

Comforting Cow Dung into Eco-Briquettes: A Rural Energy Solution in East Java

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Abstract: *This community engagement project was conducted in Cendono Village, East Java, aiming to transform cow dung into charcoal briquettes as a sustainable energy solution. The main objective was to educate and empower local cattle farmers through a community-based research (CBR) approach. Activities included awareness sessions, training, and hands-on briquette production. Participants were taught the complete process, including drying, mixing, molding, and testing the briquettes. The trial phase showed that the briquettes produced optimal burning duration and sufficient heat output for household cooking. This initiative served as both a waste management strategy and an economic empowerment tool. Results demonstrated successful community adoption of the briquette-making process, improved awareness of sustainable practices, and the potential to generate supplementary income for rural families. Additionally, the initiative contributed to reducing unmanaged cow dung waste, thus preventing environmental and health issues. This program illustrates the potential of organic waste transformation into renewable energy sources. The experience is expected to inspire other rural communities to adopt similar environmentally friendly and economically beneficial practices.*

Kata kunci: *briquettes, community-based research, cow dung, transforming*

Abstrak: *Kegiatan pengabdian kepada masyarakat ini dilaksanakan di Desa Cendono, Jawa Timur, dengan fokus pada transformasi kotoran sapi menjadi briket arang sebagai energi berkelanjutan. Tujuan utama kegiatan ini adalah memberikan edukasi dan pemberdayaan kepada peternak lokal melalui metode community-based research (CBR). Aktivitas meliputi sosialisasi, pelatihan, serta praktik langsung dalam pembuatan briket. Peserta dilatih mulai dari proses pengeringan, pencampuran, hingga pencetakan briket. Uji coba menunjukkan bahwa briket yang dihasilkan memiliki waktu bakar optimal dan menghasilkan panas yang cukup untuk kebutuhan memasak. Program ini tidak hanya memberikan solusi praktis untuk pengelolaan limbah ternak, tetapi juga meningkatkan kesadaran dan keterampilan ekonomi masyarakat. Hasil kegiatan menunjukkan bahwa tujuan pengenalan dan pelatihan telah tercapai, dengan masyarakat mampu memproduksi briket secara mandiri. Kegiatan ini memberikan dampak ekonomi positif dan mendorong pengurangan limbah ternak yang sebelumnya tidak terkelola. Diharapkan, kegiatan ini dapat menjadi model bagi wilayah lain dalam memanfaatkan limbah organik secara produktif dan ramah lingkungan.*

Keywords: *briket, CBR, energi terbarukan, kotoran sapi, perubahan.*

1. Introduction

Currently, the global community confronts significant energy challenges, compelling researchers and policymakers to explore alternative energy sources that exhibit both environmental compatibility and long-term sustainability (Kumar *et al.*, 2020; Saxena & Sandhwar, 2023; Shi *et al.*, 2024). This imperative holds particular importance in rural regions, where reliance on fossil fuels imposes both ecological and economic burdens. A pragmatic solution involves actively utilizing organic waste streams as renewable energy resources. Bovine excrement, frequently regarded as a low-value waste product, possesses substantial potential for conversion into efficient and ecologically sound fuel in the form of charcoal briquettes (Kpalo *et al.*, 2020; Majumder *et al.*, 2021).

Cendono Village, located in East Java, exemplifies the energy challenges prevalent in many rural communities. Villagers there depend primarily on fossil fuels, while simultaneously generating substantial quantities of unmanaged bovine excrement. This mismanagement contributes to environmental pollution and noxious odors, diminishing the overall quality of life within the village. However, recognizing the potential of this underutilized resource, the community, with the support of our community service activities, is now actively converting cow dung into briquettes, thereby creating an affordable and sustainable energy alternative (Majumder *et al.*, 2021). This initiative demonstrates the transformative power of strategically leveraging local resources to address critical energy needs and promote environmental stewardship. Specifically, the successful implementation of this briquetting program in Cendono Village highlights the feasibility of empowering communities through sustainable energy solutions derived from readily available organic waste.

Comparative analyses confirm that cow dung briquettes exhibit superior combustion characteristics compared to traditional fuels such as wood or charcoal. Specifically, Sathiyabarathi *et al.* (2020) demonstrated that these briquettes generate a higher heat output and possess a prolonged burn time, enabling households to reduce their overall fuel consumption and lessen their reliance on unsustainable sources. This enhanced energy efficiency directly translates to cost savings for families within Cendono Village, as evidenced by initial feedback gathered during the community service program.

Beyond their efficiency, the adoption of cow dung briquettes actively mitigates harmful emissions, contributing to a cleaner and healthier environment. Kumar *et al.* (2021) established that transitioning to briquettes reduces the release of pollutants, thereby minimizing the detrimental impact on air quality and mitigating potential respiratory health issues within the

community. This aligns with the broader goals of sustainable waste management and environmental stewardship promoted throughout our community service initiative in Cendono Village.

Moreover, the production and distribution of cow dung briquettes actively stimulates local economic growth by generating new employment opportunities and supplementary income streams for farmers. Kpalo *et al.* (2020) highlighted the potential for briquetting initiatives to empower rural communities by fostering economic independence and promoting sustainable livelihoods. In Cendono Village, this is reflected in the increasing participation of villagers in the briquette-making process, signaling a positive shift toward greater economic self-sufficiency.

Despite the inherent potential of cow dung as a viable energy source, a significant knowledge gap exists within Cendono Village regarding briquetting techniques and the associated benefits. Therefore, targeted educational initiatives and hands-on training programs are crucial for empowering the community. Ali & Sahdev (2025) emphasized that equipping farmers with the skills to produce and utilize briquettes not only enhances their practical capabilities but also fosters a deeper appreciation for the value of locally available resources. This aligns directly with the observed outcomes of the community service activities, where participants demonstrated increased proficiency in briquette production and a heightened awareness of the economic potential of cow dung.

Furthermore, comprehensive training programs actively cultivate awareness regarding the critical importance of responsible waste management practices and the adoption of renewable energy technologies within Cendono Village. Shi *et al.* (2024) and Uzorka *et al.* (2023) assert that such programs are instrumental in promoting a broader understanding of the environmental and economic advantages associated with sustainable energy solutions. This assertion directly reflects the project's goals of instilling an understanding of waste management and promoting the use of renewable energy.

The implementation of targeted training programs within Cendono Village is demonstrably catalyzing transformative change, fostering the adoption of sustainable energy practices. Specifically, Ferronato *et al.* (2022) indicated that these initiatives empower residents to produce briquettes independently, thereby mitigating waste accumulation and diminishing the incidence of pollution-related health concerns. Moreover, Purwanta & Daniel (2018) note that the resultant briquettes exhibit clean-burning characteristics and lack offensive odors, ensuring their suitability for daily cooking applications. As the community's collective

knowledge and technical proficiency expand, Cendono Village is progressing toward energy independence, leveraging locally sourced renewable resources.

However, the briquetting process is not without its limitations. Insufficient drying of the cow dung can lead to the production of briquettes with an unpleasant odor and an undesirable, sticky texture, as evidenced by challenges encountered during initial trials in Cendono Village. Furthermore, reliance on solar drying introduces vulnerabilities, as inconsistent sunlight patterns can impede the thorough desiccation of both raw materials and finished briquettes, potentially affecting product quality.

Additionally, the mixing ratio between the cow dung charcoal and the cassava peel-based adhesive requires precise calibration. Deviations from the optimal proportion can compromise the structural integrity of the briquettes, rendering them prone to cracking or disintegration. Addressing these challenges through refined techniques and optimized resource management is essential for ensuring the long-term viability and widespread adoption of cow dung briquetting as a sustainable energy solution within Cendono Village.

2. Methods

This activity employed a community-based research framework to collaboratively address cow dung management, energy access, and environmental sustainability in Cendono Village. We fostered a partnership with the cattle breeders group to define the problem and align the project with community priorities. This involved participatory assessments of needs and resources, incorporating focus group discussions, household surveys, and community mapping exercises. These efforts aimed to comprehensively understand the challenges and opportunities associated with cow dung management and briquette production, recognizing community ownership as vital.

The collaborative findings informed the development and implementation of a briquetting training program that focused on hands-on workshops and peer-to-peer learning. This training program commenced with an orientation on the benefits and process of making briquettes, introducing the community to the applied technology and its economic potential. The core of the training involved hands-on practice, where participants learned to make briquettes from cow dung using cassava peels as a natural binder. The complete process included several steps: collecting fresh cow dung and sun-drying it for 3–5 days gathering and drying cassava peels carbonizing the dried cow dung in a drum or pit with limited oxygen preparing a cassava peel adhesive by boiling chopped peels until a sticky, starch-rich paste formed mixing the cow dung

charcoal with the cassava peel adhesive in a 4:1 ratio, and molding the mixture into cylindrical or pillow shapes using a manual mold. The program's success is noted in the editor document.

Following the briquette-making process, a trial was conducted to evaluate product quality and provide feedback to participants. The briquettes, when burned, released a small amount of smoke with a slight aroma of fragrant wood, ensuring no unpleasant odors or alterations to the aroma or taste of cooked food. Data collection and monitoring efforts included maintaining production logs, conducting household monitoring visits, and performing emissions testing to ensure adherence to environmental standards. This systematic approach facilitated the assessment of briquette production rates, quality, and household adoption patterns.

A participatory evaluation process engaged community members in assessing the social, economic, and environmental impacts of the briquetting program through pre- and post-training assessments, waste reduction measurements, energy access assessments, and economic benefit analyses. Data analysis, interpretation, and dissemination were conducted collaboratively, with findings shared through community meetings and presentations. Finally, community action planning workshops empowered community members to develop strategies for scaling up briquette production, promoting adoption, and ensuring the long-term sustainability of the initiative, including establishing small businesses. This CBR approach ensured that the project was participatory, empowering, and relevant to the community's needs, particularly in addressing initial skepticism through patient engagement and demonstration of the briquettes' benefits as highlighted in the editor document. This approach aimed to ensure the community not only understood the theory but could also independently implement sustainable briquette production.

3. Results and Discussion

Community service activities in Cendono Village that aim to introduce and train the making of briquettes from cow dung have been carried out in a systematic and planned manner. The activity process began with training conducted by the implementation team, where participants were taught about the benefits, techniques, and process of making charcoal briquettes. After the training, practical assistance was provided. Participants were taught the steps from collecting cow dung, drying, mixing with binders, to molding the briquettes. The briquettes varied in shape and size depending on the mold used. The resulting briquettes are of uniform thickness and convenient size. After the briquettes are molded, checks are made to ensure that the briquettes are dry and solid. Good briquettes should have low moisture in order

to burn efficiently. In a pilot test, the briquettes were tested to determine the burning time and heat output.

The results showed that the briquettes had an optimal burning time, and could produce enough heat for cooking purposes. Theoretically, briquettes from cow dung are able to provide good energy efficiency, as well as being an alternative energy source that is environmentally friendly.

This activity is not only successful in producing briquettes, but also provides new knowledge and skills for the community. This is expected to increase the community's awareness and ability to manage cow dung waste into useful products. The activities were documented in Fig. 1-5.



Figure 1. Signing of outreach activities agreement



Figure 2. Condition of the cowshed



Figure 3. Counseling with village residents



Figure 4. Creating the cow dung briquettes with village residents



Figure 5. Drying process, burning test, and briquettes results

4. Conclusion

The results of community service activities in Cendono Village show that the main objective to introduce and train the community in making briquettes from cow dung has been achieved. The community managed to understand the process of processing waste into an alternative energy source, and was able to produce briquettes with good quality. The direct impact on the community is very positive, including:

- Increased Knowledge. The community is now more aware of the potential of cow dung waste and how to process it.
- Economic Improvement. The briquettes produced can be an additional source of income for farmers.
- Waste Reduction. Previously unmanaged cow dung waste can now be utilized productively.

For further development, it is recommended to do:

1. Advanced Training : Organize additional training sessions to improve skills in briquetting techniques and product innovation.
2. Small Businesses : Encourage the establishment of briquette-based small businesses, so that communities can sell their products commercially.
3. Regional Expansion : Engaging other villages to apply similar technology, so that the benefits can be felt more widely.

Besides helping local families save money and offering a new energy option, making briquettes from cow dung also affects forest conservation. On the positive side, using cow dung instead of firewood means people don't need to cut down as many trees. In many rural areas, collecting firewood from forests is still a daily activity. Replacing it with cow dung briquettes can ease that pressure, helping to keep forests healthier and wildlife safer over time.

But there are also some downsides to keep in mind. If people take too much cow dung from fields without letting it naturally break down into the soil, it can harm the land and reduce nutrients that crops need. And if the process of turning dung into charcoal isn't done properly, it can still release smoke and air pollution. So, while this solution can be great, it's important that people make and use briquettes in ways that are safe and sustainable for both the environment and their communities. With these steps, it is hoped that the sustainability of the program can be maintained and provide greater benefits to the community.

Even though this program was successful, it wasn't without challenges—especially when it came to how people reacted at first. When the idea of making cooking briquettes from cow dung was introduced, many people in Cendono Village responded with skepticism. Some found the idea strange, some were grossed out, and others thought it was just a waste of time. Because of these reactions, it took a lot of effort to get the community interested.

Winning people's trust wasn't easy. It required patient conversations, explaining the benefits over and over again, and showing them how the briquettes actually worked—clean burning, no bad smell, and useful for daily cooking. Slowly but surely, once people saw the results for themselves, their opinions started to change. This shows how important it is to understand people's feelings and be persistent when bringing new ideas into a community, especially when those ideas are unfamiliar or seem unusual at first.

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