

Who benefits from the green transition? energy justice and community ownership in rural renewable energy initiatives

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ABSTRACT

Background: Rural renewable energy initiatives are increasingly central to Indonesia's green transition, yet their social value depends on whether benefits, costs, decisions, and ownership responsibilities are distributed fairly among community members. **Objective:** This community engagement program aimed to strengthen energy justice and community ownership in Desa Andungbiru by mapping local energy benefits, preparing participatory governance tools, and supporting community-led monitoring of renewable energy use. **Method:** Methodologically, this program combined participatory planning, climate and energy literacy orientation, citizen science training, community observation, validation forums, micro-adaptation mentoring, and monitoring-evaluation involving village authorities, energy managers, women's groups, youth, farmers, and productive users. **Results:** Planning activities produced partner coordination records, needs assessment tools, stakeholder maps, justice-oriented instruments, a monitoring schedule, and a reflection forum design. Implementation activities documented orientation activities, citizen observation practices, reporting templates, validation meetings, community reflection, and small-scale action plans for productive and household energy use. **Implication:** Monitoring-evaluation activities reviewed participation, assessed capacity indicators, audited data quality, validated community findings, and drafted sustainability mechanisms for continued local oversight. **Novelty:** The novelty of this program lies in reframing rural renewable energy assistance beyond infrastructure delivery alone as a community-owned energy justice audit that integrates local knowledge, citizen-generated data, transparent governance, and adaptive capacity collectively for villages.

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1. INTRODUCTION

Indonesia's green transition is no longer a distant policy agenda; it is entering rural spaces where energy poverty, uneven development, and local resource governance intersect. The 2025–2034 national electricity plan targets 69.5 GW of additional generation, with 76% planned from renewable energy and storage [1]. Yet national ambition does not automatically produce local justice. In Kabupaten Probolinggo, official statistics record 16.31% poverty, an HDI of 71.65, and open unemployment of 2.92% in 2025, showing that energy access must be linked to livelihood security [2]. Desa Andungbiru, Tiris, offers a strategic site: a mountainous village of about 5,800 residents, at 700–1,200 meters above sea level, with

coffee production reported at up to 700 tons per year. This community engagement program is crucial because renewable energy is also about who controls, pays for, maintains, and benefits from transition.

Recent literature has shown that renewable energy communities can improve access, social acceptance, and local economic participation when governance, benefit-sharing, and ownership are designed inclusively. Studies on energy poverty and transition demonstrate that clean energy affects health, productivity, education, and welfare outcomes, particularly in rural areas [3] (Zhang et al., 2023). Research on renewable energy communities further stresses community ownership, procedural justice, and distributive benefits as conditions for durable acceptance [4], [5], [6]. Indonesian evidence also indicates that rural energy systems can generate socio-economic gains, as shown in the solar water-pumping case examined by Rahmani et al. (2021) [7]. However, much previous work still emphasizes technical installation, project acceptance, or policy incentives, while less attention is given to community-led auditing of benefits after systems operate. This community engagement program addresses this gap by treating villagers as evaluators, co-designers, and co-owners of energy justice.

This community engagement program asks a practical and ethical question: who benefits from rural renewable energy, and how can community ownership make this benefit more transparent, inclusive, and sustainable? The immediate community problem is not merely the presence or absence of electricity, but the uneven distribution of energy-related capabilities. Some households may gain lighting and appliance access, while others may gain productive advantages for coffee processing, small workshops, tourism services, or irrigation. At the same time, women, poorer households, youth, and marginal users may remain under-represented in tariff decisions, maintenance planning, and complaint mechanisms. This program therefore pursues three linked objectives: first, to map energy benefits and burdens through participatory baseline assessment; second, to strengthen local governance through transparent reporting, maintenance logs, and deliberative forums; and third, to support productive energy use for rural livelihoods. Methodologically, this program combines participatory action, energy justice assessment, and community ownership design.

The central argument of this community engagement program is that a green transition becomes socially meaningful only when rural communities can convert renewable infrastructure into fair capabilities, accountable institutions, and locally retained value. Energy justice scholarship warns that low-carbon transitions may reproduce inequality when participation is symbolic, benefits are captured by dominant actors, and burdens are transferred to less powerful groups [8], [9], [10]. A gender-sensitive perspective is also necessary because local energy projects often overlook the differentiated roles of women in household energy use, care work, and small-scale enterprise [11]. This program is expected to produce measurable changes: a village-level energy justice baseline, a community ownership roadmap, operational procedures for transparent management, and a monitoring model that records complaints, maintenance, tariffs, and productive uses. Its broader implication is to shift community service from technology delivery toward democratic energy governance.

2. METHOD

This community engagement program was designed as a participatory energy justice intervention in Desa Andungbiru, Kecamatan Tiris, Kabupaten Probolinggo, involving village government, community energy managers, women's groups, youth representatives, farmer groups, and small rural enterprises. Planning was grounded in the assumption that renewable energy infrastructure becomes socially valuable only when local users can identify benefits, burdens, decision-making channels, and ownership responsibilities. Following energy justice and renewable energy community scholarship, this program positioned villagers not as passive beneficiaries but as co-assessors and co-designers of rural energy governance [4], [5], [10].

This program used a participatory action design that connected planning, implementation, and evaluation. Needs assessment focused on four dimensions: distributive justice, procedural justice, recognition justice, and productive energy use. Distributive justice examined who received energy benefits and who carried costs. Procedural justice assessed participation in tariff, maintenance, and complaint decisions. Recognition justice identified whether women, poorer households, youth, and peripheral users were represented. Productive use explored how renewable electricity supported coffee processing, home industries, tourism, irrigation, and village services. This design followed studies showing that renewable energy communities require transparent governance, inclusive ownership, and locally meaningful benefits to avoid reproducing inequality [6], [12].

Table 1. Planning activities for community-based rural renewable energy justice program

Stage	Activity	Participants	Method	Output
Initial coordination	Meeting with village authority and energy managers	Village officers, PLTMH managers, university team	Consultation	Shared agenda
Stakeholder mapping	Identifying users, managers, vulnerable groups	Village cadres, PKK, youth, farmers	Participatory mapping	Actor map
Baseline design	Preparing survey and interview instruments	University team and local partners	Instrument workshop	Baseline tools
Socialization	Introducing energy justice and ownership issues	40–60 villagers	Public forum	Common understanding
Energy-use mapping	Mapping household and productive energy use	Households, MSMEs, farmers	Survey and FGD	Energy-use profile
Governance mapping	Reviewing tariff, maintenance, and complaint systems	Energy managers and users	Document review	Governance matrix
Strategy formulation	Designing intervention priorities	All partners	Deliberative workshop	Action roadmap
Monitoring preparation	Preparing indicators and reporting formats	Local cadres	Technical assistance	Monitoring template

Information sources consisted of partners, participants, facilitators, and supporting documents. Partners included village government, community energy managers, PKK, Karang Taruna, farmer groups, tourism actors, and small enterprise representatives. Participants were selected purposively to represent household users, productive users, women, youth, poorer households, and residents located near and far from renewable energy facilities. Facilitators consisted of university lecturers, students, local cadres, and technical resource persons. Supporting documents included village demographic profiles, energy management records, tariff notes, maintenance logs, community meeting minutes, complaint records, and relevant policy or technical documents. Triangulating these sources strengthened program validity and reduced dependence on formal managerial narratives alone.

Implementation was conducted through five sequential interventions. First, this program delivered energy justice socialization to build shared vocabulary on rights, obligations, ownership, benefit-sharing, and accountability. Second, participatory energy mapping identified electricity users, productive activities, service gaps, and social groups with limited voice. Third, governance training introduced simple tools for transparent tariff reporting, maintenance scheduling, complaint recording, and collective decision-making. Fourth, productive-use mentoring helped selected households and small enterprises connect renewable electricity with coffee processing, workshops, lighting, storage, or rural tourism services. Fifth, community ownership workshops formulated locally agreed principles for representation, maintenance funds, cross-subsidy possibilities, and public reporting.

Evaluation combined formative, process, and outcome-oriented assessment. Formative evaluation reviewed baseline findings and adjusted intervention priorities before implementation. Process evaluation monitored attendance, participation quality, completion of training outputs, use of reporting templates, and responsiveness of local partners. Outcome evaluation compared pre- and post-intervention knowledge, perceived fairness, participation, complaint access, and productive energy planning. Qualitative evaluation used focus group reflection to capture changes in trust, voice, and perceived ownership, while quantitative evaluation used simple scoring sheets and monitoring indicators. This evaluation strategy allowed this community engagement program to assess not only activity completion, but also whether rural renewable energy governance became more inclusive, transparent, and socially accountable.

3. RESULTS

3.1. Planning community-owned energy justice in rural renewable energy governance

Planning was organized to convert a broad concern about renewable energy transition into a community-led process of inquiry, deliberation, and institutional preparation. This community engagement program planned a sequence of preparatory activities linking partner coordination, needs assessment, actor mapping, instrument design, monitoring preparation, and reflection forum design. Each activity was structured to clarify who should participate, what information should be collected, and how community voices could inform the governance of rural renewable energy. The planning stage therefore connected energy justice with a citizen-oriented energy audit: villagers were not positioned merely as service users, but as local knowledge holders capable of identifying benefit distribution, maintenance concerns, tariff fairness, and ownership responsibilities. This orientation is consistent with renewable energy community literature, which emphasizes participation, transparency, and local benefit-sharing as preconditions for socially acceptable energy transitions.

Table 2. Planned activities and empirical outputs in the preparation of this community-owned energy justice program

Activity Component	Participants / Actors	Method	Empirical Output	Indicator	Evidence
Partner coordination	Village government, PLTMH managers, university team	Initial coordination meeting	Shared program agenda prepared	Agreement on scope, roles, and tentative timeline	Meeting notes and attendance list
Needs assessment	Household users, productive users, women's groups, youth, farmer groups	Preliminary consultation and rapid appraisal	Baseline needs matrix designed	Priority issues identified across access, benefit, tariff, and maintenance	Consultation summary
Stakeholder mapping	Village officers, community energy managers, PKK, Karang Taruna, business actors	Participatory actor mapping	Actor and influence map prepared	Key user groups and decision actors listed	Stakeholder map draft
Instrument design	University team, local cadres, technical facilitators	Instrument workshop	Survey, interview guide, and observation sheet prepared	Instruments aligned with distributive, procedural, and recognition justice	Draft instruments
Monitoring schedule	Program team, village cadres, energy managers	Joint planning session	Monitoring calendar and reporting format designed	Monthly monitoring points targeted for 3–6 months	Draft monitoring calendar
Reflection forum preparation	Community representatives, local facilitators, village authority	Forum design workshop	Community reflection mechanism prepared	Forum agenda, participant structure, and feedback pathway identified	Forum design note

The table records six planning components prepared before field implementation. Partner coordination targeted village authorities, community energy managers, and the university team to establish role clarity and a shared agenda. Needs assessment was designed to include household users, productive users, women's groups, youth, and farmer groups, with a baseline matrix prepared to organize issues related to access, benefit, tariff, and maintenance. Stakeholder mapping prepared an actor and influence map to identify formal managers, informal opinion leaders, and potentially under-represented groups. Instrument design produced survey, interview, and observation tools aligned with distributive, procedural, and recognition justice. Monitoring preparation generated a draft calendar and reporting format for monthly review over 3–6 months. Reflection forum preparation produced a forum design note containing participant structure, agenda flow, and feedback pathways for later deliberation.

The planning outputs suggest that this community engagement program was designed less as a technical dissemination activity and more as participatory governance preparation. In energy justice terms, the planned instruments and forums created an entry point for examining who gains from renewable energy, who bears costs, and who is recognized in decision-making. In citizen science terms, the planning process prepared residents to contribute situated observations about service reliability, productive use, maintenance problems, and perceived fairness. In community-led adaptation terms, the emphasis on local ownership and monitoring prepared the village to treat renewable energy not only as infrastructure, but also as a collective resource requiring accountability. The evidence remains preparatory, so no impact claim is made at this stage. Its value lies in making future implementation empirically traceable, socially inclusive, and institutionally accountable.

3.2. Implementing community energy literacy, citizen observation, and local renewable energy action

Implementation translated the planning outputs into a structured sequence of community learning, citizen observation, data reporting, validation, reflection, and local action. This community engagement program conducted energy and climate literacy orientation to connect rural renewable energy with livelihood security, fairness, and collective responsibility. It then facilitated citizen science training so residents could document service reliability, household and productive energy use, maintenance concerns, and perceived benefit distribution. Community observation and reporting were used to move discussion beyond general opinion toward traceable implementation records. Reflection meetings linked data with deliberation, while micro-adaptation actions targeted modest, locally feasible improvements. This sequence placed community members as observers, reporters, validators, and early problem-solvers in rural renewable energy governance.

Table 3. Conducted activities and documented outputs during the implementation of this community-owned energy justice program

Activity Component	Participants / Actors	Method	Empirical Output	Indicator	Evidence
Climate and energy literacy orientation	Household users, women's groups, youth, farmer groups, energy managers	Interactive orientation	Shared understanding of climate risk, renewable energy, and energy justice documented	Orientation session conducted with multi-actor participation	Attendance list and session notes
Citizen science training	Local cadres, youth, productive users, technical facilitators	Practical training and simulation	Observation formats and reporting procedures produced	Participants trained to record service reliability, use patterns, and complaints	Training record and completed practice sheets
Community energy observation	Household users, small enterprises, local cadres	Guided field observation	Initial community observations documented	Energy use, service gaps, and productive-use cases recorded	Observation sheets and field notes
Data reporting	Local cadres, energy managers, university team	Structured reporting session	Community data entries compiled	Reports submitted using agreed templates	Reporting forms and data recap
Data validation	Community representatives, facilitators, energy managers	Cross-checking and group verification	Validated issue list produced	Inconsistencies reviewed through collective discussion	Validation minutes
Community reflection	Village authority, user groups, women, youth, farmer and business actors	Deliberative forum	Reflection notes and priority responses documented	Agreed issues translated into follow-up agenda	Forum notes and participant feedback
Micro-adaptation action	Selected households, small enterprises, local facilitators	Mentoring and practical assistance	Small-scale action plans produced	Productive or household-level energy improvements targeted	Action plan sheets
Public communication	Village representatives, cadres, communication team	Information sharing and simple dissemination	Program information brief prepared	Key messages on ownership, transparency, and benefit-sharing communicated	Brief, poster draft, or village announcement

The implementation record covered eight activity components involving household users, women's groups, youth, farmers, productive users, community energy managers, village authority, local cadres, technical facilitators, and the university team. Orientation activities documented shared vocabulary on climate risk, renewable energy, ownership, and energy justice. Citizen science training produced observation formats and reporting procedures. Guided observation generated field notes on energy use, service gaps, and productive-use cases. Reporting sessions compiled community data entries using agreed templates, while validation meetings reviewed inconsistencies through collective cross-checking. Reflection forums documented priority issues and possible responses. Micro-adaptation mentoring produced action plan sheets for selected households or small enterprises. Public communication prepared simple information materials on local ownership, transparency, and benefit-sharing. These outputs should be read as implementation records rather than final impact measures.

The implementation stage demonstrates how community engagement in renewable energy can move from awareness-building to participatory evidence production. Citizen science was relevant because local residents possessed situated knowledge about energy reliability, payment practices, maintenance problems, and everyday uses that external facilitators could not fully observe. Local knowledge became methodologically valuable when it was recorded through templates, discussed in validation forums, and translated into practical action plans. This approach is consistent with energy justice literature, which argues that renewable energy transitions require more than technical access: they require recognition, procedural inclusion, and transparent benefit-sharing. The implementation evidence remains bounded to conducted activities and documented outputs, so this program does not claim measurable social impact at this stage. Its contribution lies in creating a participatory pathway through which rural residents could begin to govern renewable energy as a shared community resource.

3.3. Evaluating community-based energy monitoring and institutional learning

Monitoring and evaluation focused on whether this community engagement program produced an accountable basis for community-led learning, not on claiming long-term socio-economic impact prematurely. The evaluation reviewed participation, assessed capacity indicators, audited data quality, validated community findings, and confirmed follow-up mechanisms with local actors. This sequence was important because community-owned renewable energy requires more than physical infrastructure or one-time training. It requires continuous evidence, trusted reporting channels, and deliberative spaces where residents can compare experiences, clarify problems, and negotiate feasible responses. By placing local cadres, household users, productive users, village authorities, and energy managers within the same evaluation process, this program treated monitoring as a participatory governance practice. The evaluative focus therefore remained on institutional readiness, data credibility, and continuity of community-based energy oversight.

Table 4. Assessed indicators and validated evidence in the monitoring and evaluation of this community-owned energy justice program

Activity Component	Participants / Actors	Method	Empirical Output	Indicator	Evidence
Participation review	Household users, women's groups, youth, farmer groups, energy managers	Attendance review and participation tracking	Participation profile reviewed	Representation of key user groups assessed	Attendance list and participation matrix
Capacity assessment	Local cadres, productive users, community energy managers	Pre-post reflection and practical task review	Capacity change indicators measured	Ability to use observation, reporting, and complaint templates assessed	Reflection sheets and completed forms
Data quality audit	Local cadres, facilitators, university team	Completeness and consistency checking	Community data quality reviewed	Missing entries, inconsistent records, and unclear reports identified	Data audit sheet
Community validation	User representatives, village authority, energy managers, facilitators	Validation forum and cross-checking discussion	Validated findings confirmed	Reported issues accepted, revised, or clarified collectively	Validation minutes
Utilization review	Village officers, energy managers, productive users	Review of follow-up use	Use of monitoring findings assessed	Findings linked to tariff, maintenance, complaint, or productive-use discussion	Follow-up notes
Institutional follow-up	Village authority, community forum, energy managers	Deliberative review	Follow-up agenda prepared	Responsible actors and next actions identified	Action agenda
Sustainability monitoring	Local cadres, village representatives, university team	Continuity planning	Sustainability agreement drafted	Monitoring roles, reporting frequency, and forum schedule confirmed	Draft agreement

The table presents seven evaluation components documented during the monitoring and evaluation stage. Participation review assessed whether key user groups—households, women, youth, farmers, productive users, and community energy managers—were represented in program activities. Capacity assessment measured whether participants could complete observation, reporting, and complaint templates after facilitation. Data quality audit reviewed completeness, consistency, and clarity of community-generated records. Community validation confirmed which reported issues were accepted, revised, or clarified through collective discussion. Utilization review assessed whether monitoring findings were connected to practical conversations on tariff transparency, maintenance, complaints, or productive energy use. Institutional follow-up prepared a responsible-actor agenda for post-program action. Sustainability monitoring drafted an agreement on roles, reporting frequency, and forum continuity. These outputs function as evaluation indicators and implementation evidence, rather than as external statistical claims.

The monitoring and evaluation stage shows that adaptive capacity in rural renewable energy governance depends on the community's ability to learn from its own evidence. Citizen science contributed by transforming residents' observations into reviewable records, while local knowledge helped interpret why

certain issues mattered for daily energy use, livelihood activities, and perceived fairness. Participatory governance was strengthened when findings were not treated as external expert judgments, but were validated through community discussion involving users and managers. This is consistent with energy justice literature emphasizing procedural inclusion, recognition, accountability, and transparent benefit-sharing in renewable energy transitions. The evidence does not yet confirm durable institutional transformation; however, it confirms that this program prepared a practical evaluation infrastructure through which local actors can continue assessing service reliability, benefit distribution, complaint response, and ownership responsibilities after facilitated activities end.

4. DISCUSSION

The planning stage of this community engagement program demonstrates that rural renewable energy initiatives cannot be treated as purely technical interventions. Its practical significance lies in shifting attention from infrastructure availability to the social organization of benefit, voice, responsibility, and ownership. In Desa Andungbiru, where renewable energy is already embedded in local livelihoods, planning functioned as a diagnostic space for identifying who uses energy, who manages it, who pays for it, and who may remain peripheral to decision-making. This is socially important because green transition programs often assume that communities benefit collectively once renewable infrastructure exists, whereas energy justice scholarship warns that benefits may be unevenly captured by actors with stronger institutional access or productive assets [10], [9]. By preparing actor maps, baseline instruments, and reflection forums, this program created an empirical basis for examining fairness before claiming empowerment, sustainability, or community ownership.

The underlying mechanism of this planning achievement was the deliberate connection between participatory mapping and justice-oriented program design. Rather than beginning with training materials or technical solutions, this program first prepared instruments to trace distributive, procedural, and recognition dimensions of rural energy governance. Distributive mapping addressed the allocation of benefits and burdens; procedural mapping clarified participation in tariff, maintenance, and complaint decisions; recognition mapping identified whether women, youth, poorer households, farmers, and productive users were included as legitimate knowledge holders. This structure reflects the argument that renewable energy communities require governance architectures, not only local enthusiasm or technological feasibility [4], [6]. The planning process also reduced the risk of elite-driven participation because it positioned evidence collection before intervention. Its main contribution was methodological: community service became an organized inquiry into energy justice rather than a predetermined delivery of solutions.

The implementation stage shows that this community engagement program served a practical function by converting abstract concepts of energy justice into observable community practices. Orientation, citizen science training, community observation, reporting, validation, reflection, and micro-adaptation mentoring created a pathway through which residents could articulate energy-related experiences in structured ways. This mattered socially because many rural energy problems are not visible through technical inspection alone: intermittent service, maintenance delays, unequal productive benefits, unclear complaint channels, and gendered burdens often appear through daily use. By involving household users, productive users, women's groups, youth, farmers, and local managers, this program documented energy as a lived social system. This approach is consistent with studies showing that participation and community ownership can improve acceptance only when residents experience meaningful involvement in decision-making and benefit-sharing, rather than symbolic consultation [5], [12].

The pattern underlying implementation was the gradual movement from literacy to collective evidence production. Climate and energy literacy created a shared vocabulary, citizen science training translated this vocabulary into observation tools, and community reporting made local knowledge reviewable. Validation forums then transformed individual observations into collective records, while micro-adaptation planning connected evidence with feasible local responses. This sequence matters because participatory governance depends on more than attendance; it requires procedures through which residents can produce, question, and use information. Literature on community renewable energy emphasizes that participation becomes credible when communities are involved in problem definition, knowledge production, and governance decisions [13], [14]. The implementation mechanism therefore worked by linking mentoring, documentation, and deliberation. Its limitation is also clear: conducted activities and produced records indicate strengthened participation infrastructure, but they do not yet prove long-term redistribution of benefits.

The monitoring and evaluation stage suggests that this community engagement program's most important social contribution was the preparation of an accountability infrastructure for community-owned energy governance. Evaluation did not merely check whether activities were completed; it assessed participation, capacity, data quality, community validation, utilization of findings, institutional follow-up, and sustainability planning. This was practically significant because rural renewable energy systems can

deteriorate when monitoring depends only on technical managers or external facilitators. Community-based monitoring allowed residents to review whether complaints were recorded, whether data were complete, whether follow-up actions were identified, and whether responsibilities were shared. This reflects a key concern in energy justice literature: low-carbon transitions may reproduce inequality when accountability is weak and when affected communities cannot verify how benefits, costs, and decisions are distributed [8], [15].

The mechanism behind this evaluative contribution was the integration of audit, validation, and continuity planning. Data quality audit reviewed whether community-generated records were sufficiently complete and consistent; indicator assessment measured whether participants could use reporting tools; community validation allowed residents and managers to clarify disputed issues; follow-up planning translated findings into assigned responsibilities; and sustainability agreement prepared a structure for continued monitoring. This sequence strengthened adaptive capacity because learning was not located only in external experts, but distributed among local actors. Studies on decentralized and community renewable energy stress that sustainability depends on institutional learning, maintenance capacity, transparent rules, and continued participation after project activities end [16], [17]. This community engagement program therefore offers a cautious but important lesson: community ownership becomes credible when it is supported by evidence routines, public reflection, and locally recognized mechanisms for correction.

5. CONCLUSION

This community engagement program shows that rural renewable energy initiatives become socially meaningful when community ownership is organized through evidence, deliberation, and accountable local governance. Its most important lesson is that energy justice cannot be assumed from technological presence alone; it must be planned, practiced, and monitored with residents who experience benefits and burdens directly. A strength of this program lies in combining participatory mapping, citizen observation, governance training, validation forums, and micro-adaptation planning. This approach contributes to community engagement practice by moving from infrastructure-centred assistance toward a community-owned energy justice model that treats villagers as co-assessors and co-managers collectively.

This program also has limitations. Its outputs remain centred on planning records, implementation documentation, and early monitoring indicators, so it cannot yet claim durable livelihood improvement, tariff reform, or long-term institutional transformation. The intervention period was limited, and community-generated data still requires repeated validation across seasons, user groups, and productive activities. Future community engagement should extend monitoring for at least one annual cycle, strengthen technical-maintenance capacity, integrate gender-sensitive energy use indicators, and formalize village-level reporting mechanisms. A sustainability agenda should link community ownership, productive energy use, transparent finance, and local policy support into a replicable rural energy governance framework locally.

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AUTHOR CONTRIBUTIONS STATEMENT

Suaidi: conceptualization, methodology, formal analysis, investigation, data curation, writing – original draft, writing – review and editing.

CONFLICT OF INTEREST STATEMENT

Author states no conflict of interest.

AI USE DECLARATION

The author used artificial intelligence tools to assist with the formatting and layout of this manuscript. AI was not used to generate the substantive content, conceptualization, data, analysis, or conclusions of the program, all of which remain the sole responsibility of the author.

INFORMED CONSENT

Informed consent was obtained from community participants prior to their involvement in program activities, observation, and data collection.

ETHICAL APPROVAL

This community engagement program involved voluntary participation of community members in Desa Andungbiru, conducted in full compliance with relevant national regulations and institutional policies, in accordance with the tenets of the Declaration of Helsinki, and approved by the author's institutional review board or equivalent committee.

DATA AVAILABILITY

The data (planning records, implementation documentation, and monitoring-evaluation materials) generated in this program are available from the corresponding author upon reasonable request.

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