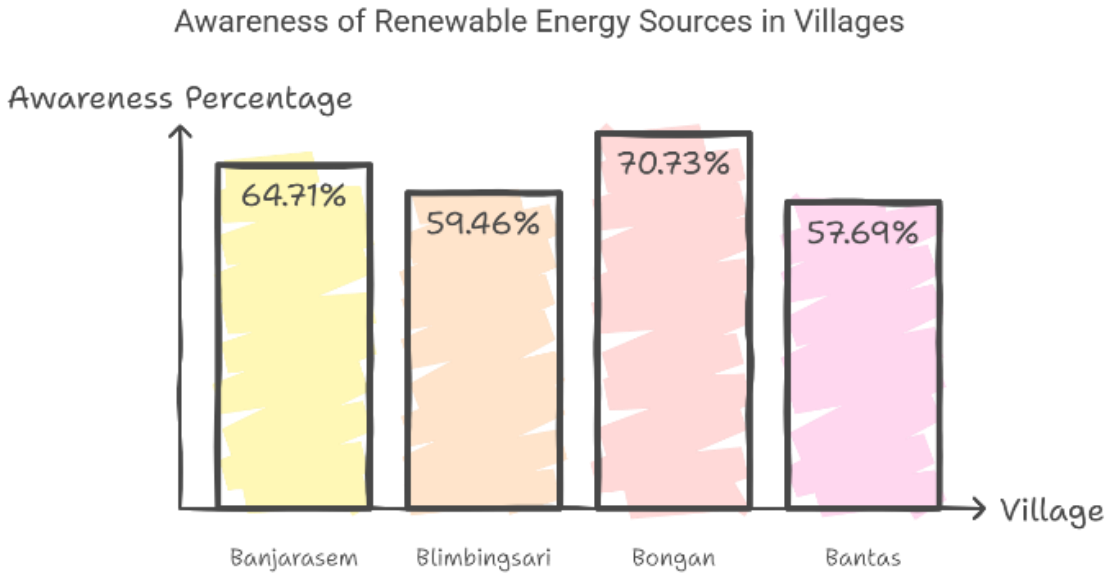

Figure 3. Awareness of renewable energy sources. Source: Authors field work, 2025

Willingness to pay more for environmentally friendly energy was high (Arifin et al., 2022): Banjarasem (67.65%), Blimbingsari (67.57%), Bongan (75.61%), and Bantas (61.54%). Participation in village energy development varied, with high participation in Banjarasem (85.29%) and Bongan (70.73%), but lower in Blimbingsari (56.76%) and Bantas (57.69%). Perceived barriers to participation in energy development existed for a notable portion of respondents (Torro et al., 2024): Banjarasem (38.24%), Blimbingsari (54.05%), Bongan (53.66%), and Bantas (46.15%). The specific barriers anticipated for renewable energy programs included high cost, lack of community understanding, maintenance issues, village politics, and adat traditions, with high cost and lack of understanding frequently cited.

As shown in Figure 5, Interest in installing Solar PV for homes or homestays was high in Banjarasem (76.47%) and Blimbingsari (64.86%). Bongan (70.73%) and Bantas (57.69%) also showed significant interest. Preferences for Solar PV installation varied: Banjarasem favored private rooftop panels (38.24%) over utility/company managed solar farming (20.59%), while Blimbingsari strongly preferred utility/company managed solar farming (40.54%) over private panels (13.51%). Bongan showed a strong preference for utility/company managed systems (63.41%), whereas Bantas respondents were more split, slightly favoring utility/company managed systems (57.69%).

Energy Stability and Needs

The primary energy source currently used is PLN electricity, reported by almost all respondents across all villages. Figure 6 shown, while most facilities were reported to have stable electricity in Banjarasem (91.18%) and Blimbingsari (97.3%), a significant portion of respondents across all villages reported experiencing disruptions due to unstable energy supply: Banjarasem (41.18%), Blimbingsari (56.76%), Bongan (48.78%),

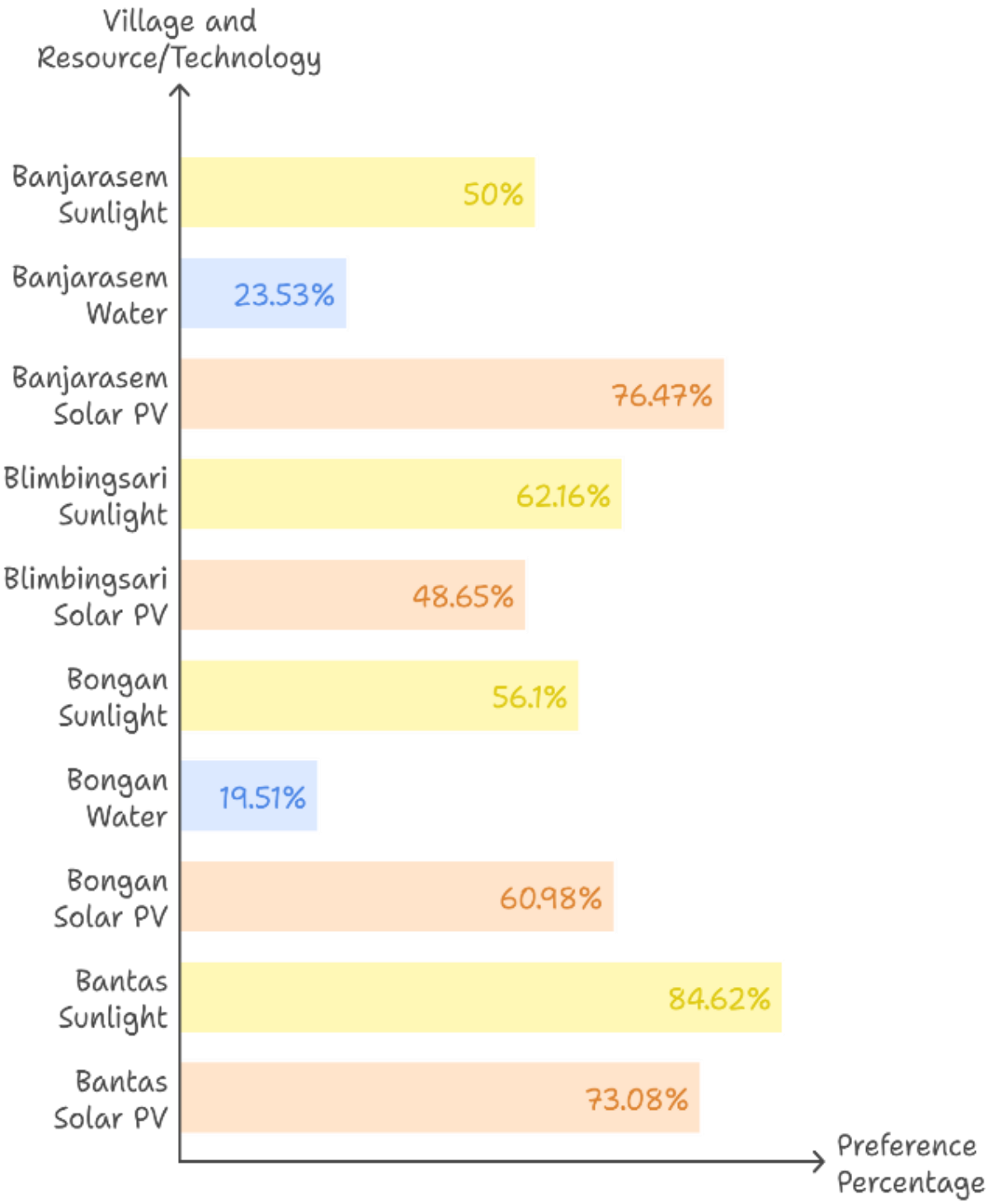

Figure 4. Renewable resources & Preference Technology. Source: Authors field work, 2025

and Bantas (50%). Specific public facilities needing sufficient energy supply included small roads/alleys, main roads, and village markets, varying by village. The dominant energy needed for business activities was electricity. Estimates of additional energy needed for public facilities and productive sectors varied, but a substantial portion in all villages indicated needing 30% or more increase: Banjarasem (82.36% needing >30%), Blimbingsari (75.67% needing >30%), Bongan (80.49% needing >30%), and Bantas (76.92% needing >30%).

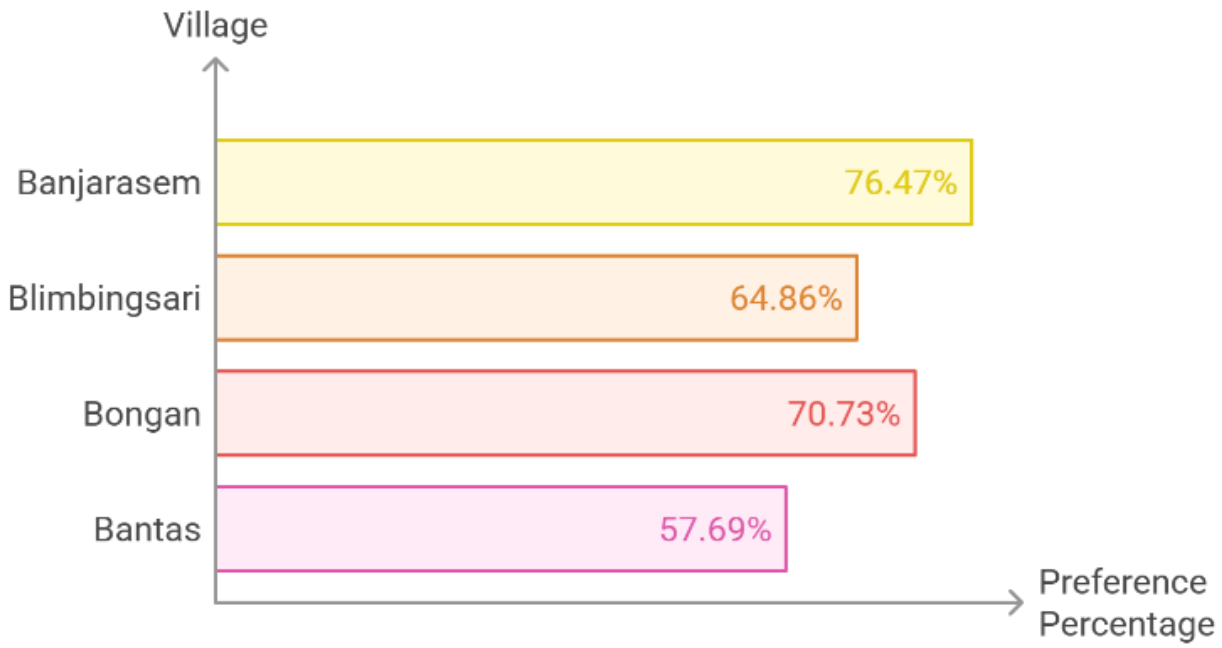

Figure 5. Preferences for Solar PV Installation by Village. Source: Authors field work, 2025

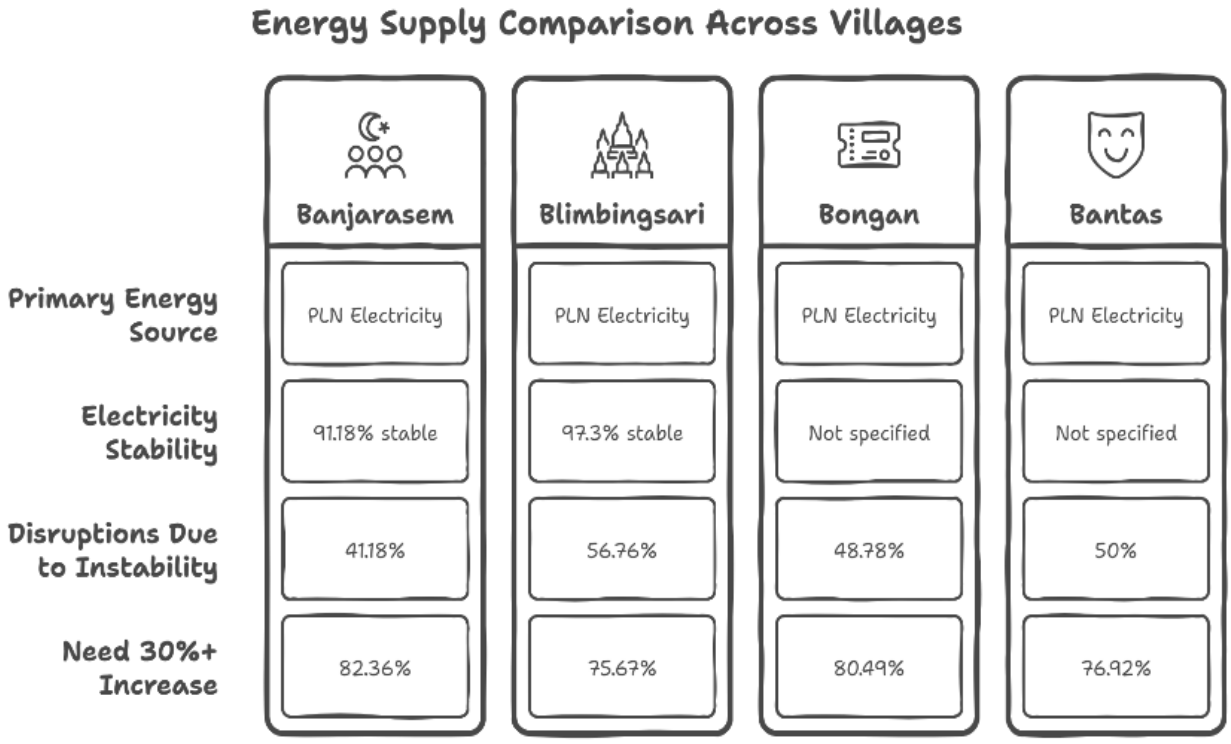

Figure 6. Stability and Needs. Source: Authors field work, 2025

Economic Sectors and Energy Requirements

Agriculture was identified as the leading economic sector in Banjarasem (73.53%) and Bongan (97.56%), while Blimbingsari cited Agriculture (83.78%) and Tourism (10.81%). As shown in Figure 7, Bantas primarily identified Agriculture (69.23%), followed by Tourism (15.38%). A large majority in Banjarasem (79.41%) and Blimbingsari (62.16%) reported that these sectors require significant energy. Bongan (65.85%) and Bantas (76.92%) also indicated significant energy needs for their key sectors.

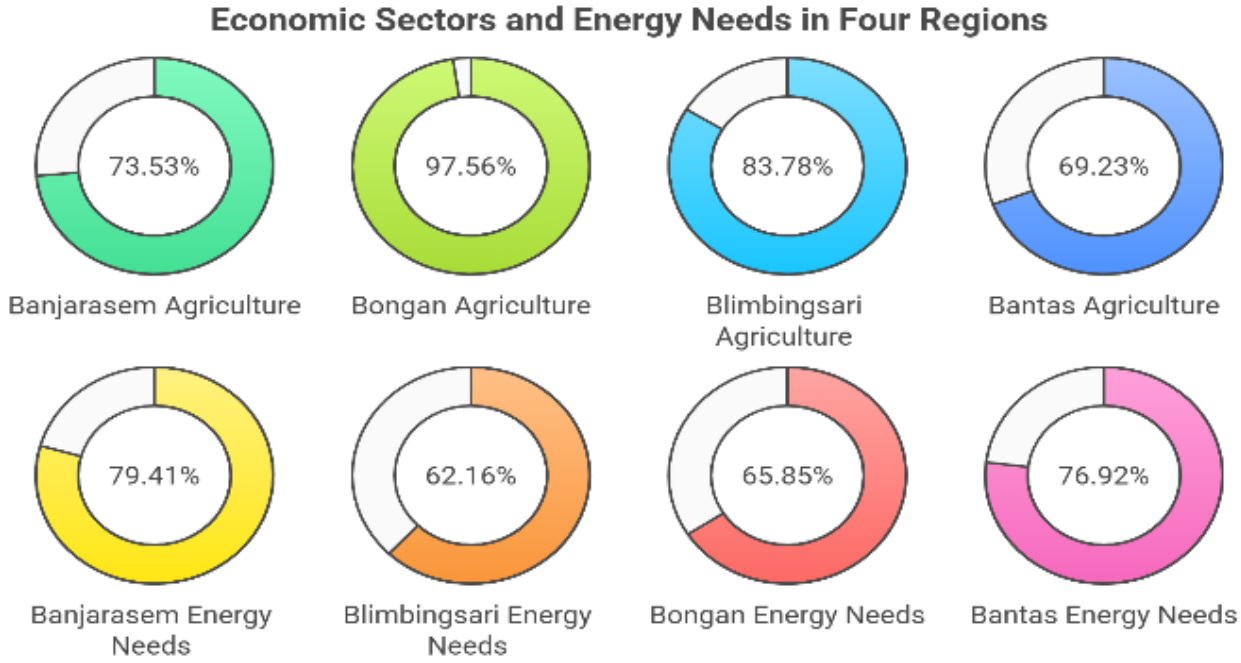

Figure 7. Economic Sectors & Energy Needs. Source: Authors field work, 2025

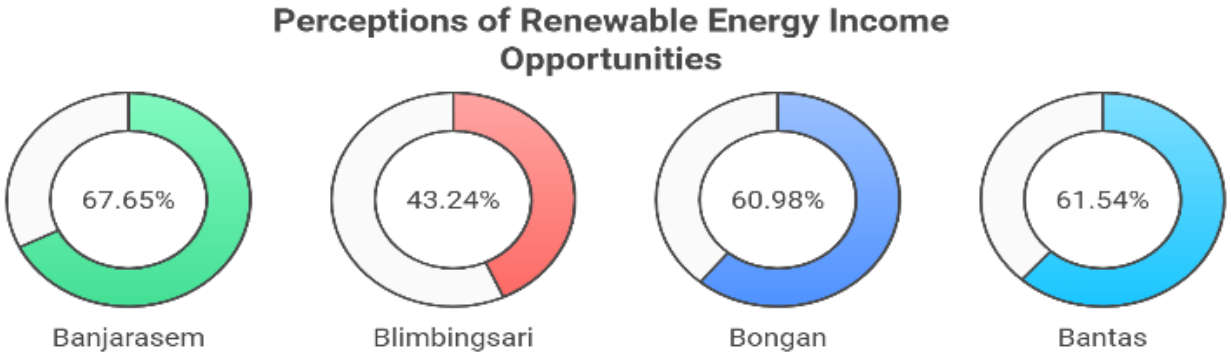

Figure 8. Economic Sectors & Energy Needs. Source: Authors field work, 2025

As shown in Figure 8, Perceptions of opportunities to increase income from renewable energy usage were mixed but leaning positive: Banjarasem (67.65% Yes), Blimbingsari (43.24% Yes), Bongan (60.98% Yes), and Bantas (61.54% Yes). Estimations of potential additional monthly income varied, with many respondents in Blimbingsari, Bongan, and Bantas reporting "Tidak tahu" (Don't know). In Banjarasem, the highest estimated income range with responses was < Rp850.000 (8.82%).

Financial Considerations

Average monthly household energy costs predominantly fell below Rp500.000 in Banjarasem (88.24%), Blimbingsari (83.79%), Bongan (87.8%), and Bantas (65.39%). As shown in Figure 9, a notable percentage in Blimbingsari paid Rp170.000–500.000 (56.76%), and Bantas had a higher percentage paying over Rp500,000. Awareness of energy subsidies varied, but a large majority in Blimbingsari, Bongan, and Bantas reported receiving them. The impact of subsidies was most often described as "Slightly helpful" or "Reducing significant burden".

If provided with credit facilities, a large majority across all villages were interested in utilizing them: Banjarasem (91.18%), Blimbingsari (91.89%), Bongan (90.24%), and Bantas (84.62%). The preferred

monthly installment amount that would not be burdensome was predominantly below Rp500.000. The preferred institutions for receiving credit were banks in Banjarasem (64.71%), Blimbingsari (37.84%), and Bongan (65.85%), while Bantas showed a stronger preference for cooperatives (35.14%), almost equal to banks (37.84%).

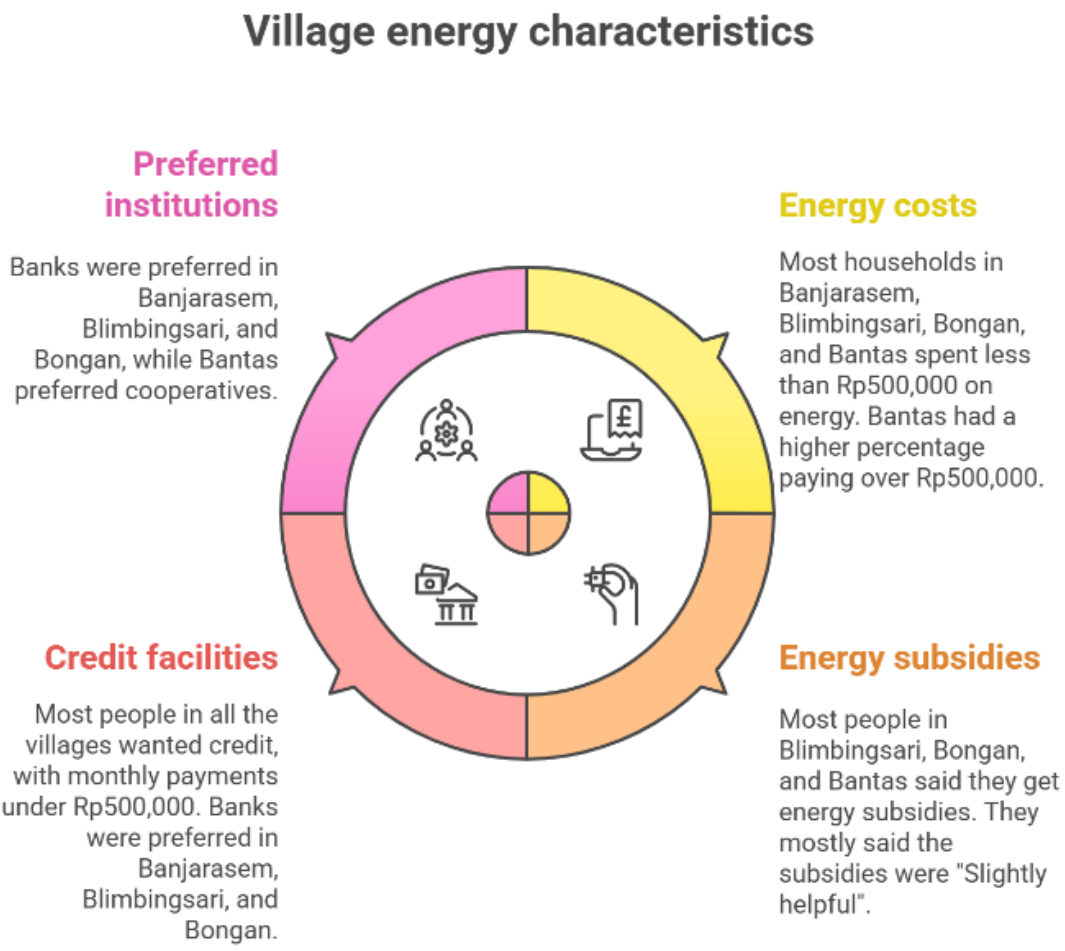

Figure 9. Village Energy & Financial outlook. Source: Authors field work, 2025

Green Areas

All villages reported having agricultural land, social forests, community gardens, or green open spaces. As shown in Figure 9, the perception of the size of these green areas varied by village, from "Starting to decrease" in Banjarasem (47.06%) and Bongan (46.67%) to "Sufficient" or "Large" in Blimbingsari and Bantas. The existence and function of green areas were considered "Very Important" by a large majority across all villages.

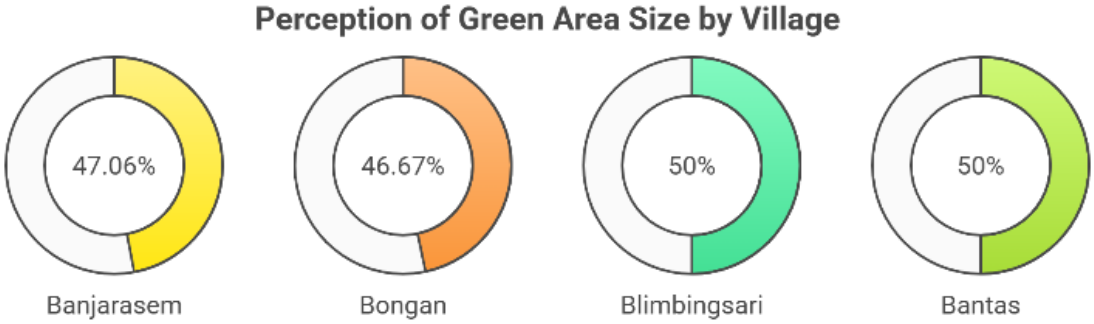

Figure 9. Decreasing Green Areas. Source: Authors field work, 2025

Discussion

The survey data from the four villages offers crucial insights for public administration concerning sustainable energy and tourism development in rural Balinese contexts.

Firstly, the findings underscore a significant public interest and perceived potential for renewable energy, particularly solar power, across all surveyed villages. This aligns well with global and national pushes towards energy transition (Arifin et al., 2022; Daniarta & Farasi, 2015; Torro et al., 2024). From a public administration perspective, this indicates a receptive environment for policy interventions aimed at promoting renewable energy adoption (Nugraha et al., 2024; Budiartha et al., 2022).

However, the data also highlights critical barriers, primarily the high cost of technology and a lack of public understanding. These are classic market and information failures that justify government intervention through subsidies, incentives, and educational programs (Torro et al., 2024). The strong stated willingness to pay more for environmentally friendly energy, coupled with interest in credit facilities and preferences for specific credit institutions like banks and cooperatives, suggests that financial mechanisms and awareness campaigns are essential policy tools (Arifin et al., 2022). Public administrators should explore designing credit schemes, potentially leveraging local financial institutions, and implementing targeted education initiatives to address these barriers.

Energy stability emerges as a practical concern, affecting not only households but crucially, public facilities and productive sectors. The expressed need for increased energy supply for public and productive activities reinforces the urgency of improving energy infrastructure (Darmana & Koerniawan, 2019; Pramana, 2021). Decentralized renewable energy solutions, such as Solar PV systems, could be integrated not just for household use but also to enhance the resilience and reliability of energy supply for key community assets and economic activities (Daniarta & Farasi, 2015; Arifin et al., 2022), which aligns with the public administration goal of providing essential services and supporting local economies.

The identification of agriculture and tourism as leading economic sectors that require substantial energy provides a clear focus for energy development programs. Policies and programs can be designed to specifically support these sectors, potentially improving productivity and sustainability (Putra et al., 2022; Novianti, 2021; Sasrawan Mananda & Sudiarta, 2024). The perceived opportunity for additional income from renewable energy suggests potential for programs that enable energy-based micro-enterprises or reduce operational costs for existing businesses (Darmana & Koerniawan, 2019).

The community's varied preferences for Solar PV installation models (private rooftop vs. utility/company managed solar farms) indicates that a one-size-fits-all approach may not be optimal. Public administrators should consider offering flexible program designs that cater to different community preferences and capacities, potentially involving both individual incentives and larger-scale, collaboratively managed projects (Arifin et al., 2022; Torro et al., 2024).

Finally, the strong value placed on green areas, alongside the presence of potential biomass resources like livestock and organic waste, suggests opportunities for integrating energy policy with environmental and agricultural strategies. Policies could encourage the use of organic waste for biogas production, offering synergistic benefits for waste management, sanitation, and energy supply (Daniarta & Farasi, 2015).

Although there are several good things that can be obtained from this study, this study also has limitations. This study is based solely on provided excerpts from a single survey, limiting the depth of analysis and generalizability of findings beyond these specific villages. A full understanding of the survey methodology, sampling strategy, and the complete dataset would allow for more robust conclusions. The interpretations here are confined to the information presented in the provided text.

Conclusion

The data from Banjarasem, Blimbingsari, Bongan, and Bantas underscores a strong local inclination towards renewable energy adoption, particularly Solar PV, driven by the abundance of sunlight and community willingness to support environmentally friendly energy (Arifin et al., 2022; Torro et al., 2024). However, significant financial constraints and knowledge gaps present key implementation challenges (Torro et al., 2024). Energy stability is a crucial issue affecting essential services and economic activities, highlighting the

need for improved infrastructure, potentially through decentralized renewable systems (Darmana & Koerniawan, 2019). Agriculture and tourism, as dominant economic sectors, require significant energy input and offer potential avenues for integrating renewable solutions that could also yield economic benefits (Putra et al., 2022; Novianti, 2021). For public administration, these findings emphasize the necessity of developing comprehensive, community-informed policies and programs that prioritize financial accessibility (e.g., credit, subsidies), capacity building (education, training), and flexible technology deployment models to effectively harness the potential for sustainable energy and tourism development in these Balinese villages (Nugraha et al., 2024; Budiartha et al., 2022; Sasrawan Mananda & Sudiarta, 2024; Suwena & Arismayanti, 2017). Leveraging existing collaborative structures and local financial institutions will be key to successful implementation (Novianti, 2021; Arifin et al., 2022).

Acknowledgment
Not applicable.

Declaration
Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Availability of data and materials
The data supporting the findings of this study are available upon request.

Competing interests
The authors declare that there is no conflict of interest regarding this work.

Declaration of generative AI and AI-assisted technologies
During the preparation of this work the author used Grammarly in order to correct spelling mistakes and help me make better sentences. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Author contributions
DKH, and DSP Conceptualization, Methodology, Investigation, Writing – original draft. JWN and DNCPData curation, Formal analysis, Validation, , Supervision.

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Publisher Notes