PRESERVING OUR ENVIRONMENT WITH ANTI-OPEN BURNING PROTOCOL:

GUIDELINES FOR THE ERADICATION OF OPEN BURNING

MAY 2025

OVERVIEW

PURPOSE

- This document primarily serves as a comprehensive guideline for both government and non-government stakeholders in Banyuwangi , providing technical guidance for the implementation of anti-open burning initiatives.
- Additionally, it stands as a valuable reference point for similar programs aimed at conducting anti-open burning initiatives elsewhere in Indonesia and beyond, amplifying its impact and utility across diverse contexts.

METHODOLOGY

- Our methodology aligns with the step-by-step implementation process of the Banyuwangi Hijau program, ensuring a comprehensive and systematic approach. Specifically, for fostering behavior change, we use the Community-based Total Sanitation (STBM Pilar IV) methodology, rigorously tested and refined based on Banyuwangi's implementation learnings.
- By leveraging these established methodologies, we capitalize on insights and adaptations from previous experiences in Banyuwangi, enhancing the initiative's effectiveness and efficiency.
- Since there is limited research and work in this area, our campaign is among the first in the country. Therefore, this guidance is based solely on our experience, and we welcome input and comments from others working in this field.

ABOUT THIS ANTI-OPEN BURNING INITIATIVE

- Open waste burning is the primary means of self-waste management in Indonesia, surpassing ocean leakage for uncollected waste. According to a 2017 NPAP study, 47% of waste in Indonesia is openly burned. A 2022 study by our team in Banyuwangi revealed that 50% of peri-urban and 94% of rural residents regularly burn waste, causing severe environmental and health consequences.
- Evidence shows that open burning releases toxic and carcinogenic substances and is a leading cause of black carbon, which has a global warming potential 2,000 to 5,000 times greater than carbon dioxide. The local public health and global environmental impacts highlight the urgent need to address this neglected issue.
- As we scale Banyuwangi's waste collection and processing systems, a primary objective is eradicating open burning practices. This initiative includes a policy trade-off for villages benefiting from improved waste collection services. By combining policy and behavior change elements with improved waste services, we aim to reduce open burning, addressing both environmental and health concerns.
- Using the tested and refined methodology from our Banyuwangi program, we hope these guidelines will serve as a framework for expanding anti-open burning initiatives within Banyuwangi and beyond.

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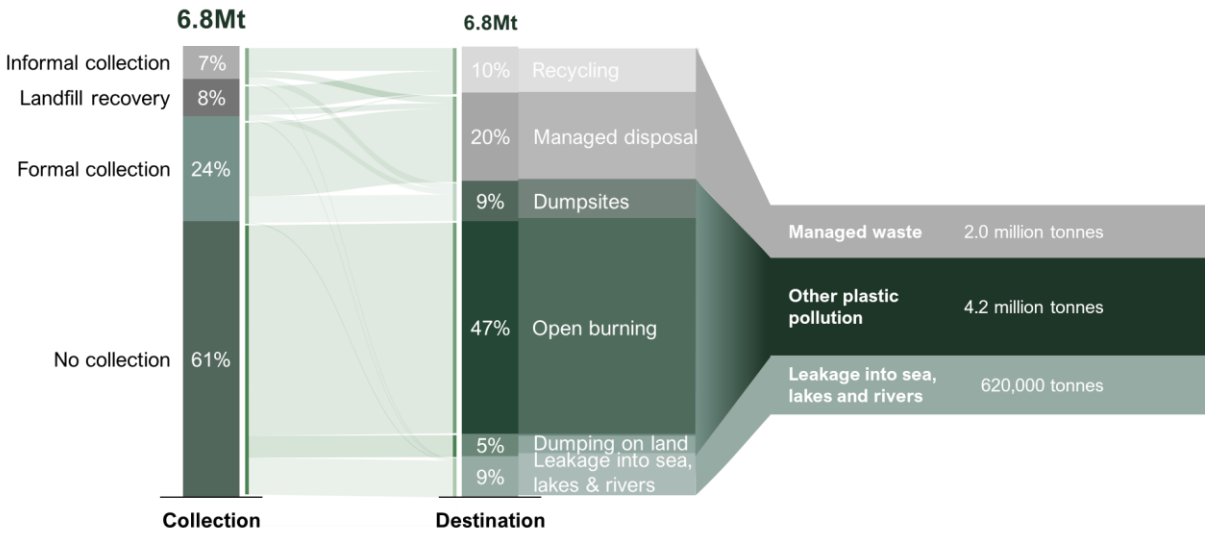
BACKGROUND

INDONESIA CONTEXT

Across Indonesia, open waste burning is currently the most widely used method of disposal for those without a waste collection service. Despite the significant environmental and public health implications, how to address it with the community remains relatively unresearched, despite presenting arguably a significantly greater challenge than the issue of ocean plastic pollution.

Figure 1. Disposal routes of Indonesian plastic waste (% of total plastic waste generated)[1]

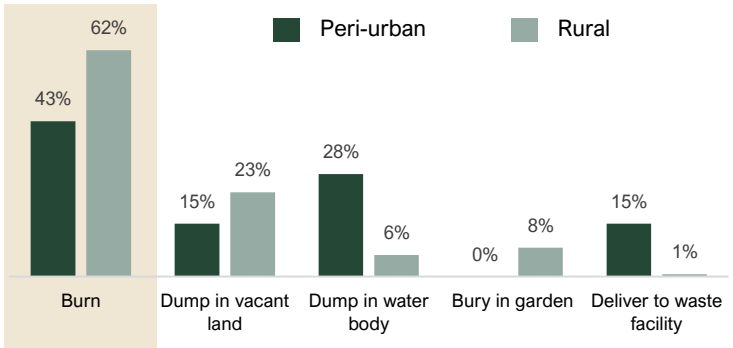


This issue has been getting more attention from national Government in recent years. Linked with the government's commitment in fulfilling Indonesia's Enhanced National Determined Contribution (ENDC), the Government of Indonesia aims to eliminate open burning by 2050[2].

OPEN BURNING IN BANYUWANGI

Given the ample availability of nearby land, open burning of waste has become the predominant recourse in Banyuwangi for managing uncollected waste.

Figure 2. How do you treat your uncollected waste? (multiple answers)[3]
% of total respondents for each peri-urban or rural category



PROBLEM STATEMENT

In the absence of reliable waste collection services, open burning prevails as primary means for people treating their uncollected waste. **A systematic approach is required to eradicate open burning practice** while concurrently addressing the improvement of local waste systems.

ADVERSE IMPACT

OF OPEN WASTE BURNING

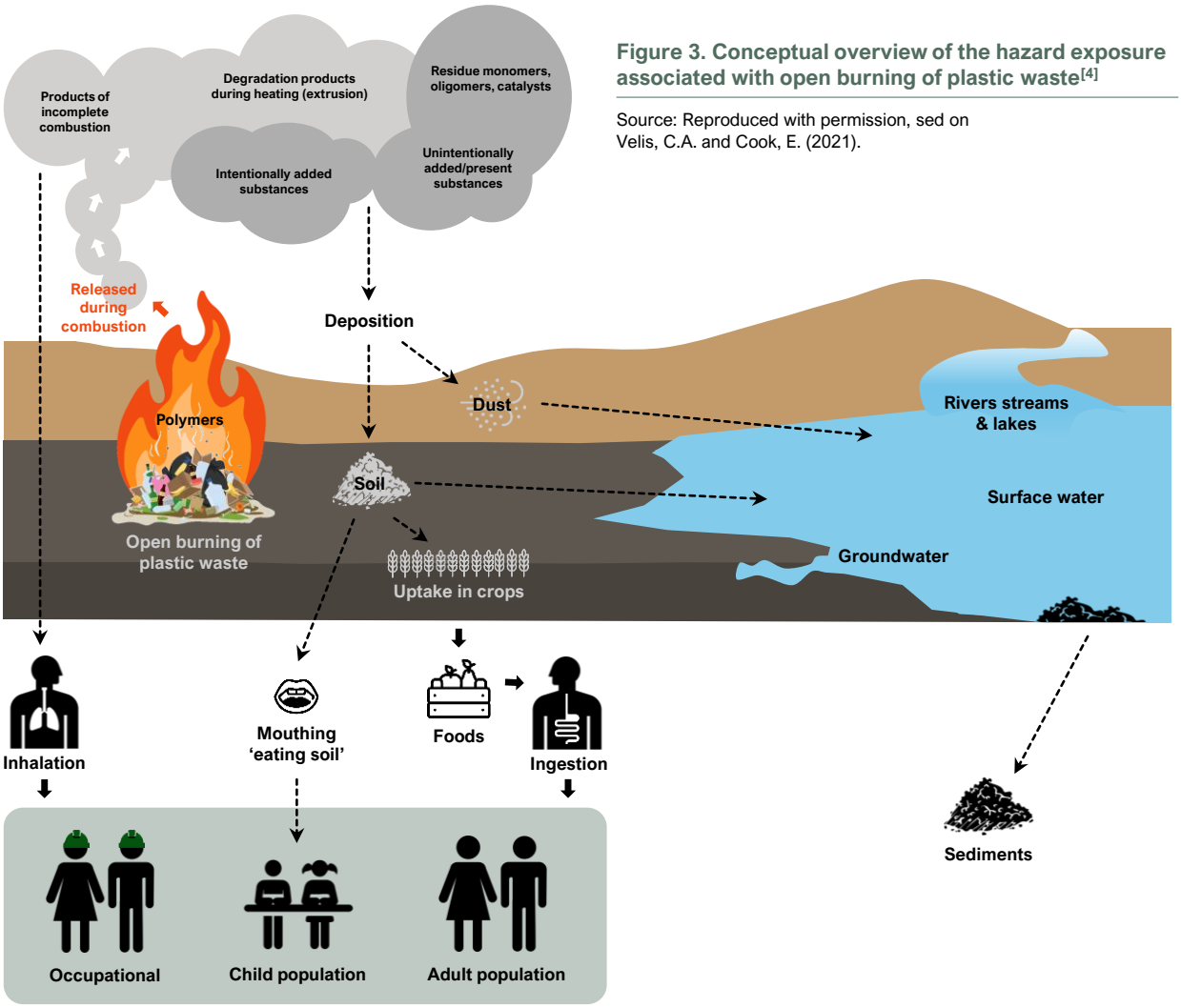


Figure 3. Conceptual overview of the hazard exposure associated with open burning of plastic waste[4]

Source: Reproduced with permission, sed on Velis, C.A. and Cook, E. (2021).

IMPACT TO HEALTH

- Waste burning releases Persistent Organic Chemicals (POPs) like dioxins, furans, and PCBs, as well as arsenic, mercury, lead, carbon monoxide, nitrogen oxides, sulphur oxides, and hydrochloric acid.
- These contaminants accumulate in the food chain and 90% of human exposure is through food, mainly contaminated meat and dairy products, fish and shellfish.
- POPs are highly toxic, leading to higher level of stunting, reproductive and developmental problems, damaging immune system, interfering with hormones, causing cancer, and an estimated 270,000 deaths per year.

IMPACT TO ENVIRONMENT

- Burning waste is also a leading cause of black carbon, with a global warming potential 2,000 to 5,000 times greater than carbon dioxide.
- Some reports estimate that as much as 20% of the planet's warming is attributed to black carbon, making it the second highest contributor to climate change after carbon dioxide.
- 5-10% of global CO2e emissions come from the black carbon released from burning plastic and other waste.

OUR APPROACH

START

Our approach cross-pollinates policy reforms and community empowerment, by integrating policy changes with grassroots initiatives. We ensure that top-down mandates are supported and sustained by bottom-up community actions. This dual approach combines the strengths of structured governance with the adaptability and influence of local engagement, leading to more sustainable and impactful outcomes.

STEP 1: POLICY SET-UP

Strengthening anti-open burning policy at regency and village level

STEP 2: VILLAGE ACTIVATION

Mobilizing community ownership to ensure universal and efficient waste management access for everyone.

STEP 3: IMPROVEMENT OF WASTE COLLECTION SERVICE

Starting door-to-door waste collection service that empowers waste sortation at source

STEP 4: OPEN BURNING HOTSPOT SELECTION

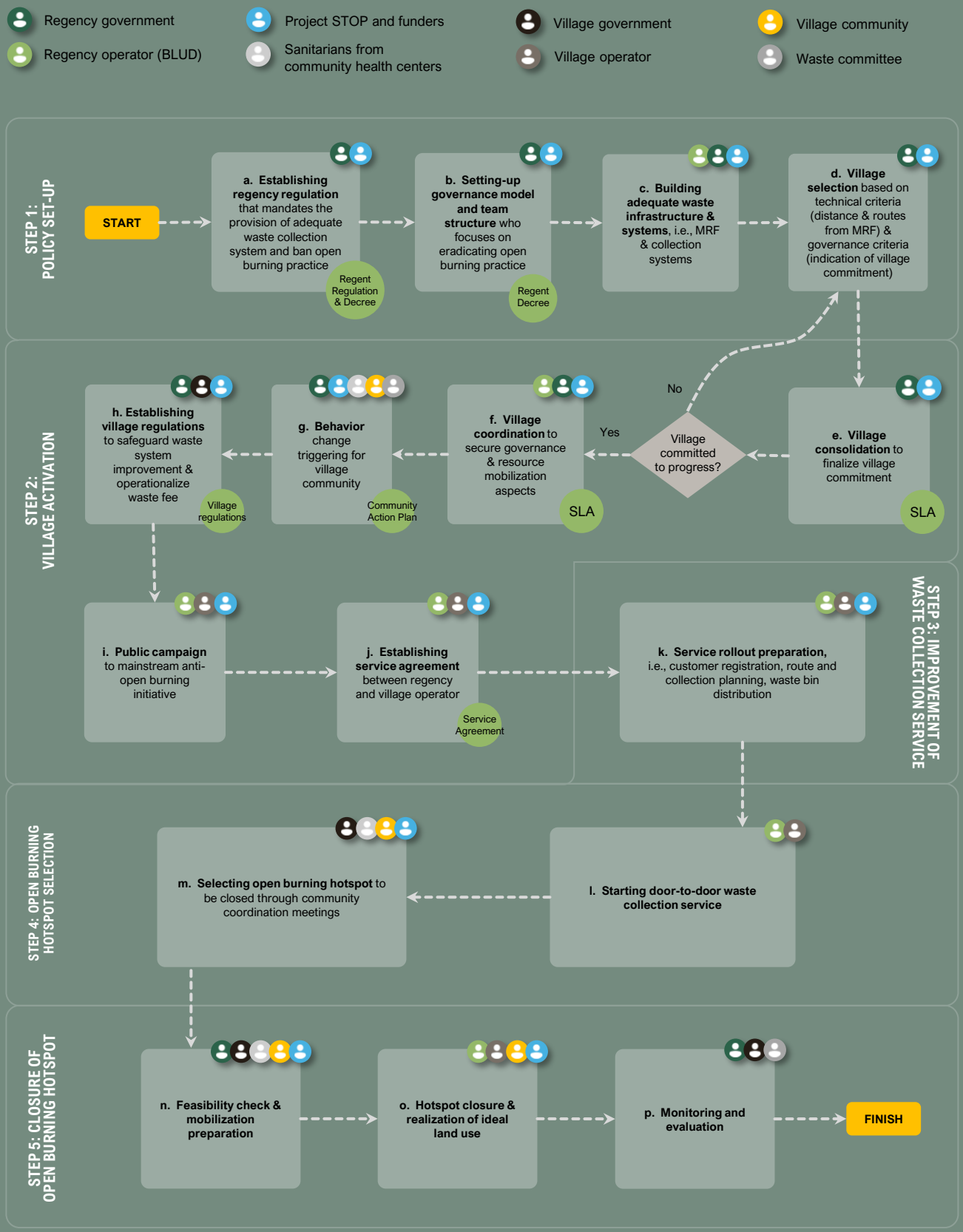
Prioritizing the most urgent and impactful open burning hotspot to close.

STEP 5: CLOSURE OF OPEN BURNING HOTSPOT

Closure of open burning hotspot and M&E

FINISH

All processes and multi-stakeholder collaborations for the 5 steps to eradicate open burning practices are government-led. Project STOP (co-founded by Borealis and Systemiq) provides technical assistance and support, supplemented by co-funding from our partners. The following outlines the in-depth process adhering to these 5 steps. Key processes are finalized with the signing of a Service Level Agreement (SLA) and/or the issuance of regulations or decrees to formalize the commitment and responsibilities of all parties.



STEP 1
POLICY SET-UP

The foundation to unlock scalable and sustainable anti-open burning initiative lies in a robust policy framework, harmonizing both national climate mission and local movements.

The national emission reduction target articulated in the Indonesia's Enhanced National Determined Contribution (ENDC) imposes a stringent mandate for the elimination of open burning by 2050[2]. This amplifies government commitment in improving the national waste systems stipulated under the waste management laws.

At the regency level, the anti-open burning initiative hinges on regency regulations, reinforced by additional mandates from the Regent to enhance regency-wide waste system. This enhancement include amplifying performance-based village waste system improvement, where special village fund disbursement is tied upon village performance in improving its waste system, including in eradicating existing open burning practices.

A Joint-Management Office (JMO) between regency government and technical assistant support (Systemiq) is established at regency level. This serves as a platform for cross-agency stakeholders that focuses on problem solving the barriers in delivering scalable and sustainable regency-wide waste system. The Community Empowerment team – a special team within the JMO set-up – is responsible for triggering behavior change and empowering communities in eradicating open burning practices in their neighborhood.

At village level, individual villages enact regulations as a testament to their commitment to enhancing their local waste system. Additionally, at operational level, village operators appointed by the village government establishes service agreements with regency operator, supporting the regency operator in securing customer satisfaction and waste fee collection.

This comprehensive and rigorously enforced methodology seamlessly integrates community-driven initiatives. Villages are incentivized to close open burning hotspots as a policy trade-off, rewarding those villages that demonstrate unwavering commitment and tangible progress in improving their local waste systems.

Figure 3. Policy set-up in eradicating open burning practice

Law No. 18/2008 on Waste Management prohibits the burning of waste that does not meet the technical requirements of waste management.

Indonesia's ENDC, where the government of Indonesia aims to eliminate open burning by 2050.

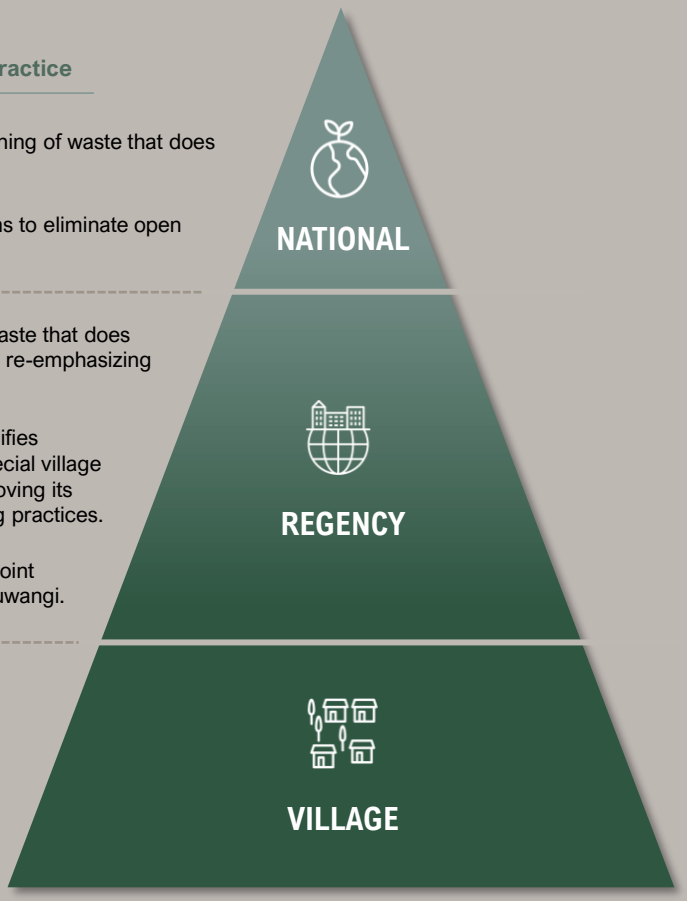
Regency Regulation No. 6/2022 prohibits the burning of waste that does not meet the technical requirements of waste management, re-emphasizing the prohibition in Law No. 18/2008.

Regent Regulation No. 4/2024 on Village Report, that amplifies performance-based village waste system improvement. Special village fund disbursement is tied upon village performance in improving its waste system, including in eradicating existing open burning practices.

Regent Decree No. 81/2024 that officiated cross-sectoral Joint Management Team for waste system improvement in Banyuwangi.

Village Regulation that emphasizes village government responsibility to improve their local waste service and eradicate open burning practices in their area.

Service Agreement between Village and Regency Operator that specifies roles and responsibility between both operators in providing collection service.

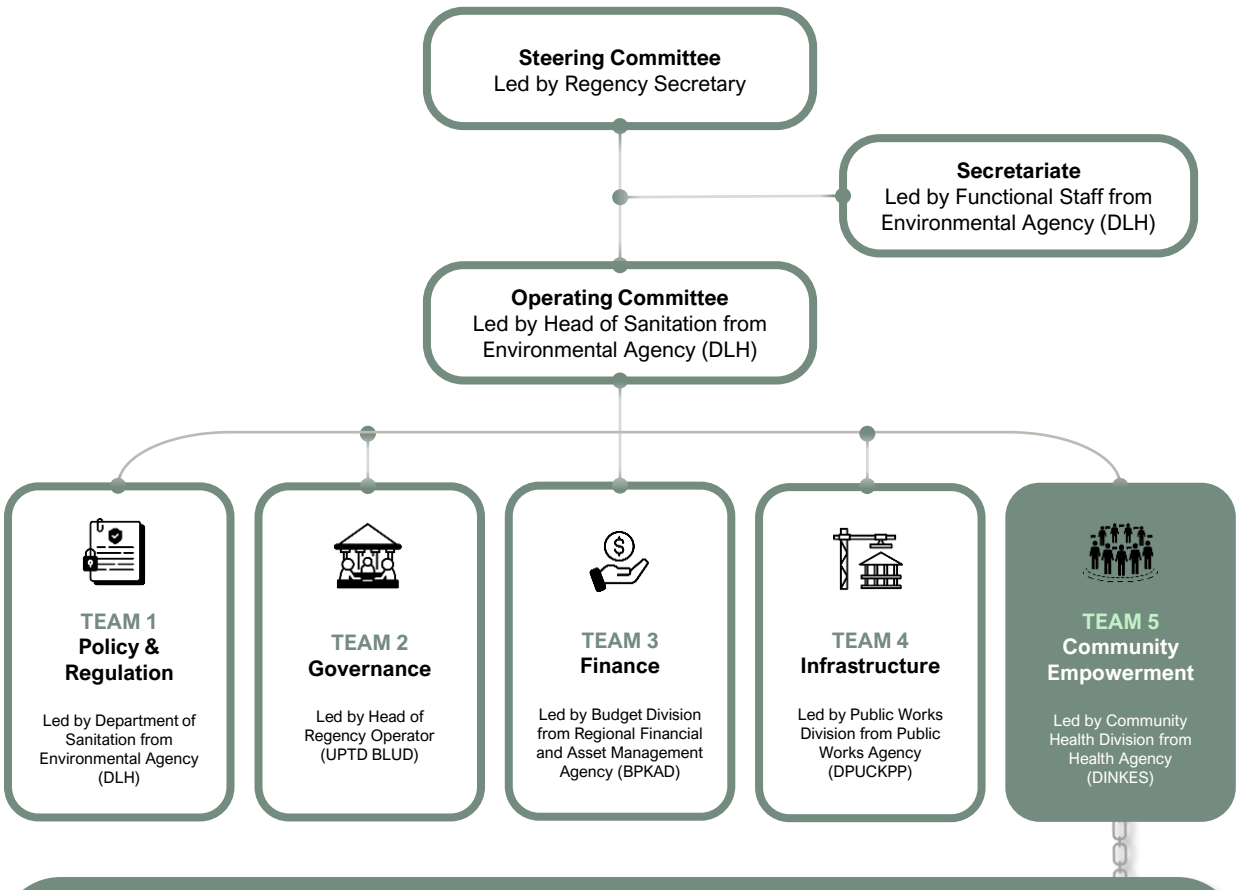


To enhance the policy framework and ensure effective implementation, a Joint Management Office (JMO) has been established between the regency government and Systemiq, providing technical assistance support.

This JMO serves as a mechanism to maintain close communication between the government and Systemiq, aligning their planning and expectations, and facilitating smooth project execution. The establishment of the JMO was formalized through Regent Decree No. 81/2024. The initiative is government-led, with the Systemiq team acting as a think tank and providing hands-on support to the regency government in operationalizing the Banyuwangi Hijau program.

The JMO is composed of five operating teams, one of which is a specialized team focused on community empowerment, led by the regency Health Agency. This special team is dedicated to ensuring active community participation in sustaining the local waste management system. A key commitment of this team for 2024 is to orchestrate the elimination of open burning practices in 44 villages in Banyuwangi.

As a form of commitment, the elimination of open burning practices is adopted by the Health Agency as a strategy to create demand for the improved waste system, thereby influencing and increasing the number of people served with enhanced waste services.



Mission

Ensuring active and sustainable community participation that supports the implementation of the BWH program.

2024 Targets

- Completing behavior change triggering and public campaign for 48 villages.
- Elimination of open burning hotspots in 44 villages.
- Activating Waste Committee in 12 priority villages.
- Household customer maintenance.

Team Members

- 1 person from Village Government Empowerment Division, DPMD
- 1 person from Information & Communication Division, DISKOMINFO
- 1 person from Regency Operator (UPTD BLUD)
- 1 person from Behaviour Change & Campaign Team, Systemiq
- 1 person from Governance Team, Systemiq

STEP 2
VILLAGE ACTIVATION

Village Activation is a rigorous process aiming towards unlocking universal access for the population to reliable waste management systems. A key component of this activation is fostering trust and ownership within the community, ensuring system's sustainability. All these activation processes are government-led, ensuring resiliency of the program delivery. Service Level Agreement (SLA) between stakeholders is signed towards the end of each milestone as a formal document that defines roles and responsibilities of each stakeholders in delivering the local waste service. This SLA is becoming a critical tool for managing expectations, accountability, and trust among stakeholders.

VILLAGE CONSOLIDATION

The purpose of Village Consolidation is to identify and select committed villages to progress. The selection criteria for this milestone is based on village government commitment and political will, willingness to allocate their village funds and resources for waste system improvement, and village readiness for preparing service.

VILLAGE COORDINATION

Once committed village is selected, the process continues with series of Village Coordination to prepare the governance of the village waste service, which includes the appointment of village coordinator, assignment of operator and customer registration team, allocation of village budget, and development of work plan. This is also where the village government team agrees on initial waste fee amount, to be tested further with the village population during behavior change triggering session.

BEHAVIOR CHANGE TRIGGERING

Once village governance is ready, the process continues with community behavior change triggering. This process is aimed to trigger awareness and behavior change of the population to start collecting waste and eliminate open dumping and burning practices, as well as to pay for the waste fee. This process also discussed the adverse impact of waste open burning to health. This session is also enriched with initial mapping of willingness from the villagers in paying for the waste fee. The process is concluded under sub-village consolidation.

VILLAGE REGULATION AND OPERATOR AGREEMENT

When all aspects from both government and community is secured, all terms and commitment are officiated under a village regulation. This village regulation stipulates service area, waste collection service terms, waste fee collection terms, assignment of Village Operator, and administrative sanction. To further regulate the rollout of door-to-door waste collection service, a business-to-business agreement between the assigned Village Operator and Regency Operator is formed. This agreement stipulates responsibility of both Village and Regency operator in providing resources to serve the village with waste collection service.

SERVICE ROLLOUT PREPARATION

Series of trainings are conducted to ensure the village operator have adequate resources and capacity in carrying out the duty, i.e., in performing customer registration, customer data management, and collecting waste fee from customers.

Behavior change triggering is the heart of village activation and community empowerment. This agenda aims to promote healthy and safe practices in managing household waste. It also challenges deeply rooted unhealthy practices within the community culture and introduces proper waste management methods.

BEHAVIOUR CHANGE TRIGGERING

Teams of facilitators – sanitarians from community health centers (Puskesmas) – are mobilized to targeted triggering groups in villages. Facilitators engage groups of 20-30 villagers, primarily women, recognized as household waste managers, conducting sessions on-site. Facilitators use discussions and simulations to demonstrate the adverse effects of poor waste management. For example, they conduct waste-burning simulations if the community typically burns waste, making the message relevant.

Community pledges to change waste disposal habits are documented on a flipchart for visibility. Volunteers are then invited to lead these commitments, forming the Waste Committee (Komite Sampah). Facilitators also introduce the Balak MRF service scheme, explaining the necessity and importance of a service fee.

Triggering is an innovative approach in Indonesia, encouraging waste management behavior change under the government program STBM Pillar IV (Community-based Total Sanitation). The Banyuwangi Hijau Triggering STBM Pillar 4 manual is crucial for the Banyuwangi Health Agency, serving as a comprehensive reference for these initiatives. Facilitators are provided with this manual during training, which is continually enhanced with lessons learned and feedback from field implementation.

CUSTOMER REGISTRATION

Following triggering activities and the finalization of cooperation agreements between villages and UPTD BLUD, customers in each targeted village are registered in a centralized database. This database serves as the basis for calculating the tariffs each village owes UPTD BLUD for collection services. Customer registration prioritizes households interested in joining the program and those recommended by village government, conducted door-to-door with facilitators recording information and geotagging locations using a dedicated mobile application.

PUBLIC CAMPAIGN

While behavior change initiatives are specifically targeted at selected community groups, our public campaign strategy aims to reach a broader audience, educating them and building momentum around the eradication of open burning practices.

To effectively combat the practice of open burning, we are implementing a multi-faceted approach aimed at both targeted community groups and the broader public. Our strategy encompasses a range of initiatives designed to educate and build momentum around the eradication of open burning practices. Our multi-media campaign is designed to reach various demographics and social groups. We utilize a combination of in-person and online media campaigns to ensure our message resonates with a diverse audience.

We have partnered with Nahdlatul Ulama (NU), a well-respected religious community organization and Family Empowerment and Welfare (PKK) cadres, as represented social community, to educate the masses and generate support for eliminating open burning. In our efforts to reach a wider range of women, we conduct in-person campaigns tailored to emphasize the importance of keeping neighborhoods clean to prevent the spread of diseases like dengue fever and typhoid. These campaigns are conducted in collaboration with local community health centers (Puskesmas). Additionally, billboards are strategically placed in villages, showcasing the community's commitment to improving waste management systems and eradicating open burning practices. To engage a younger demographic, we run online media campaigns, including a series of podcasts and skits produced in collaboration with local talent and stakeholders. These efforts help amplify our message and ensure it reaches a broad audience.

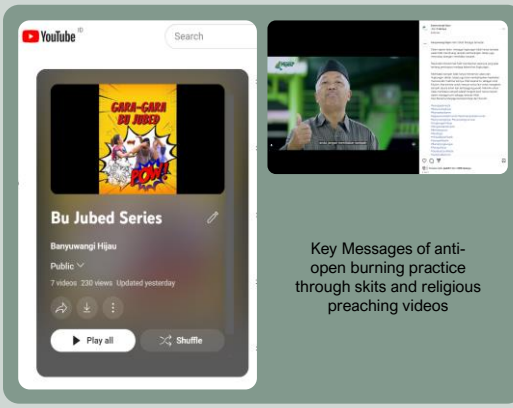
Offline campaign strategy

Training for social and religious Community to socialize message of anti-open waste burning practice

Socialization of anti-open waste burning by Family Empowerment and Welfare (PKK) and Religious Community (NU)

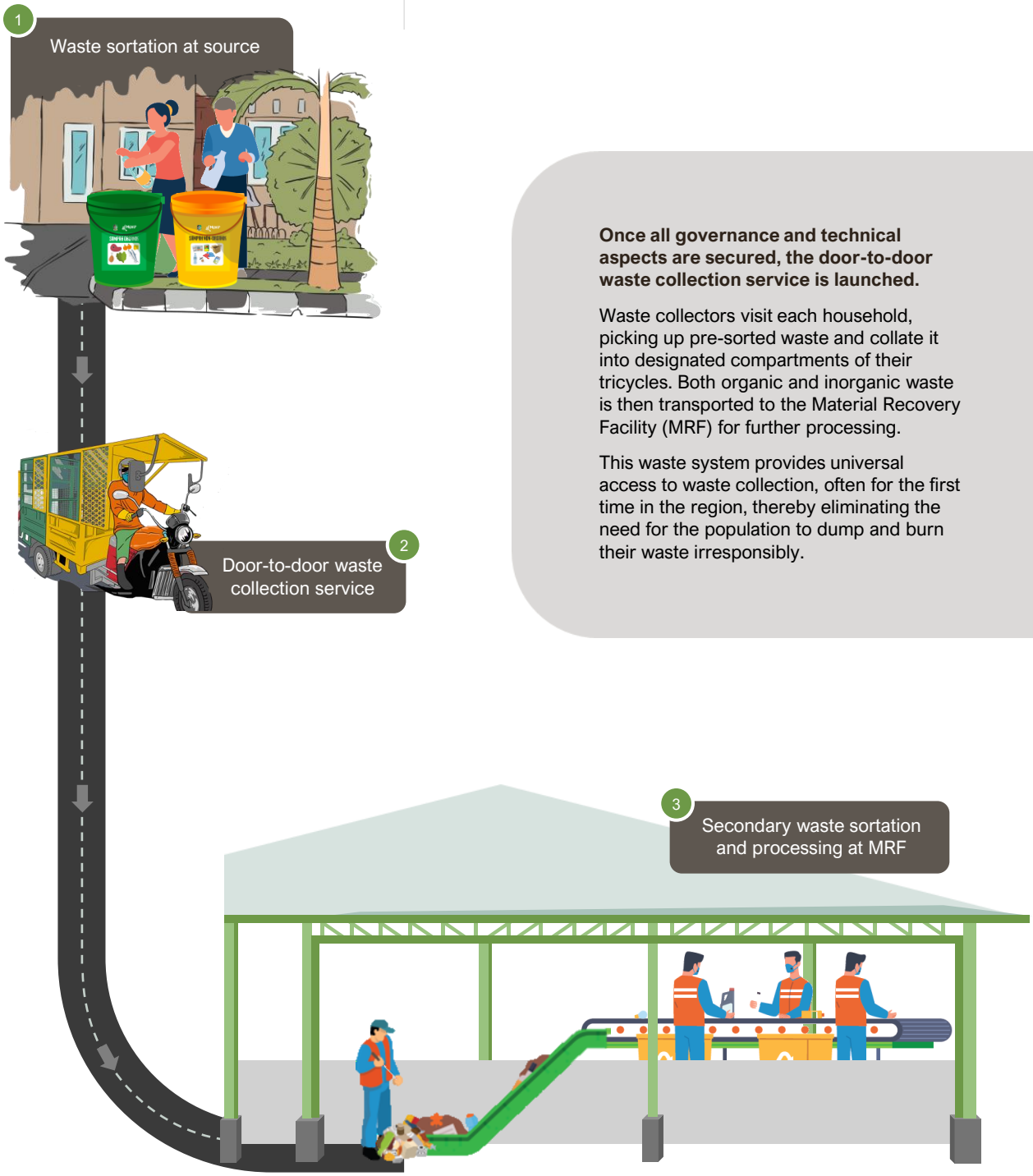
Online campaign strategy

Key Messages of anti-open waste burning practice in media campaigns



Key Messages of anti-open burning practice through skits and religious preaching videos

STEP 3
IMPROVEMENT OF WASTE COLLECTION SERVICE



Once all governance and technical aspects are secured, the door-to-door waste collection service is launched.

Waste collectors visit each household, picking up pre-sorted waste and collate it into designated compartments of their tricycles. Both organic and inorganic waste is then transported to the Material Recovery Facility (MRF) for further processing.

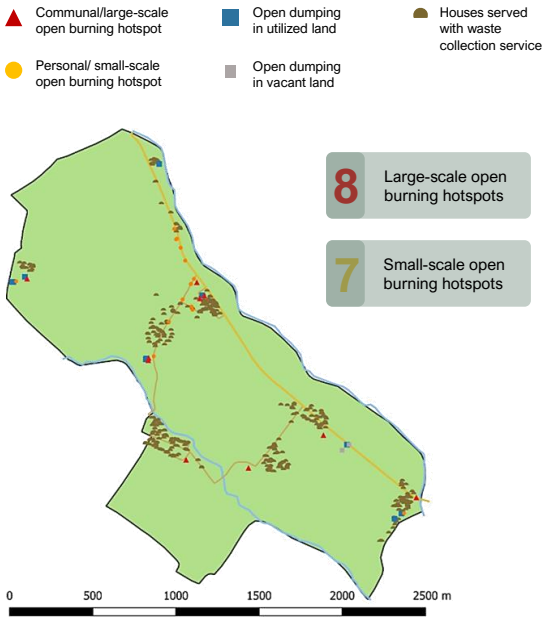
This waste system provides universal access to waste collection, often for the first time in the region, thereby eliminating the need for the population to dump and burn their waste irresponsibly.

STEP 4
OPEN BURNING HOTSPOT SELECTION

To better understand the magnitude and spread of open burning issue, a mapping of open burning hotspots is created. This will equip village and regency stakeholders for a data-driven decision making in prioritizing and selecting the ones to be closed.

The selection of the open burning hotspot to be closed is based on **impact-effort criteria**, i.e., both social and health impact and effort in mobilizing technical and financial resources.

Figure 4. Open Burning Hotspot Mapping
A study case in Singolatren Village, Banyuwangi



Preparation with stakeholders is essential before closing the open burning hotspot. The village government plays a crucial role in this decision-making process, taking into account inputs from the waste committee and the community. To ensure a successful closure and maximize its impact, several key areas must be addressed.

Regency operator | Village government | Waste committee | Project STOP and funders | Sanitarians from community health centers

Mobilization Planning

- Planning D-day manpower mobilization, e.g., involvement of PKK/youth groups
- Village announcement and circulation of invitation letter

Logistic Preparation

- Tools and Equipment
- Truck and Staff for waste collection
- Budget plan

Post Clean-up Planning

- Production and installment of anti-open waste burning billboard/banner
- Land utilization for medicinal plant garden and parking spot
- Post clean-up monitoring mechanism.e., monitoring number of people illegally dumping or burning waste in the same hotspot
- Data additional customers interested in joining the local waste collection service

STEP 5
CLOSURE OF OPEN BURNING HOTSPOT

The eradication of open burning practices stands as a joint endeavor between regency and village communities, bolstered by the co-funding of our partners, i.e., Engineering X, Banyuwangi Regency government, and village governments in Banyuwangi regency. All parties contribute human and financial resources proportionally and consensually. The closure of open burning hotspot performed under this project serves as first mover initiative, to be continued by village and regency governments to eradicate the open burning practices in their region at scale, along with their effort in providing universal access of waste collection systems.

CASE STUDY

SONGGON VILLAGE

The anti-open burning initiative in Songgon addresses a decades-long practice of open burning and dumping. For over 60 years, a piece of land was used for waste disposal, leading to river pollution and flooding during rainy seasons. With the start of universal waste collection in Songgon, stakeholders, powered by Project STOP, closed the burning hotspot.

Context

For 60 years, a plot of land in Songgon village served as a burning and dumping ground for the local community. Over time, the waste accumulated, turning the once fertile soil into a sprawling sea of refuse. This unsightly problem was compounded by the fact that out of 63 neighborhood units, only 2 were actively involved in a community-led waste management program, while others chose to dump or burn their waste in the hotspot.

The hotspot's proximity to the local market exacerbated the issue. Vendors and shoppers, seeking a convenient disposal solution, added their waste to the growing heaps of waste along the riverbanks. When the rains came, flooding impacted other villages downstream. The community's neglect had transformed the river from a lifeline into a conveyor belt of pollution, tarnishing the local environment and the reputation of their treasured tourist destinations downstream.

The Movement

In May 2023, the Songgon village government committed to becoming part of the Banyuwangi Hijau program, providing adequate and sustainable waste collection services for the population. This began with village coordination meetings to secure governance and resources, followed by behavior change triggering activities to encourage community involvement in the waste system and end open burning and dumping practices. The process culminated in a plenary session where the community committed to the waste collection program and agreed on a monthly waste fee of Rp 20,000 per household. This commitment was formalized through Village Regulation No. 1/2023 on waste management and Village Regulation No. 2/2023 on waste fees. A village operator was appointed to register customers and collect fees, forming the basis for regency-level waste collection routes and schedules.

Closure of Open Burning Hotspot

With the waste collection system in place, in March 2024, the village moved to eradicate open burning. Supported by village facilitators and sanitarians, stakeholders identified and prioritized hotspots for closure. One site, known for decades of burning and dumping and its adverse effects, was chosen. Through collaboration between village and regency stakeholders, village facilitators, and Project STOP, resources were mobilized from the village, regency, and private sector to clean the hotspot. The village provided manpower, the regency supplied dump trucks and staff, and Project STOP secured funding.

As a result, a 60-year-old dumping site was cleaned, the river became waste-free, bad odors were eliminated, and flooding was prevented.

CASE STUDY

KEDALEMAN VILLAGE

The anti-open burning initiative in Kedaleman addresses a decades-long practice of open burning and dumping.

Context

Before Banyuwangi Hijau was launched, Kedaleman was a village with a private sector waste management system. This service is accessible in all sub-villages and collected by pedicab or carriage. The waste services process involves the sale of waste with economic value, followed by the burning or open dumping of the residues. There is a large hotspot that is accessible not only from Kedaleman village, but also from nearby villages. The waste was primarily disposed of by other villages by pick-up, during the midnight. This case concerns Kedaleman Governance, and they start to address it by involving Banyuwangi Hijau.

The Movement

In February 2024, the Kedaleman village government agreed to participate in the Banyuwangi Hijau Initiative, which would provide adequate and sustainable waste collection services to the community. In the agreement with Banyuwangi Hijau, Kedaleman is classified as a type 2 village –which indicates that the village manages the waste collection process. It was due to the Kedaleman condition, which encompasses over 40% of the total communities in the previous services. Therefore, the waste operator is under the authority of the village government, as the village has the capacity to administer the waste services.

The preparation of services start with village coordination meetings to ensure governance and resources. Subsequently, community involvement in the waste system is encouraged through triggering activities. The process concluded with a plenary session in which the community committed to the waste collection program and agreed on a monthly waste fee of Rp. 25,000 per household. This commitment was ratified in Village Regulation No. 4/2023 on waste management and No. 5/2023 on waste fees. Meanwhile, the waste operator received training from UPT/DLH prior to the commencement of services. This training including the registration of customers, the collection of fees, the forming of routes and schedules, and other aspects of preparation. The initiative in Kedaleman to prevent open burning and dumping behaviors is the movement at increasing service demand.

Closure of Open Burning Hotspot

Prior to the starting of waste services in May 2024, the village dedicated to close open burning. The closure of hotspots was identified and prioritized by the village government, BUMDES, sanitarians, and stakeholders. Three open burning sites have been selected because they are actively accessible to the community. The objective is to enhance the demand for community waste services. Through collaboration between village and regency stakeholders, village facilitators, and Project STOP, resources were mobilized from the village, regency, and private sector to clean the hotspot. The village provided manpower, the regency supplied dump trucks and staff, and Project STOP secured funding.

According to this activity, 600 kilograms of waste was eliminated. After the hotspot cleaning, the billboard with a prohibition message to dispose in the cleaned area installed. The primary message includes a reference to the Village Regulation. Due to this closure, 1,089 households are interested and registered for waste services.

CASE STUDY

KEDALEMAN VILLAGE

Location 1

Location 2

Location 3

LESSONS LEARNED

GOVERNMENT BUY-IN

01

Government buy-in is key for scalable and sustainable local waste systems. To ensure this, processes must be co-created with the government. Key elements:

- **Embedding anti-open burning campaign into existing government agenda**, i.e., stunting eradication, promotion of tourism in the region.
- **Following official government processes and cycles** in planning, policy making, budgeting, and implementing anti open waste burning initiatives.

COMMUNITY PARTICIPATION

02

Community participation is crucial for achieving lasting system change, transforming programs into movements that become integral to the community's culture. Key elements:

- **Partnering with well-respected religious/community leaders**, e.g., Nahdlatul Ulama (NU)
- **Mobilizing existing community cadres**, e.g., Dasa Wisma, sanitarians from local community health center
- **Setting-up clear expectation from the community,** e.g., requiring community work plan by the end of triggering sessions to record community's commitment in improving their waste management practice.

COLLABORATIVE CULTURE

03

True system change happens when stakeholders collaborate beyond isolated efforts. Each party leverages its strengths and fills gaps through cooperation. Contributions from all are crucial, showing a collective commitment to ending open burning. Key elements

- **Empowering the role of village operators** (Bumdes/KSM) to support village waste service.
- **Empowering the role of community cadres**, e.g., sanitarians and PKK to pre-condition the village community in receiving public campaign messages.

LONG-TERM RELATIONSHIP BUILDING

04

Long-term engagement allows lasting relationship and more fluid co-creation effort, the foundation of a sustainable waste system operation. Key elements:

- **Long-term handholding support to regency government** to foster co-creation and fluid working environment.
- **Long-term technical guidance support to villages,** covering rollout preparation, the start of waste collection services, and post-rollout monitoring and evaluation to ensure villages maintain their improved waste systems.

BIBLIOGRAPHY

[1] Source: Systemiq analysis for NPAP, 2017

[2] Source: Ministry of Environmental and Forestry, 2022. A speech from Director General of Waste, Waste Water, and Hazardous Waste Management in COP27 UNFCCC, https://pslb3.menlhk.go.id/portal/read/talkshow-achieving-national-determined-contribution-ndc-through-waste-management

[3] Source: Study willingness to pay for waste collection service in Banyuwangi, 2022, J Danielson, D Limbong, M Webster dan J Palfreman, Systemiq & DAI 2022.

[4] Velis, C.A. and Cook, E. (2021). Mismanagement of Plastic Waste through Open Burning with Emphasis on the Global South: A Systematic Review of Risks to Occupational and Public Health. Environmental Science & Technology, 55(11), pp.7186–7207. doi:10.1021/acs.est.0c08536. https://pubs.acs.org/doi/10.1021/acs.est.0c08536

[5] Moore, D. (2019). Black carbon from burning waste has 'significant climate impact'. [online] Circular Online. Available at: https://www.circularonline.co.uk/news/black-carbon-from-burning-waste-has-significant-climate-impact/.

[6] Reyna-Bensusan, N., Wilson, D.C., Davy, P.M., Fuller, G.W., Fowler, G.D. and Smith, S.R. (2019). Experimental measurements of black carbon emission factors to estimate the global impact of uncontrolled burning of waste. Atmospheric Environment, [online] 213(213), pp.629–639. doi:10.1016/j.atmosenv.2019.06.047.

[7] Krecl, P., de Lima, C.H., Dal Bosco, T.C., Targino, A.C., Hashimoto, E.M. and Oukawa, G.Y. (2021). Open waste burning causes fast and sharp changes in particulate concentrations in peripheral neighborhoods. Science of The Total Environment, [online] 765(765), p.142736. doi:10.1016/j.scitotenv.2020.142736.

[8] Global Waste Management Outlook: Beyond an Age of Waste – Turning Rubish into a Resource, 2024. UN Environment Programme.