

Enhancing Energy Efficiency and Conservation in Sulu: A Case Study of the Green Bulb Project

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Abstract: Energy efficiency and conservation have become critical strategies for achieving sustainable development, mitigating climate change, and enhancing energy security, particularly in geographically isolated and resource-constrained communities. This study evaluated the implementation and effectiveness of the Green Bulb Project, a community-based energy conservation initiative implemented in the Province of Sulu, Philippines. Guided by the Theory of Planned Behavior, Community-Based Resource Management, and the OECD-DAC Evaluation Framework, the study employed a qualitative evaluative case study design. Data were collected through documentary analysis of the Green Bulb Project Terminal Report, monitoring and evaluation reports, information, education, and communication (IEC) materials, project records, and participant feedback. Thematic analysis was used to identify key patterns related to project implementation, stakeholder participation, community awareness, behavioral change, and sustainability. The findings revealed that the project successfully enhanced public awareness of energy efficiency, strengthened multi-sectoral collaboration among local government units, educational institutions, and community organizations, and promoted the adoption of practical energy-saving behaviors, including the use of energy-efficient lighting and responsible electricity consumption. Capacity-building activities and participatory approaches emerged as significant factors contributing to project effectiveness and community ownership. However, challenges related to financial resources, geographical accessibility, and long-term monitoring were identified. The study concludes that community-based energy conservation initiatives can complement national energy policies by fostering behavioral change and strengthening local participation in sustainable energy management. It recommends institutionalizing similar programs through stronger inter-agency partnerships, continuous public education, digital engagement strategies, and systematic monitoring and evaluation to enhance long-term sustainability and support national and global sustainable development objectives.

Keywords: Energy efficiency; Energy conservation; Community-based initiative; Stakeholder participation; Sustainable energy management; Behavioral change; Green Bulb Project; Sulu, Philippines.

1. Introduction

Energy is an indispensable component of socioeconomic development, industrial productivity, environmental sustainability, and human well-being. As global electricity demand continues to increase due to population growth, urbanization, and technological advancement, governments and communities are under increasing pressure to adopt sustainable energy management strategies that promote efficient resource utilization while minimizing environmental degradation. Energy efficiency and conservation have therefore become central pillars of sustainable development policies because they reduce energy consumption, lower greenhouse gas emissions, improve energy security, and decrease electricity costs for households and institutions. The International Energy Agency identifies energy efficiency as one of the most cost-effective strategies for achieving climate mitigation objectives and ensuring long-term energy sustainability. Unlike the construction of new power generation facilities, energy efficiency measures reduce demand while simultaneously improving economic productivity and environmental performance. Consequently, many countries have integrated energy efficiency into national development agendas and climate action plans to achieve the objectives of sustainable economic growth and environmental protection. In the Philippines, energy demand has steadily increased due to economic expansion, urban growth, digital transformation, and rising household electricity consumption. The country continues to face significant challenges related to electricity affordability, dependence on imported fossil fuels, vulnerability to fuel price fluctuations, and unequal access to reliable electricity, particularly in

geographically isolated and disadvantaged areas. Recognizing these challenges, the Philippine government enacted the Energy Efficiency and Conservation Act (Republic Act No. 11285), which institutionalizes energy efficiency policies and encourages both public and private organizations to implement systematic energy management practices. This legislative framework emphasizes that energy conservation is not solely the responsibility of government agencies but requires active participation from educational institutions, local government units, civil society organizations, and individual households. Although technological innovations such as smart meters, renewable energy systems, and energy-efficient appliances contribute significantly to reducing electricity consumption, evidence suggests that technological interventions alone are insufficient to achieve sustainable energy transitions. Human behavior remains a critical determinant of energy consumption patterns. Individuals' attitudes, awareness, environmental values, and daily practices directly influence household and institutional electricity usage. Consequently, community-based educational interventions have emerged as an effective complement to technological solutions by promoting behavioral change through awareness campaigns, capacity-building programs, and stakeholder participation. Community participation has become increasingly recognized as an essential component of sustainable energy governance. Participatory approaches empower local stakeholders to become active contributors rather than passive recipients of government programs. Through collaboration among local governments, academic institutions, community organizations, and residents, community-based initiatives cultivate shared responsibility for environmental stewardship and encourage the adoption of practical energy-saving behaviors. Such initiatives are particularly relevant in developing regions where financial resources and technological infrastructure remain limited. The province of Sulu presents a unique context for examining community-driven energy conservation initiatives. As an island province in the southern Philippines, Sulu experiences distinctive socioeconomic and geographical conditions that influence electricity access, energy consumption patterns, and public awareness regarding sustainable energy practices. Geographic isolation, transportation constraints, and varying levels of infrastructure development create challenges for implementing nationwide energy conservation programs. These realities necessitate localized interventions that consider the province's social, cultural, and institutional characteristics while encouraging active community participation. In response to these challenges, the Green Bulb Project was implemented as a community-based initiative designed to enhance public awareness of energy efficiency and promote responsible electricity consumption. The project utilized seminars, educational campaigns, capacity-building workshops, information dissemination activities, and stakeholder partnerships to encourage individuals and organizations to adopt practical energy-saving practices. Rather than focusing exclusively on technological improvements, the initiative emphasized behavioral transformation, environmental education, and collaborative action among multiple sectors of society. Despite the increasing implementation of community-based sustainability initiatives across the Philippines, empirical studies evaluating their effectiveness remain relatively limited, particularly within geographically isolated provinces such as Sulu. Existing research has largely concentrated on urban energy management systems, renewable energy technologies, and policy development, while comparatively little attention has been devoted to understanding how localized educational interventions influence community awareness, stakeholder engagement, and long-term behavioral change. This gap limits the availability of evidence needed by policymakers and practitioners seeking to design effective community-based energy conservation programs. Furthermore, few qualitative investigations have comprehensively documented the implementation processes, stakeholder experiences, institutional partnerships, and sustainability outcomes of local energy conservation initiatives. Understanding these dimensions is essential for identifying best practices, recognizing implementation challenges, and developing scalable models that may be replicated in similar communities throughout the Philippines and other developing countries. Guided by these considerations, this study evaluates the implementation and effectiveness of the Green Bulb Project using a qualitative case study approach. Specifically, the research examines project implementation strategies, stakeholder participation, community engagement, educational activities, and the resulting changes in awareness and energy conservation practices. The study also identifies implementation challenges and proposes recommendations for strengthening future community-based energy efficiency initiatives. The significance of this research extends beyond the local context of Sulu. Its findings contribute to the growing body of knowledge on community-based sustainability initiatives and provide evidence that can inform local government policies, educational institutions, electric cooperatives, and development organizations engaged in energy conservation programs. Moreover, the study supports the global commitment to sustainable development by advancing initiatives aligned with Sustainable Development Goal 7 (Affordable and Clean Energy), Sustainable Development Goal 11 (Sustainable Cities and Communities), Sustainable Development Goal 12 (Responsible Consumption and Production), and Sustainable Development Goal 13 (Climate Action). Through its emphasis on participatory governance and behavioral change, the Green Bulb Project illustrates how localized community engagement can contribute meaningfully to broader national and international sustainability objectives.

2. Literature Review

Global Perspectives on Energy Efficiency and Energy Conservation Energy efficiency has become one of the most effective and economical approaches to addressing global energy demand while supporting environmental sustainability. International organizations consistently recognize energy efficiency as a critical strategy for reducing greenhouse gas emissions, improving energy security, and achieving sustainable economic growth. Recent evidence indicates that improving energy efficiency can substantially reduce energy demand while supporting countries' commitments under international climate agreements and the Sustainable Development Goals. Energy efficiency therefore extends beyond technological improvements and encompasses institutional reforms, behavioral adaptation, and public participation. (SEA Energy Transition Recent studies emphasize that sustainable energy transitions require integrating technological innovation with social and institutional interventions. Policies encouraging efficient appliances, green buildings, renewable energy adoption, and energy-conscious behavior have proven more effective when combined with public education and community engagement. Consequently, energy conservation has become a multidisciplinary concern involving engineering, economics, environmental science, public administration, and community development. Community-Based Energy Conservation Initiatives Community participation has become increasingly recognized as an essential component of successful energy conservation programs. Rather than relying exclusively on government regulation, community-based initiatives encourage local residents to participate actively in planning, implementing, and sustaining conservation activities. Research on rural and island communities in the Philippines demonstrates that successful energy projects depend not only on technology but also on trust, social capital, institutional collaboration, and community ownership. Long-term adoption of sustainable energy practices is more likely when communities are involved throughout project implementation and decision-making processes. (Tethys Community-based programs generally incorporate awareness campaigns, capacity-building workshops, educational materials, stakeholder consultations, and continuous monitoring. These activities improve participants' understanding of electricity consumption while encouraging practical behavioral changes such as reducing unnecessary appliance use, replacing inefficient lighting systems, and supporting environmentally responsible household practices. The Green Bulb Project reflects these principles by emphasizing participation rather than infrastructure development alone. Its focus on education and stakeholder collaboration aligns with contemporary approaches to community-centered energy governance. Behavioral Change and Energy Conservation Behavioral science has increasingly influenced energy conservation research because household decisions significantly affect electricity consumption. Scholars argue that technological solutions alone cannot achieve meaningful reductions in energy demand without corresponding behavioral changes. The Theory of Planned Behavior provides one of the most widely applied frameworks for explaining environmentally responsible behavior. According to this theory, individuals are more likely to adopt conservation practices when they possess positive attitudes toward energy efficiency, perceive social support for conservation behaviors, and believe they have the ability to perform such behaviors. Similarly, Social Cognitive Theory emphasizes observational learning, self-efficacy, and reinforcement. Educational campaigns, demonstrations, and peer influence strengthen individuals' confidence in adopting energy-saving practices. Community seminars and public awareness campaigns therefore serve as mechanisms for influencing individual behavior while reinforcing collective environmental responsibility. Recent studies further indicate that behavioral interventions combined with educational campaigns produce more sustainable energy savings than information dissemination alone because they encourage continuous practice rather than one-time awareness. Stakeholder Participation and Collaborative Governance Collaborative governance has emerged as a key principle in implementing sustainable development initiatives. Modern environmental programs increasingly involve partnerships among government agencies, universities, civil society organizations, private institutions, and local communities. Stakeholder participation enhances project legitimacy, increases public trust, improves resource mobilization, and strengthens accountability during implementation. Participatory governance also facilitates knowledge sharing among institutions, resulting in more responsive and context-specific interventions. For community-based energy projects, stakeholder collaboration enables the integration of technical expertise with local knowledge, thereby increasing project acceptance and sustainability. Educational institutions contribute research and extension services, government agencies provide policy support, and community organizations facilitate grassroots participation. The Green Bulb Project demonstrates this collaborative model through the active involvement of local government units, academic institutions, community organizations, and volunteers. Such partnerships create opportunities for long-term sustainability beyond the project's implementation period. Energy Conservation Policies in the Philippines The Philippines has strengthened its commitment to sustainable energy through the enactment of the Energy Efficiency and Conservation Act (Republic Act No. 11285). The legislation institutionalizes energy efficiency as a national development priority by promoting efficient energy utilization across government agencies, commercial establishments, educational institutions, and households. Policy implementation encourages regular energy audits,

efficient technologies, public awareness campaigns, and institutional capacity building. The legislation also recognizes that behavioral change and public participation are essential components of national energy conservation efforts. (SEA Energy Transition Despite these policy advances, implementation challenges remain, particularly within geographically isolated provinces where infrastructure limitations, financial constraints, and varying levels of public awareness continue to influence energy consumption patterns. These challenges underscore the importance of localized interventions tailored to the specific socioeconomic and cultural contexts of individual communities. Sustainable Development Goals and Energy Efficiency Energy conservation contributes directly to the achievement of multiple Sustainable Development Goals (SDGs). Most prominently, SDG 7 advocates access to affordable, reliable, sustainable, and modern energy for all. Effective energy conservation initiatives also contribute to SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Recent Philippine studies demonstrate that strengthening household energy conservation practices supports these SDGs by reducing electricity demand, encouraging responsible consumption, and promoting environmental stewardship. Community education and stakeholder participation remain central mechanisms for achieving these objectives. (RSIS International Consequently, community-based initiatives such as the Green Bulb Project represent localized contributions toward achieving both national energy objectives and global sustainability commitments. Empirical Studies on Community Energy Programs Recent empirical investigations consistently report that educational interventions improve energy literacy and encourage sustainable household practices. Capacity-building programs enhance participants' understanding of efficient electricity utilization, environmental protection, and climate change mitigation. Studies conducted in Philippine rural communities indicate that awareness campaigns become more effective when delivered through locally relevant communication channels, including community seminars, social media, educational institutions, and partnerships with local governments. Furthermore, social capital, institutional trust, and continuous stakeholder engagement significantly influence the long-term sustainability of community energy projects. (Tethys International evidence similarly concludes that energy conservation programs are more successful when technical solutions are complemented by behavioral interventions, community ownership, and participatory governance structures. Synthesis of the Literature The reviewed literature demonstrates broad consensus that sustainable energy transitions require integrated approaches combining technology, policy, education, and community participation. While technological innovation remains essential, long-term improvements in energy efficiency depend heavily on behavioral adaptation and collaborative governance. Most previous studies have focused on urban environments, smart technologies, renewable energy systems, or national energy policies. Comparatively fewer investigations have examined community-driven conservation initiatives in geographically isolated provinces such as Sulu. Existing research also provides limited qualitative evidence regarding stakeholder experiences, implementation strategies, and behavioral outcomes associated with localized awareness campaigns. These gaps highlight the need for additional case studies documenting how community participation influences energy conservation within disadvantaged island communities. Research Gap Although previous studies have established the importance of energy efficiency, stakeholder participation, and environmental education, several important knowledge gaps remain. First, limited qualitative research has examined community-based energy conservation initiatives within geographically isolated provinces of the Philippines. Second, existing studies primarily emphasize technological innovations and policy implementation while giving comparatively less attention to community engagement, institutional collaboration, and behavioral transformation. Third, few investigations have explored how educational campaigns influence long-term energy conservation practices among diverse stakeholder groups. Finally, there remains limited evidence regarding the implementation processes, sustainability mechanisms, and lessons learned from localized initiatives such as the Green Bulb Project. Addressing these gaps, the present study employs a qualitative case study approach to examine the implementation, stakeholder participation, outcomes, and sustainability of the Green Bulb Project in Sulu. By documenting local experiences and identifying effective implementation strategies, the study contributes to the growing body of literature on community-based energy conservation and provides practical insights for policymakers, educational institutions, and development practitioners seeking to replicate similar initiatives in comparable contexts.

3. Theoretical Framework

This study is anchored on the Theory of Planned Behavior (TPB) developed by Ajzen (1991) and the principles of Community-Based Resource Management (CBRM). These complementary theories explain how individual behavior and community participation contribute to the successful implementation of energy conservation initiatives. 3.1 Theory of Planned Behavior The Theory of Planned Behavior (Ajzen, 1991) posits that an individual's intention to perform a specific behavior is influenced by three major determinants: attitude toward the behavior, subjective norms, and perceived behavioral control. These determinants collectively shape behavioral intentions, which ultimately influence actual behavior. In the context of the Green Bulb Project, participants' attitudes toward energy

conservation were enhanced through educational seminars, awareness campaigns, and information dissemination activities. These interventions increased participants' understanding of the economic and environmental benefits of energy efficiency. Subjective norms refer to the influence of family members, peers, local leaders, and community organizations in encouraging responsible energy consumption. The active participation of local government units, educational institutions, and community organizations created a supportive social environment that reinforced positive conservation practices. Perceived behavioral control reflects an individual's confidence in performing energy-saving behaviors. Through capacity-building activities, practical demonstrations, and educational materials, participants acquired the knowledge and skills necessary to adopt simple yet effective energy conservation practices, including switching off unused electrical appliances, replacing inefficient lighting with LED bulbs, and minimizing unnecessary electricity consumption. According to TPB, these improvements in attitudes, social influence, and perceived capability collectively increase the likelihood that individuals will adopt sustainable energy conservation behaviors. Consequently, TPB provides an appropriate theoretical lens for understanding how educational interventions influence behavioral change within community-based energy conservation programs.

3.2 Community-Based Resource Management Theory

Community-Based Resource Management (CBRM) emphasizes that sustainable resource management is most effective when local communities actively participate in planning, implementation, monitoring, and evaluation. Rather than relying solely on government agencies, CBRM recognizes local residents as partners in achieving sustainable development. The Green Bulb Project reflects the principles of CBRM by promoting collaboration among local government units, academic institutions, civil society organizations, youth groups, and community members. Such collaborative arrangements encourage shared responsibility, strengthen institutional partnerships, and improve project sustainability. Community participation also facilitates the exchange of local knowledge, allowing project activities to be tailored to the specific socioeconomic conditions of Sulu. This localized approach enhances public acceptance while increasing the likelihood that conservation practices will continue beyond the project's implementation period.

3.3 Integration of the Theories

The integration of TPB and CBRM provides a comprehensive framework for understanding the implementation of community-based energy conservation initiatives. The Theory of Planned Behavior explains how educational interventions influence individual behavioral intentions, whereas Community-Based Resource Management explains how collaborative governance strengthens community ownership and sustainability. Together, these theories suggest that effective energy conservation requires both individual behavioral change and collective community action. Educational activities improve knowledge and attitudes, while stakeholder participation creates an enabling environment that supports long-term behavioral transformation. Accordingly, this study assumes that awareness campaigns, stakeholder participation, and capacity-building activities positively influence community engagement, leading to improved energy conservation practices and enhanced environmental sustainability.

Conceptual Framework

The conceptual framework illustrates the relationship among the major constructs investigated in this study. The independent variables consist of the implementation strategies of the Green Bulb Project, including:

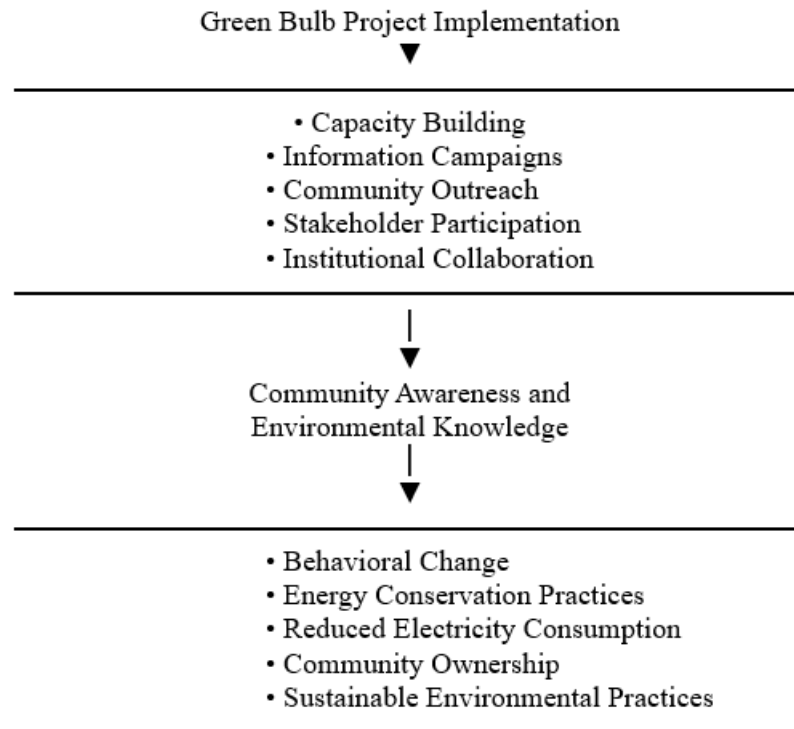
- * Capacity-building programs
- * Information and education campaigns
- * Stakeholder participation
- * Community outreach activities
- * Institutional collaboration

These implementation strategies are expected to influence the mediating variable: Community Awareness and Environmental Knowledge. Improved awareness subsequently contributes to the dependent variables:

- * Energy conservation behavior
- * Energy-efficient practices
- * Community participation
- * Environmental responsibility
- * Project sustainability

The framework assumes that increased awareness strengthens behavioral change, ultimately contributing to sustainable energy conservation within the community.

Conceptual Model



The Framework proposes that effective implementation strategies improve public awareness, which subsequently encourages sustainable energy conservation behaviors and strengthens community ownership of environmental initiatives. This study seeks to answer the following questions:

1. How was the Green Bulb Project implemented in the Province of Sulu?
2. What strategies were employed to promote energy efficiency and energy conservation among community members?
3. How did stakeholders participate during the implementation of the project?
4. What outcomes resulted from the Green Bulb Project in terms of awareness, knowledge, and behavioral change?
5. What challenges were encountered during project implementation?
6. What policy recommendations can strengthen future community-based energy conservation initiatives?

Research Objectives General Objective To evaluate the implementation and effectiveness of the Green Bulb Project in promoting energy efficiency and conservation in the Province of Sulu. Specific Objectives Specifically, the study aims to:

1. Describe the implementation process of the Green Bulb Project.
2. Examine the extent of stakeholder participation throughout project implementation.
3. Assess the effectiveness of capacity-building activities and information campaigns in increasing community awareness.
4. Determine the project's contribution to promoting energy conservation behaviors among participants.
5. Identify implementation challenges affecting project sustainability.
6. Develop policy recommendations that may strengthen future community-based energy conservation initiatives within geographically isolated communities in the Philippines.

7. Significance of the Study The findings of this study provide practical and scholarly contributions to several sectors. Local Government Units (LGUs). The findings may assist policymakers in designing community-based energy conservation programs that encourage public participation and support local sustainability initiatives. Department of Energy (DOE). The study provides evidence that may inform future policies, extension programs, and awareness campaigns promoting energy efficiency across geographically isolated provinces. Educational Institutions. Universities and schools may utilize the findings to strengthen environmental education, extension services, and sustainability programs aligned with national development goals. Community Organizations. Local organizations may adopt the project's participatory strategies to promote environmental stewardship and responsible energy consumption within their respective communities. Researchers. The study contributes to the growing literature on community-based energy conservation, participatory governance, and sustainable development in developing countries while providing a foundation for future comparative studies. Ultimately, the study demonstrates how localized educational interventions can complement national energy policies and contribute to achieving long-term environmental sustainability.

8. Methodology Research Design This study employed a qualitative evaluative case study design to examine the implementation and effectiveness of the Green Bulb Project in promoting energy efficiency and conservation in the Province of Sulu, Philippines. A qualitative case study is appropriate because it enables an in-depth exploration of a contemporary phenomenon within its real-life context, particularly when the boundaries between the phenomenon and its context are not clearly evident (Yin, 2018). The evaluative component focuses on assessing the project's relevance, effectiveness, implementation processes, outcomes, and sustainability. The study also adopts the OECD-DAC Evaluation Framework, which examines five key dimensions of program performance: Relevance, Effectiveness, Efficiency, Impact, Sustainability Using these evaluation criteria provides a systematic approach to assessing the overall performance of the Green Bulb Project while generating recommendations for improving future community-based energy conservation initiatives.

Research Setting The study was conducted in the Province of Sulu, Philippines, where the Green Bulb Project was implemented as a community-based extension initiative promoting energy efficiency and environmental sustainability. Sulu consists of several municipalities characterized by diverse socioeconomic conditions and varying access to electricity infrastructure. These contextual characteristics make the province an appropriate setting for examining localized energy conservation interventions. The project involved multiple stakeholders, including: Local Government Units (LGUs), Educational institutions, Barangay officials, Community organizations, Youth organizations, Household representatives, Project implementers Sources of Data This research utilized multiple qualitative data sources to ensure a comprehensive assessment of project implementation. Primary Documents The principal source of information was the official Green Bulb Project Terminal Report, which documented: Project objectives, Implementation activities, Training programs, Monitoring reports, Participant attendance, Evaluation results, Project accomplishments Secondary Documents Additional documentary sources included: Progress reports, Extension program documentation , Activity completion reports, Project photographs, Information, Education, and Communication (IEC) materials, Social media campaign records, Energy conservation brochures, Institutional reports, Government policy documents related to energy efficiency The use of multiple documentary sources enhanced the credibility and richness of the analysis through data triangulation. Participants Although the study primarily relied on documentary evidence, project records indicate that approximately 455 stakeholders participated in various Green Bulb Project activities. Participants represented diverse sectors, including: Local government officials, Faculty members, Students, Community leaders, Barangay officials, Women's organizations, Youth volunteers' Civil society organizations, Household beneficiaries The diversity of participants enabled the project to reach multiple sectors within the community, thereby strengthening stakeholder ownership and promoting wider dissemination of energy conservation practices.

Data Collection Procedures

Documentary data were collected following a systematic review process. First, official project documents were obtained from the implementing institution. Second, all available project records were organized chronologically according to project phases, including planning, implementation, monitoring, and evaluation. Third, documents were reviewed repeatedly to identify recurring themes concerning project implementation, stakeholder participation, capacity-building activities, communication strategies, and behavioral outcomes. Finally, information obtained from various documents was compared and cross-validated to ensure consistency and accuracy.

Data Analysis

The study employed thematic analysis, following the procedures proposed by Braun and Clarke. The analysis consisted of the following stages: Phase 1: Familiarization All project documents were carefully reviewed multiple times to gain a comprehensive understanding of project implementation. Phase 2: Initial Coding Relevant statements, observations, and accomplishments were assigned preliminary codes reflecting their underlying meanings. of initial

codes included: awareness campaign, stakeholder collaboration, capacity building, behavioral change, electricity conservation, community participation, environmental education Phase 3: Theme Development Related codes were grouped into broader analytical themes, such as: Community Awareness, Stakeholder Engagement, Institutional Collaboration, Capacity Development, Behavioral Transformation, Project Sustainability Phase 4: Theme Review Emerging themes were reviewed and refined by comparing evidence across multiple documentary sources to ensure coherence and consistency. Phase 5: Interpretation The final themes were interpreted using the Theory of Planned Behavior and Community-Based Resource Management framework to explain how project activities influenced community awareness and energy conservation behavior. Trustworthiness of the Study To ensure methodological rigor, the study adopted the four criteria proposed by Lincoln and Guba. Credibility was established through data triangulation by comparing information from multiple documentary sources, including project reports, monitoring documents, participant feedback, and communication materials. Transferability Rich descriptions of the project context, implementation strategies, and community characteristics were provided to enable readers to determine the applicability of findings to other settings. Dependability A detailed audit trail documenting data collection procedures, coding decisions, and analytical processes was maintained to ensure transparency and consistency. Confirmability Interpretations were grounded in documentary evidence rather than researcher assumptions. Analytical decisions were supported by documented project records. Ethical Considerations Although the study relied primarily on documentary analysis, ethical principles were observed throughout the research process. Permission to access project documents was obtained from the implementing institution. Confidential information relating to individual participants was not disclosed. Data were analyzed solely for academic and research purposes. The study adhered to the principles of integrity, transparency, objectivity, and respect for institutional ownership of project records. Limitations of the Study The study has several limitations. First, the analysis relied primarily on documentary evidence rather than direct interviews with participants. Second, behavioral outcomes were assessed based on project monitoring reports and participant feedback rather than long-term measurements of household electricity consumption. Third, because the study focuses on a single case in Sulu, the findings may not be directly generalizable to other regions with different socioeconomic and institutional contexts. Despite these limitations, the study provides valuable insights into the implementation of community-based energy conservation initiatives and offers practical recommendations for policymakers and development practitioners.

4. Results and Discussion

The findings are organized according to the OECD-DAC evaluation dimensions and interpreted through the Theory of Planned Behavior (Ajzen, 1991) and Community-Based Resource Management (CBRM). The analysis demonstrates that the Green Bulb Project achieved meaningful outcomes in promoting energy efficiency and conservation by enhancing public awareness, strengthening stakeholder collaboration, and encouraging behavioral change among participants.

Relevance of the Green Bulb Project to Community Energy Needs One of the principal findings of this study is that the Green Bulb Project addressed an important community need by promoting awareness of energy efficiency and conservation in Sulu. The project was implemented in response to increasing electricity consumption, limited public knowledge of energy-saving practices, and the need to support national policies on energy efficiency. The documentary analysis indicates that the project was designed to provide practical knowledge rather than purely theoretical information. Training sessions, community forums, and awareness campaigns emphasized simple and affordable practices that households, schools, and local organizations could immediately adopt. These included switching off unused electrical appliances, maximizing natural lighting and ventilation, replacing conventional incandescent bulbs with LED lighting, and encouraging responsible electricity consumption. The project's objectives were aligned with the Philippine government's Energy Efficiency and Conservation Act (Republic Act No. 11285), which promotes responsible energy use through public awareness, institutional participation, and capacity-building. By contextualizing national policy within the local realities of Sulu, the project enhanced the relevance and applicability of energy conservation messages. From the perspective of Community-Based Resource Management, the project's relevance was strengthened by involving local stakeholders in implementation. Rather than imposing externally designed interventions, the project encouraged community ownership and participation, increasing the likelihood that energy-saving practices would be adopted and sustained.

Effectiveness of Capacity-Building and Awareness Campaigns Documentary evidence indicates that the Green Bulb Project successfully implemented a series of capacity-building activities that improved participants' understanding of energy conservation principles. Educational seminars, orientation sessions, printed information materials, and social media campaigns served as the primary mechanisms for disseminating knowledge. Project monitoring reports documented participation by approximately 455 individuals representing local government units,

educational institutions, barangay organizations, youth groups, and community associations. This broad participation expanded the project's reach and created opportunities for knowledge sharing across different sectors of the community. Thematic analysis identified three major outcomes of these activities:

1. Increased awareness of household energy conservation practices.
2. Improved understanding of environmental sustainability.
3. Greater willingness to adopt energy-efficient behaviors.

These findings are consistent with the Theory of Planned Behavior, which suggests that educational interventions influence attitudes and perceived behavioral control, thereby increasing individuals' intentions to engage in responsible environmental behavior. Participants demonstrated greater confidence in implementing practical conservation measures after participating in project activities. Moreover, the use of multiple communication channels including face-to-face seminars, printed educational materials, and digital platforms enhanced the accessibility of project information and accommodated participants with varying levels of educational attainment and technological access. Stakeholder Participation and Collaborative Governance Stakeholder participation emerged as one of the strongest indicators of project success. The Green Bulb Project adopted a collaborative governance approach by engaging local government units, academic institutions, community organizations, youth leaders, and volunteers throughout implementation. Document analysis revealed that institutional partnerships facilitated resource sharing, improved coordination, and expanded the dissemination of energy conservation messages. Educational institutions contributed technical expertise and extension services, while local government units provided logistical support and encouraged community participation. The collaborative approach also strengthened trust among participating organizations, increasing community acceptance of project activities. Rather than viewing energy conservation as solely the responsibility of government agencies, stakeholders recognized their collective role in promoting sustainable energy practices. The findings support previous research indicating that collaborative governance enhances project effectiveness by integrating technical knowledge with local experience. Community participation increased ownership of project activities and contributed to the sustainability of conservation initiatives beyond the project's formal implementation period. Behavioral Changes in Energy Conservation Practices One of the most significant outcomes of the Green Bulb Project was the positive behavioral change observed among participants. Project evaluation reports and participant feedback consistently indicated increased adoption of energy-saving practices following project implementation. Commonly reported behavioral changes included: Turning off lights and appliances when not in use. Using energy-efficient LED lighting, maximizing natural lighting and ventilation, Reducing unnecessary electricity consumption. Sharing energy conservation knowledge with family members and neighbors. These behavioral changes demonstrate that increased awareness translated into practical household actions. According to the Theory of Planned Behavior, educational interventions influence behavior by improving attitudes, strengthening perceived social expectations, and increasing confidence in one's ability to perform desired actions. The project successfully addressed these determinants through continuous information dissemination and community engagement. Although the study did not directly measure electricity consumption before and after the intervention, participant feedback and project monitoring reports suggest that many households became more conscious of their electricity usage, indicating progress toward more sustainable consumption practices.

Challenges Encountered During Project Implementation Despite its accomplishments, the Green Bulb Project encountered several implementation challenges. Financial constraints limited the expansion of project activities to additional municipalities and restricted the production of educational materials. Resource limitations also affected the frequency of follow-up activities and monitoring efforts. The geographical characteristics of Sulu posed logistical challenges for project implementation. Transportation constraints and the dispersed location of communities made it difficult to conduct regular outreach activities across all target areas. Differences in educational background, literacy levels, and prior knowledge of energy conservation also influenced participants' understanding of technical concepts. To address these differences, project implementers adapted communication strategies by using simple language, practical demonstrations, and locally relevant examples. Sustaining behavioral change beyond the project's completion remains another challenge. Without continuous reinforcement through community campaigns and institutional support, some participants may gradually revert to previous electricity consumption habits. This finding highlights the importance of integrating energy conservation education into long-term community development programs. Sustainability and Opportunities for Scaling Up The study indicates that the Green Bulb Project possesses strong potential for long-term sustainability due to its emphasis on community ownership, stakeholder collaboration, and environmental education. Several factors contributed to project sustainability: Active involvement of local stakeholders. Strong institutional partnerships, Practical and affordable conservation strategies, Community-based

educational approaches, Alignment with national energy policies. These characteristics provide a foundation for expanding similar initiatives to other municipalities within Sulu and to geographically isolated provinces throughout the Philippines. Future implementations could strengthen sustainability by incorporating digital learning platforms, mobile applications for energy education, smart energy monitoring technologies, and regular community-based evaluation systems. Partnerships with electric cooperatives, higher education institutions, and local government units would further enhance technical support and resource mobilization. Scaling the Green Bulb Project would not only promote energy efficiency but also contribute to climate change mitigation, environmental sustainability, and the achievement of the country’s long-term energy security objectives.

Local Government Units, Higher Education Institutions, Barangay Officials, Community Organizations, Youth Organizations, Households

Tables and Figures

Table 1. Profile of the Green Bulb Project

Project Component	Description
Project Title	Green Bulb Project
Project Location	Province of Sulu, Philippines
Project Type	Community-Based Energy Efficiency and Conservation initiative
Research Design	Qualitative Evaluative Case Study
Theoretical Foundation	Theory of Planned Behavior (TPB) and Community Based Resource Management (CBRM)
Total participants	455
Major Stakeholders	Local government Units Higher Education Institutions, barangay Officials, Community Organizations, youth organizations Household
Primary data Source	Green Bulb Project Terminal Report
Data Analysis	Thematic Analysis

Table 2. Summary of Projects Activities

Activity	Purpose	Outcome
Community Orientation	Introduce Project Objectives	Increased Public Awareness
Capacity Building Seminar	Develop Knowledge on Energy Conservation	Improved Understanding of Energy - efficient Practice
IEC Caampaign	Disseminate Conservation Information	Greater Community Participation
Social Media Campaign	Reach Wider Audiences	Increased Public Engagement
Community Outreach	Promote Household Conservation Practices	Adoption of Energy Saving Behaviors
Project monitoring	Evaluate Implementation	Continuous Project Improvement

Table 3. major Themes Identified from Documentary Analysis

Theme	Key Findings	Supporting Evidence
Community Awareness	Increased Knowledge of Energy Conservation	Project Reports, Participants Evaluations
Stakeholder Participation	Strong Collaboration among partner Institutions	Attendance records, activity reports
Capacity Building	Improved Understanding of Efficient Electricity use	Training Documentation
Behavioral Change	Adoption of Practical Energy Saving Practiced	Participant Feedback
Institutional Collaboration	Strong Partnerships enhanced Implementation	Memoranda and Coordination reports
Sustainability	Community Ownership Supports Long-Term Implementation	Monitoring Reports

Table 4. Evaluation of the Green Bulb Project Using OECD-DAC Criteria

Criterion	Assessment	Evidence
Relevance	High	Project addressed local energy awareness needs
Effectiveness	High	Awareness and participation increased
Efficiency	Moderate to High	Resources were effectively utilized despite financial constraints
Impact	High	Positive behavioral changes among participants
Sustainability	Moderate to High	Continued support from stakeholders indicates potential for long-term implementation

Summary of Findings

The qualitative analysis demonstrates that the Green Bulb Project successfully promoted energy conservation through community-based education and stakeholder participation. The initiative increased public awareness, strengthened collaborative governance, encouraged practical energy-saving behaviors, and established a foundation for sustainable community engagement. However, the findings also emphasize that sustained behavioral change requires continued institutional support, regular monitoring, and adequate financial resources. Community-based initiatives should therefore be integrated into broader local development and environmental management strategies to maximize their long-term impact.

Policy Implications

The findings of this study have important implications for policymakers, local governments, higher education institutions, electric cooperatives, and community organizations seeking to strengthen energy efficiency and conservation initiatives. The success of the Green Bulb Project demonstrates that community-based interventions can complement national energy policies by translating technical concepts into practical household and institutional actions.

Implications for the Department of Energy (DOE) The Green Bulb Project illustrates that localized awareness campaigns can significantly improve public understanding of energy conservation. The Department of Energy may strengthen its Energy Efficiency and Conservation Program by encouraging partnerships with local government units and higher education institutions to implement similar community-based initiatives in geographically isolated and disadvantaged areas. The DOE may also consider developing standardized educational modules, multilingual information materials, and digital learning resources that can be adapted to local contexts. Such initiatives would expand the reach of national energy conservation programs while ensuring that information is culturally appropriate and accessible. Implications for Local Government Units Local government units play a vital role in mobilizing

communities and institutionalizing sustainable environmental practices. The findings suggest that municipalities and barangays should integrate energy conservation into local development plans, climate change action plans, and disaster risk reduction programs. Regular community seminars, household awareness campaigns, and recognition programs for energy-efficient practices may strengthen long-term community engagement. LGUs can likewise establish partnerships with electric cooperatives, schools, and civil society organizations to ensure sustained implementation of conservation activities. Implications for Higher Education Institutions Universities and colleges are strategically positioned to advance sustainability through instruction, research, and extension. The Green Bulb Project demonstrates that extension programs can serve as effective platforms for translating academic knowledge into practical community action. Higher education institutions should incorporate energy efficiency and environmental sustainability into relevant academic curricula while encouraging faculty and students to participate in extension activities that address local energy challenges. Interdisciplinary collaboration among engineering, public administration, environmental science, and social science programs can further enhance the quality and impact of community-based initiatives. Implications for Electric Cooperatives and Utility Providers Electric cooperatives may strengthen consumer education by collaborating with educational institutions and local governments in conducting regular information campaigns on efficient electricity use. Integrating energy conservation messages into billing statements, customer service activities, and social media platforms may further increase public awareness. Utility providers may also explore community incentive programs that recognize households and institutions demonstrating exemplary energy-saving practices. Implications for Community Organizations Community organizations, youth groups, women's associations, and faith-based organizations can play a significant role in sustaining energy conservation initiatives. Their continued participation can reinforce positive social norms, encourage peer learning, and promote community ownership of environmental programs. Training local volunteers as community energy advocates would expand the reach of awareness campaigns and facilitate continuous monitoring of conservation activities.

Recommendations

Based on the findings of this study, the following recommendations; Institutionalize community-based energy conservation programs. Local government units should incorporate energy efficiency education into regular community development and environmental programs, Strengthen multi-sectoral partnerships. Greater collaboration among the Department of Energy, local governments, higher education institutions, electric cooperatives, and civil society organizations should be encouraged to maximize program resources and expertise, Expand capacity-building initiatives. Continuous training, seminars, and public awareness campaigns should be conducted to reinforce energy conservation knowledge and encourage sustained behavioral change, Leverage digital technologies. Mobile applications, online learning platforms, and social media campaigns should be integrated into future programs to reach wider audiences, particularly younger populations, Establish monitoring and evaluation systems. Long-term monitoring should be undertaken to assess changes in household electricity consumption, participant behavior, and the sustainability of project outcomes, Replicate successful models. The Green Bulb Project may serve as a model for implementation in other municipalities within Sulu and in geographically isolated and disadvantaged areas across the Philippines, with adaptations based on local needs and contexts. Promote interdisciplinary research. Future studies should integrate perspectives from public administration, engineering, environmental science, economics, and behavioral science to develop more comprehensive approaches to community-based energy conservation.

5. Conclusion

This study evaluated the implementation and effectiveness of the Green Bulb Project as a community-based initiative promoting energy efficiency and conservation in the Province of Sulu. Using a qualitative evaluative case study design, the research examined project implementation, stakeholder participation, awareness-building activities, behavioral outcomes, and sustainability through documentary analysis and thematic interpretation. The findings indicate that the Green Bulb Project successfully enhanced community awareness of energy conservation, strengthened collaboration among local government units, educational institutions, and community organizations, and encouraged the adoption of practical energy-saving behaviors. Capacity-building activities, information campaigns, and stakeholder engagement emerged as key drivers of project effectiveness. These findings support the view that sustainable energy transitions require not only technological solutions but also active community participation, environmental education, and collaborative governance. The study also identified challenges related to financial constraints, geographical accessibility, and the need for sustained post-project monitoring. Addressing these challenges will require stronger institutional partnerships, continuous public education, and the integration of energy conservation initiatives into broader local development and sustainability programs. Theoretically, the study contributes to the application of the Theory of Planned Behavior and Community-Based Resource Management in understanding community-based energy conservation initiatives within geographically isolated settings. By

demonstrating how educational interventions and stakeholder collaboration influence behavioral change, the research expands the literature on participatory approaches to sustainable energy management. Practically, the findings provide evidence-based guidance for policymakers, higher education institutions, electric cooperatives, and local communities seeking to design, implement, and sustain effective energy conservation programs. The Green Bulb Project illustrates that localized, participatory interventions can complement national energy policies and contribute to broader objectives related to climate action, environmental stewardship, and sustainable development. Ultimately, the Green Bulb Project demonstrates that empowering communities through knowledge, collaboration, and shared responsibility is fundamental to achieving long-term energy efficiency and conservation. Its experiences offer valuable lessons for other provinces and developing regions seeking to build resilient, environmentally responsible, and energy-conscious communities.

References

1. Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
2. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
3. International Energy Agency. (2020). *Energy Efficiency 2020*. Paris, France: International Energy Agency.
4. International Energy Agency. (2023). *Energy Efficiency 2023*. Paris, France: International Energy Agency.
5. Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.
6. Organisation for Economic Co-operation and Development. (2021). *Applying Evaluation Criteria Thoughtfully*. OECD Publishing.
7. Republic of the Philippines. (2019). Republic Act No. 11285: Energy Efficiency and Conservation Act. *Official Gazette of the Republic of the Philippines*. (Supreme Court E-Library^{©2021})
8. Department of Energy. (2020). *Implementing Rules and Regulations of Republic Act No. 11285*. Department of Energy, Philippines. (Issuances Library)
9. Department of Energy. (2026). *Advisory on CY2025 Compliance of Designated Establishments pursuant to Republic Act No. 11285*. Department of Energy, Philippines. (doe-parent)
10. Energy Transition Partnership. (2024). *Diagnostic Review and Analysis of Energy Efficiency Development in the Philippines*. Energy Transition Partnership. (energytransitionpartnership.org)
11. United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. United Nations.
12. Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th ed.). Sage Publications.
13. World Bank. (2022). *Philippines Country Climate and Development Report*. World Bank.
14. United Nations Development Programme. (2023). *Human Development Report 2023/2024*. UNDP.
15. Department of Energy. (2023). *National Energy Efficiency and Conservation Program*. Department of Energy.
16. Kumar, A., & Palit, D. (2019). Community participation in sustainable energy initiatives: Lessons from India. *Energy Policy*, 129, 11–20.
17. Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.
18. Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.
19. Sovacool, B. K. (2021). Decarbonizing the energy sector: The role of behavioral change and public participation. *Energy Research & Social Science*.
20. United Nations Environment Programme. (2023). *Emissions Gap Report 2023*. United Nations.
21. World Health Organization. (2022). *Health and Climate Change Report*. World Health Organization.