Kementerian PPN/ Bappenas

SIPA
Sustainable Infrastructure Programme in Asia

UNDP

# EVENT REPORT

# SITE VISIT AND STAKEHOLDER DISCUSSION ON RDF BUSINESS MODEL IN BANYUMAS & CILACAP

22 - 23 JULY 2025

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# SITE VISIT AND STAKEHOLDER DISCUSSION ON RDF BUSINESS MODEL IN BANYUMAS & CILACAP

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# Site visit and technical stakeholder discussion in Banyumas & Cilacap Central Java Province focusing on the Refuse Derived Fuel (RDF)

# I. Introduction

As part of Indonesia's ongoing commitment to achieving sustainable and low-carbon development, the advancement of Refuse-Derived Fuel (RDF) technologies has become increasingly relevant—offering a strategic solution to the country's mounting waste management challenges, while also supporting national climate and circular economy goals. In alignment with these objectives, the Sustainable Infrastructure Programme in Asia (SIPA), implemented by UNDP Indonesia in collaboration with the Directorate of Housing and Settlement Infrastructure of Bappenas, has launched a series of stakeholder engagements and field assessments to better understand the operational and institutional dynamics of RDF facilities across Indonesia.

From 21 to 24 July 2025, a high-level site visit and stakeholder dialogue were conducted in Banyumas and Cilacap, two districts that have emerged as notable cases in the landscape of RDF development in Indonesia. These visits formed a critical part of SIPA's broader RDF business model study, aiming to explore diverse RDF implementation models, from community-driven to public-private partnership (PPP)-based systems. The mission brought together key representatives from the national and sub-national governments, private sector entities, and development partners to examine the enabling environments, operational performance, governance structures, and financing mechanisms that underpin RDF production in both regions. Through direct observation of processing facilities, presentations by local authorities, and targeted stakeholder discussions, the visit sought to distill key lessons that could inform scalable and replicable RDF business models across other Indonesian localities.
The contrast between Banyumas—an exemplary case of decentralized, community-based waste management—and Cilacap—a district leveraging institutionalized PPP collaboration—provided valuable comparative insights into how RDF initiatives can be tailored to fit local governance capacities, infrastructure readiness, and socio-economic contexts. These experiences will directly feed into the ongoing formulation of a robust, inclusive, and technically sound roadmap for RDF adoption under the SIPA initiative.

*"From 21 to 24 July 2025, a high-level site visit and stakeholder dialogue were conducted in Banyumas and Cilacap, two districts that have emerged as notable cases in the landscape of RDF development in Indonesia"*

## **Banyumas,** 22 July 2025




## **Cilacap,** 23 July 2025



# REFUSE DERIVED FUEL

*Site Visit and Stakeholder Discussion on RDF Business Model in Banyumas & Cilacap*

# II. Key Highlights from Banyumas

### A. Community-Driven Zero Landfill Strategy

Banyumas has emerged as a model of integrated waste management, built upon robust community engagement through 39 active waste treatment facility, including Tempat Pengelolaan Sampah Terpadu (TPST) and Tempat Pengelolaan Sampah Reduce-Reuse-Recycle (TPS3R) units managed by the community based organizations- Kelompok Swadaya Masyarakat (KSM). KSMs hold legal status through a Village Head (Kepala Desa) or Urban Ward Head (Kepala Lurah) Decree, endorsed by the Head of the Environmental Agency in accordance with the local regulation (Perda). Since the official closure of TPA Tipar Kidul in January 2024, the district has moved toward a "zero waste to landfill" goal, implemented through decentralized waste processing and a regional RDF facility at TPA BLE.

### B. Technological & Operational Features:

- Daily input: ~250 tons of mixed waste processed at TPA BLE
- RDF production: ~40 tons/day
- Use of non-incinerator pyrolysis technology for residuals
- Digital tools like Salinmas and Jeknyong incentivize household waste separation at source
- Production of RDF, compost, maggot-based feed, biomass fuel, and plastic-based building materials (paving blocks, tiles)
- Integrated waste management system generates significant economic impact, employing approximately 1,500 people across collection, processing, and value-added product manufacturing.

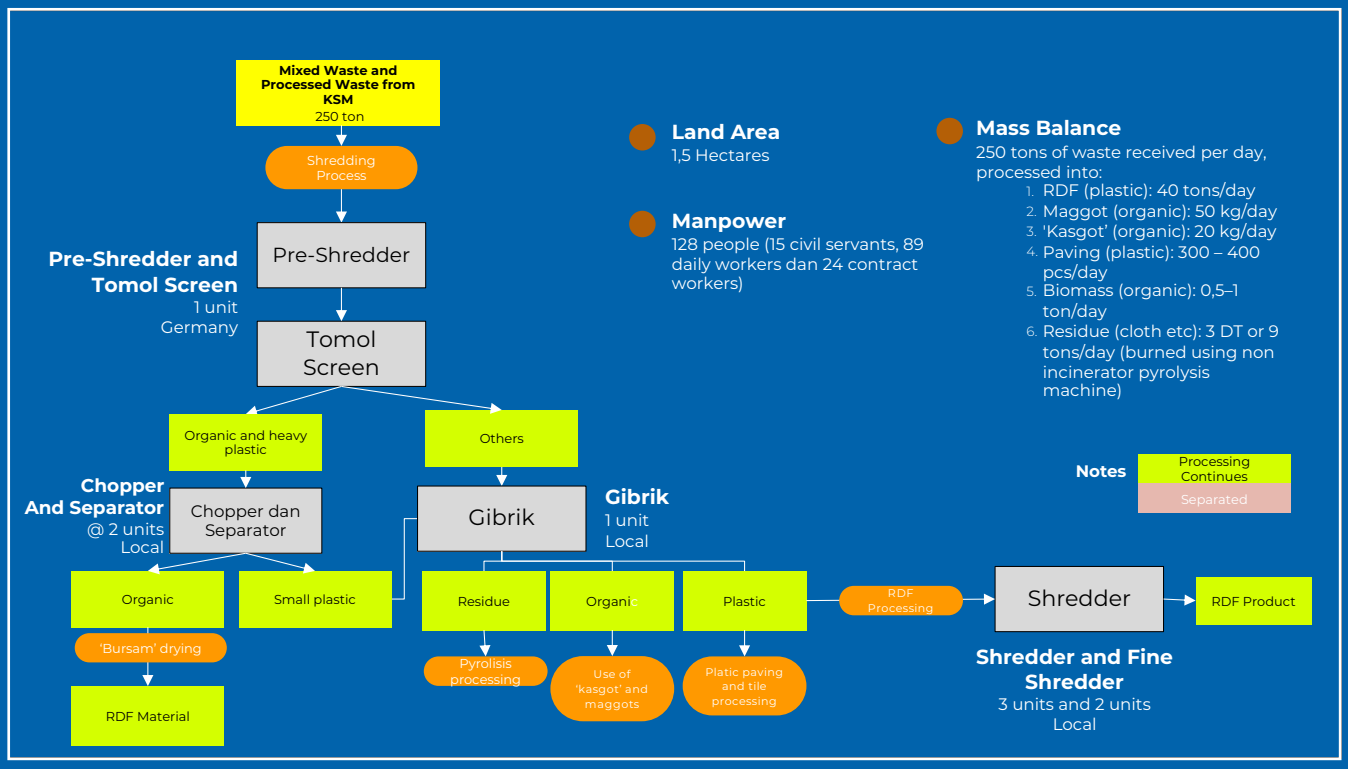
### C. Governance and Financing:

- No uniform municipal tipping fee; service tariffs for households vary by KSM in accordance with a local regulation (Perda) that mandates tariff determination by each KSM.
- Service fee collection applies not only to households but also to non-household waste generators such as businesses and institutions.
- Tipping fee system in place: KSMs are charged IDR 50,000 per ton for residual waste and IDR 100,000 per ton for fresh waste processing.
- KSMs are also subject to retribution fees for the use of regional-owned assets (Barang Milik Daerah), which have been applied over the past two years.
- Major RDF off-takers include PT Solusi Bangun Indonesia; PT Semen Bima is planned to start as an off-taker in September 2025.

## D. Challenges:

- Low waste segregation at source
- Low maggot product quality due to poor quality of organic waste input
- Infrastructure capacity limitations in some facilities, unable to keep up with the increase in customer numbers
- Ban on the implementation of incinerators and pyrolysis technologies by the Ministry of Environment due to environmental concerns
- Frequent spare part breakdowns requiring high replacement costs
- Temporary suspension of cement kiln operations due to overhaul, coupled with lack of warehouse capacity to store RDF stock
- Several community-based organizations (KSM) are no longer functioning in waste management due to limited capacity, particularly in ensuring the availability of self-managed funding to support the sustainability of the facilities.
- Need for national RDF quality standards (SNI) and operator certification
- Limited formal waste audit and emissions monitoring

## E. Schematic Flow and Machine Specifications



# REFUSE DERIVED FUEL

**Since the official closure of TPA Tipar Kidul in January 2024, the district has moved toward a “zero waste to landfill” goal, implemented through decentralized waste processing and a regional RDF facility at TPA BLE.**

*Site Visit and Stakeholder Discussion on RDF Business Model in Banyumas & Cilacap*

# III. Key Highlights from Cilacap

**A. Institutionalized RDF through Operational Collaboration with the Private Sector**

Cilacap presents a contrasting model—one driven by institutional collaboration between the local government and PT Solusi Bangun Indonesia (SBI). The RDF facility at TPST Jeruklegi, operational since 2020, processes around 150 tons/day of municipal solid waste into 75 tons/day of RDF, primarily for cement kilns.

**B. Technological & Operational Features:**

- Integrated mechanical-biological treatment process
  - Shredding (Metso, Denmark) – 40 TPH
  - Bio-drying (Eggersman, Germany) – 9 bays @500 ton
  - Screening (Ecostar, Italy) – 20 TPH
- RDF calorific value: ~4,453 kcal/kg
- Emphasis on drying via semi-permeable membranes and 21-day biological processing cycles

**C. Governance and Financing:**

- 5-year cooperation agreement (renewable) with SBI
- RDF transported using 5 trucks (2 shifts/day, 40 tons/day)
- Co-financing arrangement with operational expenditure (OPEX) ranging from approximately IDR 10–17 billion per year
- Capital investment for facility development was jointly funded by the Ministry of Public Works and Housing, the Government of Denmark, the Central Java Provincial Government, and the Cilacap District Government.
- Exploring expansion and EPR-based partnerships (e.g., Unilever)

**D. Environmental & Social Safeguards:**

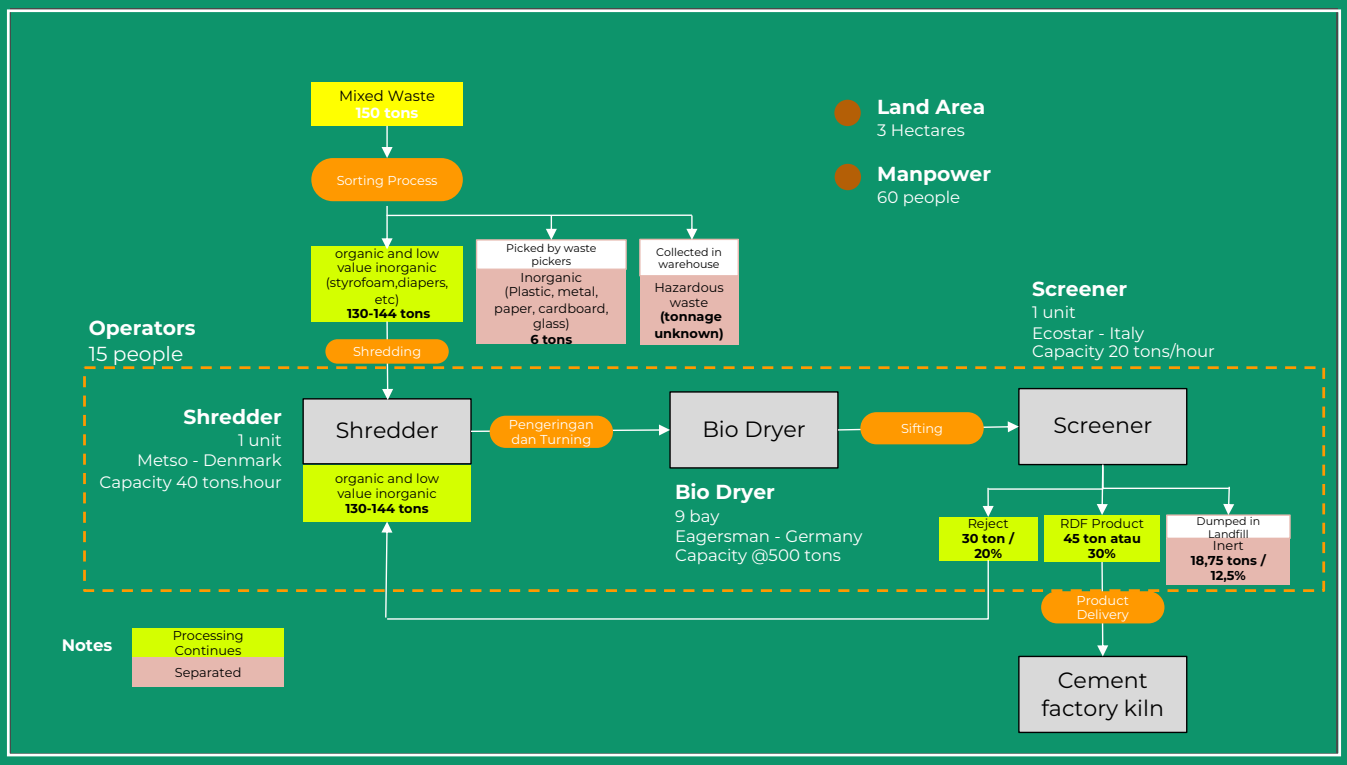
- Voluntary engagement of informal waste pickers
- Use of vegetation buffers, bio-activators, and IPAL for leachate treatment
- Minimal public resistance, though seasonal odor and equipment wear remain issues

**E. Challenges**

- Progressive corrosion of civil structures as the facility approaches its fifth year of operation, requiring substantial maintenance and potential structural rehabilitation.
- High costs for spare part replacements due to dependence on imported components; while local alternatives are more affordable, they often result in reduced equipment performance.
- Insufficient availability of heavy equipment (wheel loaders), leading to overutilization of existing units—operating up to 16 hours per day—thereby accelerating wear and tear.

- Absence of nationally standardized RDF specifications and pricing, creating variability in market acceptance and commercial transactions.
- Operational interruptions at cement kilns during scheduled overhauls, compounded by the lack of adequate warehouse capacity for RDF stockpiling.
- Limited human resource capacity to manage operational continuity in the event of a transition following the conclusion of the cooperation agreement with SBI.

## F. Schematic Flow and Machine Specifications




The RDF facility at TPST Jeruklegi (Cilacap Regency), operational since 2020, processes around 150 tons/day of municipal solid waste into 75 tons/day of RDF, primarily for cement kilns.

*Site Visit and Stakeholder Discussion on RDF Business Model in Banyumas & Cilacap*

# IV. Comparative insights

| Aspect | Banyumas | Cilacap |
|---|---|---|
| Governance Model | Community-based (KSM) | Operational Collaboration with the private sector |
| Waste Input | ~250 tons/day | ~150 tons/day |
| RDF Output | ~40 tons/day | ~75 tons/day |
| Technology | Pyrolysis, decentralized TPSTs | Mechanical-biological treatment |
| Financing | Self-sustained + APBD | Shared cost model with SBI |
| Key Off-taker | a. PT SBI<br>b. PT Semen Bima (cooperation process ongoing) | PT. SBI |
| Strength | Civic engagement, decentralized model | Scalable with industry collaboration |
| Challenge | a. Low waste segregation and poor organic waste quality<br>b. Limited facility capacity<br>c. Technology bans (incinerator/pyrolysis)<br>d. Frequent costly breakdowns<br>e. RDF stock storage issues during cement kiln overhauls<br>f. Inactive KSMs due to funding and capacity gaps<br>g. Need for training, RDF standards, and operator certification<br>h. Limited waste audit and emissions monitoring | a. Corrosion of facility structures after 5 years<br>b. High spare part costs due to import dependence and lower-performance local alternatives<br>c. Insufficient heavy equipment causing overuse<br>d. No national RDF specs or pricing standards<br>e. RDF stockpile issues during kiln overhauls<br>f. Limited HR capacity for post-cooperation operational continuity. |

# V. Strategic Follow-up and Opportunities

- Replicate KSM-based systems in high civic participation regions (based on Banyumas model)
- Promote BLUD establishment in Cilacap to clearly delineate regulatory and operational roles
- Develop national technical standards (SNI) and certification schemes for RDF quality
- Expand off-taker ecosystem to include PLTU and biomass-based industries
- Integrate Extended Producer Responsibility (EPR) into RDF ecosystem financing

# VI. Conclusion

The site visits to Banyumas and Cilacap provided a valuable opportunity to observe two distinct yet equally important approaches to advancing Refuse-Derived Fuel (RDF) as a key component of Indonesia's sustainable waste management and circular economy agenda. Together, these models demonstrate how both community-based initiatives and institutionalized operational collaboration with the private sector can offer effective, scalable pathways for waste-to-energy solutions that align with national development priorities.

In Banyumas, the strong civic engagement and bottom-up waste processing ecosystem reflect how localized innovation, digital tools, and a sense of community ownership can foster meaningful environmental impact. With over 39 active waste treatment facility including Tempat Pengolahan Sampah Terpadu (TPST) and Tempat Pengolahan Sampah Reduce-Reuse-Recycle (TPS3R) units operated by the community-based organizations- Kelompok Swadaya Masyarakat-KSM, Banyumas has successfully transitioned to a zero-landfill system, where nearly all waste is either recovered, repurposed, or transformed into RDF, compost, and other valuable by-products. The cost-efficiency and socio-economic co-benefits of this model—including employment generation, environmental awareness, and reduced municipal expenditure—make it highly relevant for replication in regions with high community mobilization and limited infrastructure budgets.

Conversely, Cilacap showcases a technically advanced, institutionally structured RDF model developed through a formalized partnership with the private sector. The RDF facility at Jeruklegi integrates high-capacity mechanical-biological treatment technology and structured operational protocols that allow for consistent RDF production at commercial scale. The five-year cooperation agreement with PT SBI and ongoing engagement with major stakeholders, such as Unilever under the Extended Producer Responsibility (EPR) framework, illustrate the potential for RDF to become a reliable alternative fuel supply for energy-intensive industries while reducing the volume of municipal solid waste.

Despite their different approaches, both districts face shared challenges: the need for standardized RDF specifications and operator certifications; the importance of consistent waste input quality; the requirement for ongoing capacity building and equipment maintenance; and the necessity of sustainable financing models that reduce dependency on public budgets. Additionally, legal clarity—especially regarding community operators like KSM—and strengthened environmental safeguards remain cross-cutting issues to be addressed moving forward.

Ultimately, the visits reinforced that RDF is not a one-size-fits-all solution, but rather a flexible concept that can and should be adapted to suit varying regional contexts. As Indonesia accelerates its transition toward low-carbon and resource-efficient development, the integration of RDF into both urban and semi-urban waste systems offers a promising means to tackle not only environmental pollution and landfill overcapacity but also the broader goals of energy diversification, economic circularity, and climate resilience.

The experiences from Banyumas and Cilacap will serve as cornerstone references in shaping SIPA's national roadmap and business model development for RDF. By synthesizing these local innovations into national policies, standards, and investment frameworks, the Government of Indonesia—with support from UNDP and other partners—can facilitate a more inclusive and technically robust scale-up of RDF solutions nationwide.

# PARTICIPANTS & COLLABORATORS

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PT Waste to Wealth

PT Cagar Bentara Sakti
Consultant Team

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