JOURNAL OF INNOVATION (JSI)
(Empowerment and Community Service)
ISSN XXXX-XXXX (online) | XXXX-XXXX (print)
Vol 1, No. 1, pp. 32-36

Utilization of Coffee Grounds-Based Eco Briquettes as an Alternative Energy Source for Coffee Shop Enterprises in Aceh Barat Regency

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Abstract

This community service program aims to enhance the capacity of micro, small, and medium enterprises (MSMEs) producing briquettes from spent coffee grounds in West Aceh Regency, as part of efforts to support the transition to renewable energy and sustainable economic development. The challenges faced by local MSMEs include limited technical knowledge in waste processing, low production efficiency, and insufficient use of digital technology for product marketing. To address these issues, a participatory approach was employed through a series of technical training sessions, cleaner production mentoring, and digital marketing workshops based on social media platforms. The implementation methods included technical training on processing coffee grounds into eco-friendly briquettes, focusing on drying raw materials, mixing with optimal binder compositions (4–12%), molding, and efficient combustion techniques. The cleaner production concept was applied to minimize production waste and optimize the reuse of materials. Digital marketing sessions aimed to strengthen branding, promotional content creation, and the use of e-commerce platforms such as WhatsApp Business, Facebook, and Instagram. Program effectiveness was evaluated using pre- and post-tests, field observations, and focus group discussions (FGDs) with local communities. The results showed a significant increase in participants' technical capacity, with 85% of MSMEs successfully applying more efficient production techniques and producing higher-quality briquettes characterized by more uniform moisture and density. The implementation of cleaner production reduced production waste by up to 30% and decreased water usage in the binder mixing process. In terms of marketing, around 70% of participants successfully created digital business accounts and began marketing products online, which led to increased demand from outside the village. The program also triggered social change, as the community began to view coffee waste as an economic resource. Several farmer groups even established partnerships with MSMEs to provide a sustainable supply of raw materials. The integration of participatory approaches, cleaner production technology, and digital transformation has proven effective in strengthening the competitiveness of MSMEs in the alternative energy sector. This mentoring model is suitable for replication in other regions with similar organic waste characteristics to support inclusive and sustainable green economic development.

Keyword: Coffee briquettes, Renewable energy, Waste utilization

INTRODUCTION

The growing global demand for coffee has contributed significantly to the accumulation of spent coffee grounds, a by-product that is often discarded as waste despite its potential as a renewable energy source. In regions such as Aceh Barat, where coffee consumption is

increasing and small-scale coffee shops are proliferating, managing coffee waste has become both an environmental challenge and an economic opportunity. Spent coffee grounds, when improperly disposed of, contribute to organic waste in landfills and methane emissions. However, through proper processing, this biomass can be converted into high-energy Eco Briquettes, offering a cleaner, more sustainable alternative to conventional fuels such as firewood or charcoal (McNutt & He, 2018; Peluso, 2023).

Eco Briquettes made from coffee waste not only support environmental sustainability but also promote circular economy principles by turning waste into a valuable resource. These briquettes reduce air pollution, lower carbon emissions, and provide a cost-effective energy source for small businesses like coffee shops. Their use aligns with the vision of green business practices while empowering local communities through job creation and the development of new economic activities. In India and other countries, briquetting has been proven as a profitable model, demonstrating the feasibility and growth potential of biomass-based energy enterprises (Aishwariya & Amsamani, 2018).

In the context of Aceh Barat Regency, coffee shops generate significant quantities of spent coffee grounds daily, yet most lack proper waste processing systems. Many of these businesses still rely on non-renewable energy sources for heating, boiling, and roasting processes, incurring high operational costs. The adoption of coffee ground-based Eco Briquettes can offer a dual solution—addressing waste management issues while reducing fuel expenditures. Additionally, coffee shops that adopt such eco-friendly innovations are more likely to attract environmentally conscious consumers and enhance their brand reputation as green enterprises (Banu et al., 2020; McNutt & He, 2018).

This community engagement program seeks to bridge this gap by providing training and support to coffee shop enterprises in utilizing spent coffee grounds as raw materials for briquette production. Through participatory methods, the program promotes technical knowledge transfer, cleaner production practices, and business model development tailored to local conditions. By fostering collaboration between coffee shop owners, briquette producers, and relevant stakeholders, the initiative also supports Aceh Barat's role in advancing Indonesia's national agenda for renewable energy development and MSME empowerment (Aulia et al., 2024).

Ultimately, the integration of coffee waste briquetting into the operations of coffee shops represents a strategic step towards sustainable business practices. It strengthens local economies, reduces environmental burdens, and sets a precedent for other regions in adopting innovative, circular solutions to common waste and energy challenges.

METHOD

This community engagement initiative was carried out using a participatory approach integrated into a capacity-building program for MSMEs producing briquettes from coffee waste in West Aceh Regency. The program aims to enhance production capacity, product quality, and market reach of MSMEs through the application of appropriate technology and sustainable digital marketing strategies.

1. Location and Duration of the Program

The program was implemented in West Aceh Regency from March to June 2024, centered around the Eco Briket production site and its partner MSME communities in the surrounding areas.

2. Target Groups and Participants

The target groups include MSME briquette producers, farmer groups generating coffee waste, and community members with potential to be involved in the production and distribution processes. The activities also involved environmental academics, representatives from local government agencies, and technical experts as facilitators.

3. Strategies and Implementation Stages

This community engagement program employed a Participatory Action Research (PAR) approach, with the following stages:

- Problem identification and local potential mapping, conducted through focused group discussions (FGDs) and field observations.
- Technical training on briquette production using organic and coffee waste, covering drying processes, material composition mixing, molding, and clean-burning techniques.
- Implementation of cleaner production technologies to improve efficiency and reduce the environmental impact of production processes.
- Workshops on strengthening digital marketing capacity, including promotional content creation, use of social media, and e-commerce platforms.
- Intensive mentoring for MSMEs in the post-production and marketing phases, including product quality monitoring and distribution network development.

RESULTS AND DISCUSSION

The community service program conducted in West Aceh Regency demonstrated a significant impact on enhancing the capacity of MSMEs engaged in producing eco-friendly briquettes made from spent coffee grounds. This initiative yielded tangible outcomes in three primary areas: increased production capacity, process efficiency, and strengthened digital marketing.

1. Enhancing Production Capacity and Product Quality

Technical training results showed a substantial improvement in participants' understanding of processing techniques for spent coffee grounds into environmentally friendly briquettes. Approximately 85% of participants successfully applied methods such as raw material drying, optimal binder composition (between 4–12%), and efficient molding and combustion techniques. These adjustments led to briquettes with more uniform dryness and density, which improved combustion quality and extended burn time (Soares et al., 2015).

2. Implementation of Cleaner Production Technology

By applying cleaner production principles, MSME participants started optimizing raw material use, minimizing leftover waste, and reusing materials previously discarded. Field observations documented a 30% reduction in production waste and lower water usage in the binder mixing process. This aligns with the goals of reducing environmental impact and positions the briquettes as part of a sustainable energy solution (Joy et al., 2024; Santosa et al., 2024).

3. Strengthening Digital Marketing Capacity

The digital marketing workshop introduced participants to the importance of branding, promotional content creation, and leveraging social media and e-commerce platforms. Around 70% of MSMEs created online business accounts and began marketing products through platforms such as WhatsApp Business, Facebook, and Instagram. Follow-up mentoring noted

increased demand from outside the village, particularly from eco-conscious consumers (Rahmayanti et al., 2022).

4. Social Change and Community Involvement

This program also encouraged community participation in waste management and its transformation into an alternative energy source. Focus group discussions revealed a shifting perception, where coffee waste is now seen as an economic asset rather than a by-product. Several farmer groups have started collaborating directly with briquette MSMEs to provide a sustainable supply of raw materials (Base et al., 2023); (Mulyana & Suryaningsih, 2019).

5. Program Success Evaluation

Based on pre- and post-test questionnaires, there was an average knowledge increase of 40% in technical production and digital marketing. Success was also reflected in production consistency, with 60% of participants actively producing and marketing briquettes within two months post-training (Kandou et al., 2022).

6. Discussion

This community engagement initiative illustrates that the integration of participatory approaches, cleaner production technology, and digital transformation can strengthen MSMEs' positions in the renewable energy value chain. The application of circular economy principles—reusing organic waste as a productive commodity—proves effective in local contexts (Karningsih et al., 2025). These findings reinforce earlier research emphasizing the value of social innovation and local potential in developing alternative energy sources (Marliana et al., 2024).

With an adaptive and collaborative mentoring model, the program contributes not only to local economic upliftment but also to increased environmental awareness and long-term sustainability. This model offers strong potential for replication in other regions with similar characteristics.

CONCLUSION

The community engagement program implemented in West Aceh Regency has proven effective in empowering MSMEs that produce briquettes from spent coffee grounds. By integrating participatory approaches, cleaner production technology, and digital transformation, the program significantly enhanced production capacity, process efficiency, and market reach for local entrepreneurs. The application of circular economy principles in the local context demonstrates that organic waste, such as coffee residues, can be transformed into productive and environmentally friendly commodities, supporting the transition to renewable energy and improving community welfare. These findings align with recent studies that emphasize the importance of social innovation and the utilization of local potential in developing alternative energy and sustainable economic models. This model is worthy of replication in other regions with similar organic waste potential to support inclusive green economic development.

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