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IMPLEMENTATION OF ROCKET STOVE AS AN ENVIRONMENTALLY FRIENDLY WASTE MANAGEMENT INNOVATION IN THE GREEN VILLAGE PROGRAM OF CIBAREGBEG VILLAGE

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ABSTRACT

This community service project addresses the critical issue of improper waste management in Cibaregbeg Village, where open burning remains a widespread practice due to the lack of a formal waste collection system. The program introduces Rocket Stove technology as an environmentally friendly innovation that enables more efficient, smoke-reduced combustion of household waste. Implementation methods include environmental education, collaborative construction, training on operation procedures, and integration within the Green Village initiative. The results demonstrate improved community awareness, reduced waste accumulation, and noticeable improvements in environmental quality. Overall, the Rocket Stove initiative proves to be sustainable, and scalable solution for rural waste management.

Keywords: rocket stove; waste management; green village

INTRODUCTION

Cibaregbeg Village, located in the Cianjur Regency of West Java, represents a typical rural settlement where environmental challenges have become increasingly visible in recent years. One of the most pressing concerns in the village relates to the management of household and community waste. Waste accumulation in public spaces, narrow roads, riverbanks, and empty plots of land has intensified due to rapid population growth, shifting consumption patterns, and limited access to formal waste collection services. Like many rural communities in Indonesia, Cibaregbeg Village lacks an integrated waste processing system, which results in unsustainable disposal practices.

The most common method of waste disposal practiced by residents is open burning, typically conducted in backyards, along roadsides, or near agricultural fields. This method persists due to cultural familiarity, convenience,

and the absence of viable alternatives. However, open burning is known to produce toxic emissions, including particulate matter (PM2.5 and PM10) (Harrison, 2020)(Singh, 2022), carbon monoxide (Wang, 2025), and volatile organic compounds (Wang, 2025). Prolonged exposure to these emissions has well-documented consequences, such as respiratory illnesses, irritation of the eyes and skin, and the exacerbation of chronic diseases such as asthma. Environmental impacts are equally concerning, including local air pollution, soil degradation, and contributions to greenhouse gas emissions that accelerate climate change.

Another common practice in Cibaregbeg Village is informal dumping of waste into vacant land or waterways. These areas often become informal landfills that contribute to the proliferation of insects, rodents, and foul odors. Moreover, plastics and other non-biodegradable materials can accumulate in drainage channels and rivers, leading to increased flood risk during heavy rainfall. These environmental hazards have significant implications for community health, agricultural productivity, and overall quality of life.

Recognizing these urgent issues, the community service program initiated by the university team aims to introduce a more environmentally responsible waste management solution, particularly through the implementation of Rocket Stove technology. Rocket Stoves are an efficient combustion system designed to maximize thermal output while minimizing harmful emissions. Traditionally used for cooking or heating, the Rocket Stove adapts well to controlled waste combustion due to its high-temperature burning chamber, improved airflow system, and reduced smoke production. As documented in prior studies (Yahya & Ningrum, 2023), Rocket Stove combustion decreases visible smoke and enhances fuel efficiency, making it a more sustainable alternative to traditional open burning.

This community service initiative not only introduces an innovative technology but also promotes the broader principles of environmental education, community participation, and sustainable village development. The program aligns with the national agenda for improved

waste management as outlined by Ministry of Environment and Foresty of Indonesia (2021) and supports the localized Green Village (Kampung Hijau) program implemented by the Cianjur Regional Environmental Agency (2023). By combining technological innovation with community empowerment, this initiative aims to create long-term behavioral changes that support a cleaner, more resilient environment.

Furthermore, the introduction of Rocket Stove technology is accompanied by awareness-building efforts and collaborative activities such as the JUBIRIN clean-up program. JUBIRIN—short for "Jumat Bersih Rutin"—is a scheduled village-wide cleanliness campaign conducted every Friday. Through this initiative, residents, school communities, and local leaders collectively engage in environmental preservation. Integrating Rocket Stove adoption into the framework of JUBIRIN not only formalizes waste processing routines but also enhances community ownership and sustainable implementation of the program.

Overall, the introduction of Rocket Stove technology serves as both a technical innovation and a catalyst for environmental transformation. This article presents a detailed overview of the methods, results, and impacts of the program, offering insight into how community-based interventions can effectively address waste management challenges in rural Indonesia.

IMPLEMENTATION METHOD

The implementation of this program used Community-Based Participatory Research (CBPR) that takes a collaborative approach by placing community members, researchers, and other stakeholders as equal partners in the entire research/service process. CBPR aims to combine knowledge and action to create positive and sustainable social change, especially in addressing health and social inequalities. (Collins et al., 2018).

The implementation of this community service program involved a comprehensive series of activities structured to promote understanding, acceptance, and continued use of Rocket Stove technology within Cibaregbeg Village. The methodology followed a

participatory approach, emphasizing collaboration, capacity-building, and community empowerment. The detailed activities are explained below.

Environmental Education for Residents

(1) Awareness Sessions and Public Discussions. The program began with a set of structured educational sessions aimed at increasing residents' awareness regarding the dangers associated with open burning. These sessions were facilitated in community halls, school auditoriums, and neighborhood meeting points. Through interactive presentations, short videos, and real-case examples, participants were informed about the health risks posed by smoke from open burning, the environmental pollution it causes, and the long-term consequences on soil and water quality. (2) Distribution of Educational Materials. Educational pamphlets, posters, and infographics were distributed to households and public institutions. These materials summarized key concepts such as the harmful chemical compounds released during open burning, proper segregation of waste, and the benefits of adopting environmentally friendly technologies such as the Rocket Stove. (3) Dialogue and Community Feedback. The education sessions included open forums where residents could express their concerns, ask questions, and share their experiences related to waste disposal. This feedback was crucial for identifying local needs and tailoring the technology to fit community practices. The dialogues also encouraged residents to reflect on their current waste management habits and consider more sustainable alternatives.

Collaborative Construction of Rocket Stoves

(1) Technology Introduction and Demonstrations. Before construction, the project team conducted a demonstration of the Rocket Stove's structure, components, and operational mechanisms. This demonstration involved explaining airflow dynamics, heat retention, and external insulation, which collectively ensure efficient combustion. (2) Community-Based Design and Planning. Rather than imposing a standardized design, the team adopted a collaborative approach. residents participated in selecting materials such as bricks, clay, metal pipes, and insulation components.

Village builders and craftsmen also provided input to ensure the Rocket Stoves were durable, affordable, and replicable using locally available materials. (3) Construction Workshops. Hands-on workshops were conducted, involving residents from different neighborhood clusters (RT/RW). Participants were divided into small groups and guided step-by-step by the project team to build a Rocket Stove in selected public areas, such as near the village office, school compounds, and waste collection points. The workshops provided practical learning opportunities, enabling residents to acquire skills that could later be used to construct their own Rocket Stoves independently. (4) Installation and Testing. After construction, the Rocket Stoves were tested to evaluate airflow efficiency, combustion speed, and smoke reduction. Adjustments were made based on test results, such as modifying the chimney height or burner diameter. Residents actively participated during this testing phase, increasing their familiarity with the technology.

Training in Operation and Maintenance

(1) Operational Training. Residents received hands-on training on how to operate the Rocket Stove properly. They were instructed on the types of waste suitable for combustion, how to arrange waste for optimal burning, and safety considerations such as maintaining distance and avoiding overloading the combustion chamber. This phase ensured that the Rocket Stoves could be used effectively for daily waste processing. (2) Maintenance and Troubleshooting Procedures. Maintenance training included guidance on cleaning ash residue, checking airflow channels, repairing cracks, and replacing worn-out components. A troubleshooting guide was also provided, helping residents identify common operational issues such as insufficient airflow or incomplete combustion. (2) Establishment of Maintenance Teams. To ensure sustainability, maintenance teams were formed at the community level. These teams consist of local volunteers who monitor the Rocket Stoves regularly and ensure proper functioning. This structure

strengthens community responsibility and builds a system of collective care.

Coordination with Local Institutions Through the JUBIRIN Program

(1) Integration with Local Schools. Schools played a central role in environmental education and implementation. Teachers were involved in awareness activities, and students participated in Rocket Stove demonstrations. The involvement of youth strengthened intergenerational sustainability and ensured the continuation of environmental values. (2) Friday Clean-Up (JUBIRIN) Collaboration. The JUBIRIN program was used as a strategic platform to introduce Rocket Stove usage to a wider audience. During these weekly clean-ups, collected organic and combustible waste was processed using the Rocket Stoves, reducing the likelihood of open burning in uncontrolled areas. (3) Institutional Partnerships. Collaborations with the Village Office, PKK women's groups, Karang Taruna youth organizations, and environmental cadres helped mobilize residents and integrate the Rocket Stove program into broader village development plans. These partnerships ensured administrative support and resource allocation needed for long-term sustainability.

Table 1. Construction of the Rocket Stove

Step	Activity	Description
1	Start	Beginning of the construction workflow.
2	Identify Community Needs	Assessing local conditions and determining the necessity for Rocket Stove technology.
3	Material Preparation	Preparing clay, sand, bricks, metal pipes, and construction tools.
4	Base Formation	Shaping the foundation and combustion area to ensure proper structure.
5	Outer Structure Construction	Strengthening the walls using clay and bricks to form the main stove body.
6	Testing and Hardening	Allowing the constructed stove to dry and stabilize before use.
7	Testing and Heat Efficiency Check	Evaluating combustion performance, airflow, and efficiency.
8	User Training and Demonstration	Training community members in proper operation, safety, and maintenance.

This process aimed not only to produce an efficient and low-emission stove, but also to empower residents through hands-on participation and practical skill development. Each stage—from material preparation to assembly, testing, and user training—was implemented collaboratively to ensure

that the resulting technology would be easy to understand, sustainable, and replicable by the local community. The following steps outline the complete workflow for building the Rocket Stove as part of the community service program.

RESULT AND DISCUSSION

The implementation of Rocket Stove technology in Cibaregbeg Village produced tangible improvements in waste management practices and environmental quality. Several key outcomes were observed and are discussed below.

(1) Reduction in Open Burning Practices. After the installation of Rocket Stoves, as many as 85% of residents reported a significant decrease in open-burning practices. This helps to effectively reduce air pollution and create a cleaner environment. In addition, 90% of residents feel that the quality of the environment has become healthier. The controlled combustion process provided by the Rocket Stove reduced visible smoke and improved air quality in residential areas. This data proves that simple technology such as Rocket Stoves is able to have a great positive impact on people's quality of life. These findings align with Yahya & Ningrum (2023), who found that Rocket Stoves decrease toxic emissions through high-efficiency burning. (2) Improvement in Environmental and Health Conditions. Residents expressed positive perceptions of reducing air pollution, with 85% of survey respondents expressing satisfaction with cleaner air quality. Fewer complaints about respiratory discomfort, irritation, and foul odors were reported. The village environment became noticeably cleaner, and waste accumulation decreased, especially around common dumping areas. (3) Enhanced Community Participation. The JUBIRIN program fostered a culture of shared responsibility. Residents, students, and local leaders became more engaged in environmental care. Community involvement in the construction phase increased their sense of ownership, consistent with findings by Zulfa et al. (2022), which emphasize the importance of community empowerment in environmental sustainability. As shown in Figure the JUBIRIN program fostered a culture of shared responsibility. Residents, students, and

local leaders became more engaged in environmental care.

Figure 1. JUBIRIN

(3) Sustainability and Replicability. After the initial installation, some households began to attempt to replicate the Rocket Stove independently in various locations. This initiative shows the public's interest in efficient environmentally friendly technology. This replication process involves the use of materials available in the vicinity, as well as collaboration between citizens to share techniques and experiences. This demonstrates the program's success in empowering residents with practical knowledge and technical skills. The collective maintenance teams also helped sustain the functionality of installed Rocket Stoves.

Figure 2. Process Rocket Stove

As shown in Figure, the installed Rocket Stove demonstrates the final structure placed in the designated public waste processing area.

Figure 3. Finish Rocket Stove

Figure displays the completed Rocket Stove, highlighting its efficient design and readiness for community use.

CONCLUSION

The Rocket Stove program implemented in Cibaregbeg Village demonstrates that appropriate technology, when combined with community education and participatory engagement, can effectively address waste management problems in rural

settings. The program successfully reduced open burning, improved environmental conditions, and strengthened community participation through integrated activities such as JUBIRIN and school-based involvement.

Future initiatives should focus on expanding Rocket Stove installations to other neighborhood units, introducing formal waste collection systems and integrating recycling and composting strategies to build a holistic, sustainable waste management model. The success of this program highlights the potential for scaling the approach to other rural communities facing similar challenges across Indonesia.

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