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Sustainable Infrastructure Programme in Asia

UNDP

ASSESSMENT AND POLICY DIRECTION FOR ENERGY-BASED WASTE MANAGEMENT (WASTE TO ENERGY) RDF CASE STUDY: TOWARDS THE DEVELOPMENT OF A ROADMAP FOR WTE EXPANSION IN INDONESIA, 2026-2045

2nd Book

MAPPING THE POTENTIAL FOR RDF IMPLEMENTATION IN 2026-2045

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Excecutive Summary

RDF POTENTIAL IN SUPPORT WASTE MANAGEMENT

Indonesia currently faces significant challenges in waste management, with waste generation reaching 68-70 million tons per year. The waste management system, which still relies on final disposal sites (TPA), is projected to reach full capacity by 2028[1], highlighting the urgency of adopting more sustainable alternative approaches. The waste emergency is further exacerbated by the fact that 343 landfills across Indonesia still use open dumping methods[2], which have the potential to trigger various environmental and health issues

Refuse-derived fuel (RDF) is emerging as a strategic option in national waste management, in line with the waste management hierarchy that prioritizes energy extraction over final disposal. This technology transforms non-recyclable waste into an alternative fuel for industry, potentially serving as an alternative fuel source while minimizing waste volume at landfills. RDF also plays a role in Indonesia's efforts to mitigate greenhouse gas emissions, as outlined in the Enhanced National Determined Contribution (ENDC) document, while supporting the principles of the circular economy hierarchy by utilizing residual waste that can no longer be recycled.

POTENTIAL CONTRIBUTION OF RDF INTO NATIONAL WASTE MANAGEMENT THROUGH MATERIAL AND ENERGY RECOVERY

National waste management is one of the main focuses in supporting the achievement of the Sustainable Development Goals (SDGs) and the realization of the Indonesia Emas 2045 vision through the National Long-Term Development Plan (RPJPN) and the National Medium-Term Development Plan (RPJMN).

Potential contribution of RDF into national waste management targets is calculated based on projections of national waste generation with a baseline year of 2023, waste projections for 2045 from the Ministry of Environment and Forestry, and waste management targets in the RPJPN document through material and energy recovery for the period 2029 to 2045. This approach considers the estimated volume of waste that can be processed into RDF, as well as the potential absorption of RDF based on the needs of user industries (offtakers).

Year to Date	Target for Processed Waste (material & energy recovery) (Source: Bappenas)	Total Estimated Waste Processing Based on Targets (tons per year)	Total Estimated Waste Processed into RDF (tons per year)	RDF's Contribution to National Waste Management through Material & Energy Recovery
2029	18%	13.176.000	3.111.000	23,44%
2034	30%*	22.452.719	5.457.000	23,78%
2039	41%*	32.365.375	6.630.000	20,40%
2045	55%	45.100.000	7.089.000	15,72%

*) prognosis based on targets 2029 and 2045

[1] Directorate of Environment, Ministry of National Development Planning (Bappenas), 2024.
[2] Ministry of Environment, 2024..

Melihat kontribusi RDF yang diproyeksikan terhadap target pengolahan sampah nasional sebagaimana ditunjukkan dalam tabel di atas, terlihat bahwa pemanfaatan RDF akan menjadi salah satu elemen kunci dalam mencapai sasaran material & energy recovery hingga tahun 2045. Oleh karena itu, diperlukan langkah lanjutan untuk mengidentifikasi potensi wilayah, infrastruktur, dan kapasitas yang mendukung implementasi RDF secara berkelanjutan.

POTENTIAL MAPPING OF RDF IMPLEMENTATION

As a follow-up to Book 1: Study of RDF Implementation Gaps, mapping is needed for strategic steps in RDF implementation to ensure sustainability. The findings of this study will serve as the basis for the development of **Book 2: Mapping the Potential for RDF Implementation from 2026 to 2045**, which will outline and implement a comprehensive framework for policy, infrastructure, technology, market strategies, stakeholder collaboration, and integrated monitoring mechanisms to support the sustainable development and utilization of RDF in national waste and energy management. This document presents a roadmap for RDF implementation in Indonesia from 2026 to 2045, divided into four phases with five-year intervals.

The determination of RDF targets is based on scientific criteria, taking into account the availability of off-takers to assess RDF demand, waste generation conditions to assess RDF supply, and the availability of existing TPSTs. The methodology used involves analyzing the distance between districts/cities and potential off-takers (industries), waste generation volume, landfill urgency, local fiscal capacity, infrastructure readiness, and consideration of existing national waste management programs. From the list of priority districts/cities that have been determined, the potential for RDF implementation at each stage can be summarized as follows.

	2026-2030	2031-2035	2036-2040	2041-2045
Accumulation of RDF Facilities	34 Plant	59 Plant	72 Plant	77 Plant
Accumulation of RDF Production (tons per year)	1.088.850	1.909.950	2.320.500	2.481.150
Accumulation of Regional Distribution	58 Regencies/Cities	108 Regencies/Cities	132 Regencies/Cities	143 Regencies/Cities
RDF's Contribution to Waste Management	23,61%	24,30%	20,48%	15,72%
Accumulation of Potential Offtakers	43	67	74	80
CAPEX	Rp 5,871 Trillion	Rp 4,541 Trillion	Rp 2,169 Trillion	Rp 1,088 Trillion
OPEX	Rp 5,069 Trillion	Rp 4,117 Trillion	Rp 1,978 Trillion	Rp 958,576 Billion

Potential implementation will cover 143 Regencies/Cities with the following distribution:

In support of these efforts, a systematic preparation procedure is required to optimize the construction of RDF facilities. This process begins with a pre-feasibility study conducted by the local government to ensure the availability of waste, land, and compliance with relevant policies, followed by the selection of partners, the processing of permits, the drafting of cooperation agreements, and the submission of BLPS assistance. Once the facility is built and operational, including the issuance of an Operational Compliance Certificate, the local government conducts annual performance-based evaluations to ensure the effectiveness and sustainability of the RDF and the optimal management of the facility.

STRATEGIES AND PROGRAMS FOR RDF IMPLEMENTATION

The principle in the application of RDF is to contribute as one of the waste management options without neglecting other efforts such as prevention, reduction, reuse, and recycling. RDF is not intended to be a commodity or source of regional income. Therefore, in the implementation of RDF, the following prerequisites must be considered:

Urgency of Waste Management

RDF hanya diperlukan jika sampah yang tidak dapat didaur ulang masih signifikan setelah upaya 3R (*reduce, reuse, recycle*) dilakukan secara optimal.

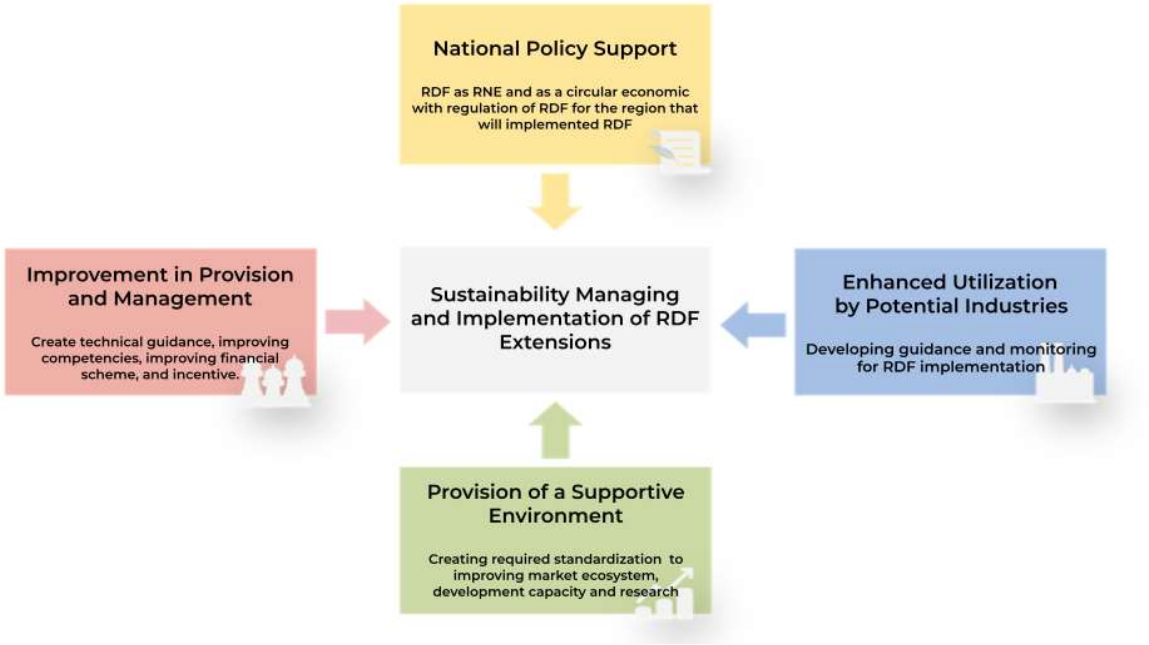
Availability of Supplier (Offtakers)

RDF is effectively implemented in areas with user industries such as cement or coal-fired power plants within a radius of less than 100 km.

Economic Scale

RDF facilities must be economical and sustainable, and are recommended for areas with a minimum waste generation of 150 tons per day so that operating costs can be covered..

The main strategies to support the implementation of RDF include providing national policies that cover its use and mandate potential utilization, improving the supply and management systems, increasing utilization by potential industries, and providing a comprehensive support environment. These strategies will be supported by various programs that are concrete steps in the implementation of RDF, involving relevant actors. Monitoring and evaluation will be conducted on a regular basis by all relevant ministries and agencies, with systematic knowledge management to document lessons learned from RDF implementation.



Dengan pendekatan strategis dan sistematis ini, perluasan RDF diharapkan dapat berkontribusi signifikan dalam mengatasi tantangan pengelolaan sampah di Indonesia, mendukung tercapainya target *zero waste* dan *net zero emission*, serta memperkuat transisi menuju ekonomi sirkular yang berkelanjutan.

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List of Abbreviations

Abbreviation	Term of Definition
3R	Reuse, Reduce, Recycle
BBA	Alternative Fuel
BBJP	Refuse-Derived Fuel (RDF) Pellets
BLPS	Waste Management Service Assistance
BUMN	State-Owned Enterprises
CAPEX	Capital Expenditure
COD	Commercial Operation Date
EBT	Renewable Energy
GESI	Gender Equality and Social Inclusion
GRK	Greenhouse Gases
ISWMP	Indonesia Solid Waste Management Project
LSDP	Local Service Delivery Improvement Project
MBT	Mechanical Biological Treatment
MSW	Municipal Solid Waste
MW	Megawatt
NSPK	Norms, Standards, Procedures, and Criteria
OPEX	Operational Expenditure
PKS	Cooperation Agreement
PLN	State Electricity Company
PLTSa	Waste-to-Energy Power Plant
PLTU	Coal-Fired Power PlantCofiring Power Plant
PPP	Public-Private Partnership
RDF	Refuse-Derived Fuel
RPJPN	National Long-Term Development Plan
RPJMN	National Medium-Term Development Plan
SDM	Human Resources
SINSIMAS	Sanitation Infrastructure Information System
SIPSN	Sistem Informasi Pengelolaan Sampah Nasional
SLO	Operation Feasibility Certificate
SOP	Standard Operating Procedure
SWM-SUD	Solid Waste Management Sustainable Urban Development
TPA	Final Disposal Site
TPS	Temporary Disposal Site
TPST	Integrated Waste Processing Site
WtE	Waste to Energy

01.

Introduction

Indonesia faces a major challenge in waste management, with an annual waste generation of 68-70 million tons[3]. The waste management system, which still relies on the collect-transport-dispose method, has led to long-term limitations in the capacity of final processing sites (TPA) and has also increased the environmental impact due to greenhouse gas (GHG) emissions and soil and water pollution. With projections indicating that TPA capacity will reach full capacity by 2028[4], a new, more sustainable, innovative, and integrated approach is needed to support the achievement of the 2050 zero waste target, the 2060 net zero emissions target, and the National Long-Term Development Plan (RPJPN) 2025-2045.

One solution that is developing globally and beginning to be implemented in Indonesia is refused-derived fuel (RDF), a technology that processes waste into alternative fuel for industry. In line with the targets set in the National Medium-Term Development Plan (RPJMN) 2025-2029, RDF plays a role in reducing dependence on fossil fuels, reducing the volume of waste ending up in landfills, and promoting the transition toward a circular economy. By 2045, Indonesia aims to process 90% of waste at national processing facilities, with at least 35% through recycling and 55% processed as material or energy, leaving only 10% of residue to be disposed of in landfills, with RDF being a key pillar in achieving this target[5]. By utilizing RDF, industries such as cement, power generation, and manufacturing can reduce carbon emissions and improve energy efficiency. However, the implementation of RDF in Indonesia still faces various challenges across all aspects, including supply, utilization, and supportive infrastructure.

Aspect	Challenges of RDF Implementation
Supply of RDF	
Governance	1. There are no policies or guidelines for determining the entities and forms of RDF management institutions, nor are there any tools for monitoring their performance. 2. There are no guidelines related to the regulation and management of cooperation in RDF management to support the utilization of RDF that has been produced.
Planning	Not all districts/cities have waste management planning documents that include RDF projects.
Infrastructure and Technology	1. The sustainability of RDF supply is not yet guaranteed, and TPST facilities are still not optimal to meet the needs of offtakers. 2. Potential industries exist in several regions, but RDF facilities are not yet available, are not yet optimal, or do not yet have sufficient capacity. 3. Lack of competence among planners and contractors.
Financing	1. RDF funding still depends on government sources, while private sector involvement in financing schemes remains limited. 2. The operating and maintenance costs of RDF production per ton do not yet meet the cost recovery principle to ensure the operational sustainability of RDF plants. 3. Low budget allocation for waste management.
Environmental and Social Safeguards	1. There are no specific guidelines for local governments to calculate GHG emission reductions, including methane emissions, from waste-to-RDF activities. 2. There is no standardized and periodic reporting and auditing system for environmental and social aspects. 3. There is a lack of formal community involvement and limited education about the benefits of RDF.
Demand of RDF	
Infrastructure and Technology	1. The large investment required for replacing/modifying equipment and building supporting infrastructure on the off-taker side. 2. Non-cement industries such as fertilizer, paper, steel, and chemical industries have the potential to utilize RDF, but most are still in the early stages of assessment because this transition requires
Financing	There is no fiscal incentive scheme available to attract offtakers.

[3] Ministry of National Development Planning (Bappenas), "Presentation Material at FGD 1: Preparation of Indonesia's RDF Roadmap", December 2024.
[4] Ibid, Ministry of National Development Planning (Bappenas), "Presentation Material at FGD 1: Preparation of Indonesia's RDF Roadmap", December 2024.
[5] Ibid, Ministry of National Development Planning (Bappenas), "Presentation Material at FGD 1: Preparation of Indonesia's RDF Roadmap", December 2024.

Aspect	Challenges of RDF Implementation
Environmental and Social Safeguards	1. The emission quality standards for RDF use are set more strictly than those for hazardous waste, even though RDF is classified as non-hazardous waste. 2. The industry's ability to control emissions still varies.
Terbatasnya kolaborasi riset tentang RDF di antara pemerintah, akademisi, dan industri.	
Regulations and NSPK	1. The specific implementation of RDF technology as part of the EBT mix is not yet fully supported by a comprehensive regulatory framework. 2. The availability of NSPK that supports RDF management is still limited.
Market Development	1. Production capacity and utilization of RDF are not yet balanced. 2. The absence of national standards regarding RDF specifications has caused the industry to hesitate to invest in the use of RDF
Incentive Schemes and Mechanisms	1. There are no incentive mechanisms (fiscal and non-fiscal) specifically designed to encourage the use of RDF. 2. Limited incentives/assistance for local governments implementing RDF.
Capacity Building	There are no specific institutions or mechanisms for improving RDF capacity, including competency standards and curricula.
Research and Development	Limited research collaboration on RDF among government, academia, and industry.

In the previous book, various factors that pose challenges and also potential in the implementation of RDF in Indonesia were discussed in more detail. Additionally, a number of key strategic recommendations, along with the responsible stakeholders, recommendations for RDF supply and management models, and recommendations for RDF technology funding schemes have been mapped out. Therefore, as a follow-up to these findings, a more in-depth study is needed on how RDF technology should be implemented to support the achievement of national waste management targets, zero waste, and net zero emissions.

Book 2: Mapping the Potential for RDF Implementation in 2026-2045 was compiled in order to respond to the need for recommendations on long-term RDF implementation scenarios linked to the potential for regional support for the achievement of national waste management development targets. Furthermore, this book is expected to provide detailed answers to a number of objectives, as follows:

1. Mapping the potential for RDF infrastructure development, including RDF production facilities, logistics systems, and distribution to user industries
2. Mapping the estimated financing needs for infrastructure, operations, and maintenance of RDF facilities
3. Mapping the potential supply to meet the needs of industries as off-takers or users of RDF and achieving national waste processing targets
4. Recommending key steps for local governments in planning the implementation of RDF technology
5. Identifying potential risks and mitigation strategies in the implementation of RDF
6. Developing strategies to increase the implementation of RDF in Indonesia

The process of drafting this document was carried out using an evidence-based approach involving technical studies, cross-sector discussions, and policy and strategy validation. The drafting of this document was based on:

1. **Analysis of existing conditions and gap analysis**
   Identify key challenges in RDF implementation and opportunities for development.

2. **Consultation with stakeholders**
   Involve various parties from the government and industry to ensure that the RDF strategy developed can be implemented effectively.

3. **Mapping of potential applications and formulation of RDF strategies and targets**

Mapping potential applications and setting RDF production and utilization targets based on projected demand and potential waste supply.

With a comprehensive approach, it is hoped that the recommendations formulated in Book 2 can complement the findings from the previous book and also address the needs of all parties regarding policy directions and basic guidelines for implementing RDF technology in Indonesia. Furthermore, this document is also expected to provide solutions to the challenges of synchronization between the government and industry, as well as serve as a basis for consideration in various decision-making processes related to efforts to expand energy-based waste management (waste to energy), particularly RDF.

02.

Phases of RDF Implementation in Indonesia, 2026 - 2045

This section discusses the mapping of the potential implementation of RDF in Indonesia during the period of RPJPN 2025-2045. This mapping aims to estimate the potential contribution of RDF as one of the solutions for waste management and as an alternative to fossil fuels in the industrial sector. Considering regional characteristics, raw material availability, infrastructure readiness, and supportive policies, this mapping is developed in a phased approach to ensure its implementation is targeted and effective.

The implementation of RDF is divided into four phases, each spanning five years, starting from the initial phase in 2026-2030 to the final phase in 2041-2045. Each phase is designed based on target-setting methodologies and investment requirement calculations, taking into account demand and supply dynamics, as well as the readiness of local actors to support RDF implementation. The strategy in each phase is designed to address specific challenges related to time and local conditions, so that RDF implementation can be carried out in a sustainable and measurable manner.

In addition to periodic strategic mapping, this chapter also discusses the preparation process required before RDF can be widely implemented in new areas. Aspects such as institutional capacity building, integration with national and regional policies, and the development of financing mechanisms are also addressed. Thus, this chapter not only presents a phased plan for RDF implementation but also provides comprehensive guidance for stakeholders in supporting the transition to a more sustainable waste management system in Indonesia.

2.1. Staging Methodology

The determination of RDF implementation targets for the 2026-2045 period was carried out using a data-based methodological approach and strategic assumptions that describe actual conditions and future demand projections. The methodology for determining the phased implementation of RDF is designed to identify priority locations with potential for RDF use, considering waste generation potential, proximity to RDF-using industries (offtakers), and the presence of existing infrastructure. Additionally, this process accounts for technical and economic aspects, including waste-to-RDF conversion and industry absorption capacity for RDF products. Various key assumptions are also used to build realistic scenarios, such as government policy support, technological developments, and the ongoing increase in demand for renewable energy. Thus, this approach aims to ensure that RDF implementation is carried out effectively, efficiently, and sustainably.

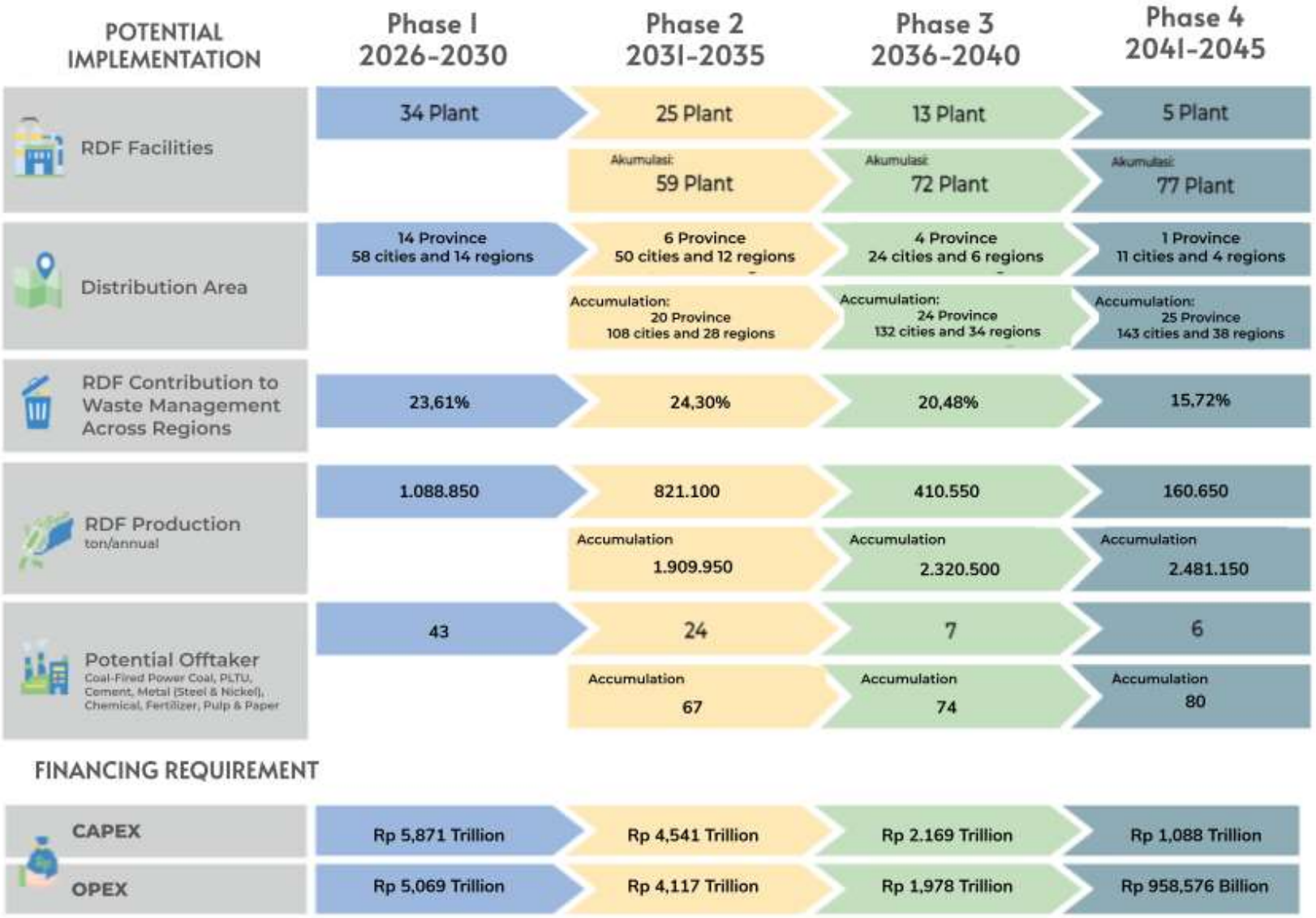


Figure 2. 1 Target of RDF Implementaton

2.1.1 Data Collection

The calculation of potential supply and demand in the study was obtained by processing Data collection in the document was carried out through various activities:

1. **Supply and Demand Potential,** compiled from various primary and secondary data sources as follows:
    a. Data on municipal and district waste generation comes from the National Waste Management Information System (SIPSN) of the Ministry of Environment, based on 2023 data.
    b. Data on the potential absorption of RDF by industry was obtained through: previous studies conducted by Bappenas (2023) and KLH (2024), interviews with industry associations, industry sustainability reports, and industry decarbonization reports.
    c. General industry profile data was obtained from BPS and the Technical Directorate of the Ministry of Industry.
    d. Data on power plants that have implemented co-firing was obtained from PLN reports to the Ministry of Energy and Mineral Resources in 2024.
    e. Government policy data was obtained from interviews with relevant ministries, including the Waste Directorate at KLH, the Bioenergy Directorate at the Ministry of Energy and Mineral Resources, the Green Industry Center at the Ministry of Industry, the Sanitation Directorate at the Ministry of Public Works, as well as interviews with research institutions.
2. **Mapping of districts/cities included in the TPA emergency condition and/or recipients of national programs** related to TPST, derived from secondary data in SIPSN, SI INSAN, Ministry of National Development Planning/Bappenas, and Ministry of Environment.

2.1.2. Methodology for Determining RDF Implementation Targets

The data and assumptions used in determining the RDF 2026-2045 implementation targets are as follows:

(1) Waste generation data in regencies/cities in Indonesia was taken from SIPSN data with a baseline year of 2023, considering that in that year the level of integrated data in SIPSN was 482 data points and was declared valid by the Ministry of Environment at 80.9% or 390 data points[6].

(2) Based on SIPSN data in 2023, the national average of managed waste is 62.34%, while waste handling is 48.61%. The basis for calculating the potential supply of RDF is the amount of waste handled in each district/city identified as having the potential to implement RDF.

(3) The assumption for the conversion of waste into RDF products is 35%. This figure is based on the achievement at the Jeruk Legi Cilacap TPST of 35%-50% and the Appendix to Minister of Home Affairs Regulation No. 7 of 2021, and represents best practice in RDF technology worldwide.

(4) The total RDF capacity requirement for 2026-2045 is the total annual RDF capacity requirement for that period, minus the RDF production of existing RDF facilities, assuming that those facilities are producing RDF in accordance with their design capacity.

[6] Presentation by the Ministry of Environment, March 6, 2025.

(5) Due to limited data on the production of recycled waste materials in Indonesia, the reduction in waste resulting from this activity was not included in this study.

(6) The absorption capacity of RDF by non-cement industries, whether used as fuel for independent power plants or industrial boiler fuel, remains at 5% of total fuel requirements.

(7) The RDF absorption capacity of the cement industry follows the road map data of two cement company groups, namely Semen Indonesia Group and PT Indocement Tunggal Prakarsa, while other cement industries are assumed to be the same as the national cement industry road map.

(8) The fuel absorption capacity of solid fuel (BBJP) by PLN's coal-fired power plants is assumed to be the same as PLN's target of 1% for 2026-2030, 3% for 2031-2035, 5% for 2036-2040, and unchanged until 2045.

(9) The assumption that there will be advances in RDF technology that will enable more efficient RDF production so that the RDF facilities to be built will be able to reach their design capacity..

(10) It is assumed that the government will continue to provide support through policies and regulations that encourage the development of RDF, including incentives for RDF providers and users, the development of supporting infrastructure for waste collection, distribution access, and other supporting policies.

(11) It is assumed that demand for renewable energy, including energy generated from RDF, will continue to increase, in line with the Government's efforts to reduce dependence on fossil fuels and lower carbon emissions from energy use.

(12) It is assumed that all stakeholders, including the Central Government and Local Governments, industry, research institutions, financing institutions, and the community will actively collaborate in developing systems and infrastructure for RDF.

The methodology for determining RDF targets for the 2026-2045 period involves several systematic steps aimed at optimizing RDF production and utilization in Indonesia, taking into account various aspects such as the amount of waste generated, the availability of RDF user industries, and the capacity requirements of the RDF facilities to be built. These steps are as follows:

Create a list of districts/cities in Indonesia within a radius of less than 100 km from potential RDF off-takers, including coal-fired power plants, cement factories, fertilizer factories, metal industries (steel and nickel), pulp and paper, and chemical industries.

The regencies/cities have waste generation of more than or equal to 150 tons per day or are experiencing waste emergencies, including full landfills and/or have received warnings to improve landfills through Circular Letter (SE) SE.14/MENLHK/ PSLB3/PLB.0/2/2025 regarding instructions and guidelines related to the gradual closure of open dumping landfills (TPA)..

3 

Identify the availability of RDF facilities to analyze the existing supply that can be provided by the district/city.

4 

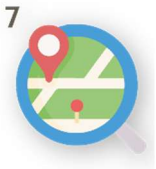
Identify existing RDF supplies that can be provided by the district/city.

5 

Make estimates of RDF requirements based on energy usage data from offtakers that can be replaced by RDF.

6 

Develop new/additional RDF facilities to close the RDF capacity gap.

7 

If a district/city is close to an offtaker but the district/city's waste generation is less than 150 tons per day, then in order to meet the economic scale, the RDF facility is built on a regional scale.

8 

If a district/city is close to an offtaker but the district/city's waste generation is less than 150 tons per day, then in order to meet the economic scale, the RDF facility is built on a regional scale.

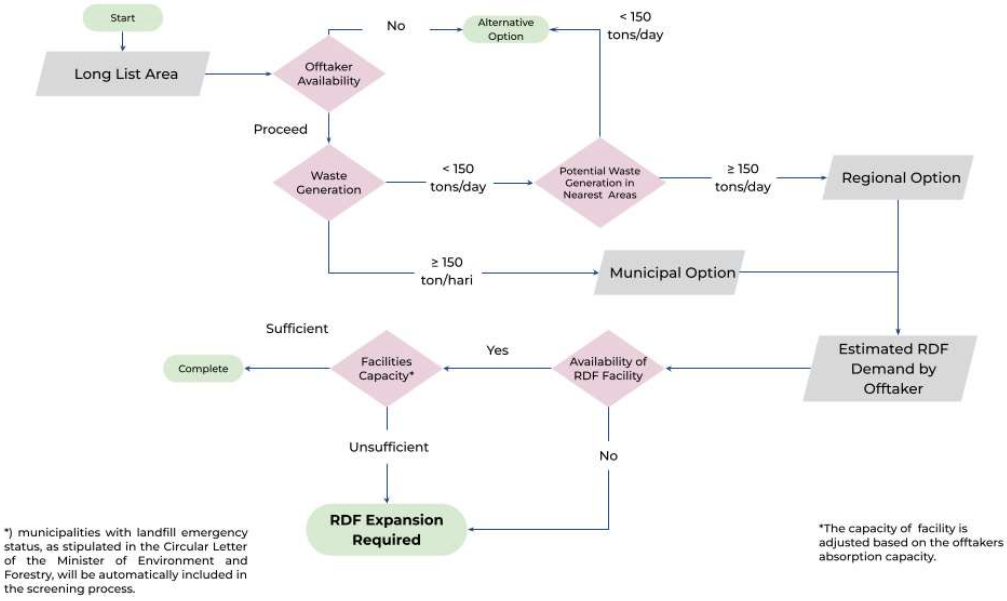


Figure 2. 2 Screening for Determining Waste Management Alternative in Regencies/Cities

In addition to the main aspects above, the assessment also considers other criteria such as the availability of a sustainable supply of waste, the suitability of the treatment method with regional policies, and the availability of land. This entire process is carried out as part of an initial assessment before further stages such as feasibility studies, detailed planning, procurement, and commissioning of the RDF facility.

2.1.3. Investment Cost Calculation Methodology

In calculating investment costs, CAPEX and OPEX data collection includes capital costs (CAPEX) and operating and maintenance costs (OPEX) from facility construction and RDF volume produced in tons per day. The price of each component is based on Minister of Home Affairs Regulation Number 7/2021, with the data and assumptions used in this calculation as follows:

(1) Data collection for CAPEX includes:
   a. Civil Works,
   b. Plant Facilities,
   c. *Mechanical electrical*.

(2) Data collection for OPEX includes:
   a. Number of workers involved in RDF process,
   b. Accumulation of Electrical Power used (Kwh),
   c. Accumulation of fuel used (liter),
   d. percentage of maintenance costs relative to the CAPEX value.

(3) Data collection of the average national inflation rate from 2020 until 2024

(4) Data collection of the BI Rate for 2024.

(5) The CAPEX value is calculated using the index of RDF data capacity in tons per day with the planned RDF capacity in tons per day, namely from the Cilacap RDF Plant with a capacity of 120 tons per day and the Greater Cirebon RDF Plant Study with a capacity of 350 tons per day.

(6) The number of operators is also used as an index of RDF tonnage per day capacity with planned RDF tonnage per day capacity.

As part of economic considerations and investment feasibility, it is important to also consider the willingness to pay (WTP) of the industrial sector in utilizing RDF as an alternative fuel. The industry's WTP is influenced by a number of factors, one of which is the potential for cost savings per unit of thermal energy used in the production process. RDF tends to be more attractive if it is proven to be economically more efficient than conventional fuels such as coal for producing an equivalent amount of heat.

In addition to economic factors, policy support and incentives from the government also play a significant role in encouraging the adoption of RDF, including through supportive regulations, price subsidies, and fiscal incentives. Furthermore, the industry's increasing commitment to sustainable and low-carbon business practices has strengthened the preference for environmentally friendly alternative fuels, such as biomass and RDF.

On the other hand, the availability of a stable supply of RDF and consistent RDF quality are important factors in increasing industry confidence. Risks associated with fuel transition, such as potential operational disruptions and the need for additional investment in infrastructure, can reduce WTP. However, these risks can be offset by the competitive price advantage of RDF compared to coal. Overall, the combination of economical prices, adequate fuel quality, strong policy incentives, and a commitment to sustainability can drive an increase in the industry's willingness to pay for RDF. However, any decision by the industry to utilize RDF still requires a comprehensive review of all relevant technical and economic aspects.

In order to support technical and economic feasibility and strengthen the competitiveness of RDF at the industrial level, a systematic and data-driven approach to investment cost calculation is required. This approach must not only consider technical and operational aspects but also reflect economic value and market preferences. Therefore, investment value calculations are performed through mathematical formulations that take into account CAPEX and OPEX, as well as other determining variables.

Calculation Equations

To determine the amount of investment, i.e., CAPEX, the amount will be added to Price Contingencies and Interest Rates, which are calculated using the following equations[7]:

$$H_{iTPST} = \frac{CAPEX \times SD_{tph}}{RDF_{tph}}$$

Descriptions
H_i = Investment Price
RDFtph = RDF (*tons per day*)
SDtph = sampah diolah (*tons per day*)

Equations 6.1

Then, based on the investment price, current inflation conditions, and interest rates, the Investment Cost equation can be calculated as follows:

$$B_{iTPST} \text{ per tahun} = \frac{H_{iTPST} \times \text{inflasi} \times \text{suku bunga}}{n}$$

Descriptions:
Bi_{TPST} = Investment Cost TPST
H_{iTPST}= Investment Price TPST
n= RDF Plant usage period

Equations 3.25 – Investment costs to obtain the amount of TPST RDF Fluff investment per year.

[7] Peraturan Menteri Dalam Negeri Nomor 7 Tahun 2021 tentang Tata Cara Perhitungan Tarif Retribusi dalam Penyelenggaraan Penanganan Sampah.

Based on the value obtained from the above equation, the investment cost per ton can also be calculated using the following equation:

$$\mathrm{B_{iTPST}\ per\ ton} = \frac{\mathrm{B_{iTPST}\ per\ annual}}{\mathrm{SD_{tph}} \times Jn}$$

Equations 3.26 – Investment costs to obtain the amount of TPST RDF Fluff investment per ton.

Descriptions:

Bi_{TPST} = Investment Cost TPST
Jn = n operational days in 1 year
SD_{tph} = Waste generated that processed at TPST

Meanwhile, for operating and maintenance costs (OPEX) for TPST RDF Fluff, the following equations can be used:

$$\mathrm{B_{opT}\quad annual} = \frac{OPEX_{annnual}}{\mathrm{RDF_{tph}}} \times SD_{tph}$$

Equations 3.27

B_{opTPST} per Annual= Annual TPST Operational and Maintenance Costs
RDF_{tph} = Annual RDF Production
SD_{tph} = Waste generation that processed at TPST
RDF_{tph} = RDF Production
OPEX per tahun = Annual Operational Cost
Jn = RDF Plant usage period

$$\mathrm{B_{opTPST}\ per\ tons} = \frac{B_{op\ TPST}\ annual}{\mathrm{RDF_{tph}} \times Jn}$$

Equations 3.28

B_{opTPST} per tahun = Annual TPST Operational and Maintenance Costs
B_{opTPST} per ton = Tons of TPST Operational and Maintenance Costs
RDF_{tph} = Annual RDF Production
SD_{tph} = Waste generated that processed by TPST
RDF_{tph} = RDF Production

Based on two equations for investment costs (CAPEX) and operating and maintenance costs (OPEX), the waste management costs are obtained using the following equations

$$\mathrm{B_{psTPST}} = \mathrm{B_{iTPST}} + \mathrm{B_{opTPST}}$$

Equations 3.30

B_{psTPST} = Waste Management Cost in TPST
$B_{i\ TPST}$ = Investment Cost in TPST
$B_{op\ TPST}$ = Operational & Maintenance Cost in TPST
*Calculation are doing in 1 year retention time

$$\mathrm{B_{psTPST}\ per\ ton} = \frac{B_{ps\ TPST}\ per\ tahun}{\mathrm{RDF_{tph}} \times Jn}$$

Equations 3.31

B_{psTPST} = Waste Management Cost at TPST
$B_{i\ TPST}$ = Investment Cost at TPST
RDFtph = RDF Production
Jn = RDF Plant usage period

2.1.4 Methodology for Calculating RDF Contribution to Waste Management Targets

National waste management is one of the main focuses in supporting the achievement of SDGs and the realization of the Indonesia Emas 2045 vision through the RPJPN and RPJMN.

The main indicator is an increase in the percentage of waste processed through waste treatment facilities, including material recovery and energy recovery..

The calculation of the contribution of RDF facilities to national waste management targets is based on projections of national waste generation and waste management targets through material and energy recovery for the period 2029 to 2045. This approach takes into account estimates of the volume of waste that can be processed into RDF based on technical capacity, waste quality, and the needs of industrial users (offtakers)..

Table 2. 1 Calculation of RDF Implementation to Waste Management Targets

Year to Date	Target for Processed Waste (material & energy recovery) (Source: Bappenas)	Total Estimated Waste Processing Based on Targets (tons per year)	Total Estimated Waste Processed into RDF (tons per year)	RDF's Contribution to National Waste Management through Material & Energy Recovery
2029	18%	13.176.000	3.111.000	23,61%
2034	30%*	22.452.719	5.457.000	24,30 %
2039	41%*	32.365.375	6.630.000	20,48%
2045	55%	45.100.000	7.089.000	15,72%

*) prognosis based on targets 2029 and 2045

Source: Ministry of National Development Planning/Bappenas; Consultant Analysis Results 2025

At each stage of the period, waste treatment targets are calculated as a percentage of total national waste generation. Next, the volume of waste that can potentially be processed into RDF is projected, based on an analysis of infrastructure availability, waste characteristics, and market absorption of RDF products.

In 2029, the national waste management target through material and energy recovery is set at 18% of total waste generation, or approximately 13,176,000 tons per year. Of this amount, the estimated amount of waste that can be processed into RDF reaches 3,111,000 tons per year, so the contribution of RDF to the national management target is estimated at 23.44%.

Entering 2034, the processing target will increase to 30%*, with an estimated processing volume of 22,452,719 tons per year. During this period, the potential waste that can be processed into RDF is estimated to reach 5,457,000 tons per year, contributing 23.78% to the national material & energy recovery target.

In 2039, the national waste management target will reach 41%*, with an estimated volume of 32,365,375 tons per year. Waste that can be processed into RDF is projected to be 6,630,000 tons per year, contributing around 20.40%.

By 2045, with the increase in the waste processing target to 55%, the volume of waste targeted for processing will reach 45,100,000 tons per year. During this period, the estimated volume of waste that can be converted into RDF is 7,089,000 tons per year, contributing 15.72% to the national target.

Considering the trend of RDF contributions to national waste management targets, the implementation of RDF facilities in the future will be directed more selectively, taking into account priority locations, such as districts/cities within a radius of less than 100 km from RDF users (offtakers) and areas with large amounts of waste, areas with landfill emergencies, adequate infrastructure readiness, and areas included in national program priorities. To this end, the development of a phased implementation strategy for RDF is integrated with various waste management development programs, such as the Improvement of Solid Waste Management to Support Regional and Metropolitan Cities

(ISWMP), Solid Waste Management for Sustainable Urban Development (SWM-SUD), and the Local Service Delivery Improvement Program (LSDP).

2.2 Staging of Implementation Strategic Scenario for RDF

As part of the national strategy to improve sustainable waste management, the implementation of RDF facilities is being promoted through the synergy of various strategic programs, namely Improvement of Solid Waste Management to Support Regional and Metropolitan Cities (ISWMP), Solid Waste Management for Sustainable Urban Development (SWM-SUD), and Local Service Delivery Improvement Project (LSDP).

ISWMP, supported by funding from the World Bank (IBRD Loan 9024), focuses on strengthening institutional capacity, integrated planning, and providing waste management infrastructure, including RDF, in urban and metropolitan areas. This project supports local governments in policy formulation, improving waste transportation and sorting services, and gradually developing TPST and RDF facilities..

Solid Waste Management Sustainable Urban Development (SWM-SUD) is a waste management program that aims to improve waste management services in selected cities/districts through the development of waste treatment infrastructure such as RDF plants and landfill upgrades, institutional strengthening, and community and vulnerable group empowerment in the context of a circular economy. This project also includes support for the implementation and application of social inclusion principles, environmental protection, and the implementation of strict complaint mechanisms and monitoring.

Meanwhile, LSDP is a national program that promotes a performance-based grant (PBG) scheme with support from the World Bank. LSDP focuses on improving the financial and institutional capacity of local governments to provide efficient and sustainable waste management services. This project emphasizes the 3R approach (reduce, reuse, recycle), waste-to-energy solutions, including RDF, and the development and implementation of a Waste Management Master Plan (RIPS) in the region.

In support of identifying priority areas for RDF development, a national program map was presented based on a map of districts/cities according to a number of key indicators, such as waste volume, distance to off-taker locations, and regional fiscal capacity, as shown in **Table 2.2.**

Table 2. 2 Central Government National Funding Program

No	Local Government*	Province	National Program	Waste Generations <150 tons per day	Distance to Offtaker >100 km	Fiscal Capacity Low & Very Low
1	Reg. Aceh	Aceh	SWM-SUD	V		
2	Kabupaten Toba	Sumatera Utara	LSDP	V		
3	Kota Padang	Sumatera Barat	ISWMP			V
4	Kabupaten Lebak	Banten	LSDP			V
5	Kota Cilegon		ISWMP	V		
6	Kota Cimahi		ISWMP	V		
7	Kota Cirebon		KFW	V		V
8	Kabupaten Cirebon	Jawa Barat	SWM-SUD			V
9	Kabupaten Tasikmalaya		SWM-SUD	V	V	V
10	Kabupaten Indramayu		ISWMP			V
11	Kabupaten Rembang		SWM-SUD	V		V
12	Kabupaten Jepara	Jawa Tengah	SWM-SUD	V		V
13	Kota Magelang		SWM-SUD	V		

No	Local Government*	Province	National Program	Waste Generations <150 tons per day	Distance to Offtaker >100 km	Fiscal Capacity Low & Very Low
14	Kabupaten Temanggung	Jawa Timur	SWM-SUD			V
15	Kabupaten Banyuwangi		SWM-SUD		V	
16	Kota Denpasar	Bali	ISWMP		V	
17	Kabupaten Gianyar		ISWMP		V	

*) The list of districts/cities is adjusted to the status of the program at the time of the study (May 2025).

Source: Ministry of Public Works, Consultant Analysis 2025

The National Funding Program presented in **Table 2.2** shows that a number of districts/cities in Indonesia have low to very low fiscal capacity and therefore require additional support in planning and implementing RDF projects. This assessment was conducted by considering three main indicators, namely: participation in the national waste management program, daily waste generation volume (<150 tons per day), and distance from the location of industrial users (offtakers) of more than 100 km.

Most of the districts/cities on the list are from provinces with weak fiscal characteristics, such as Aceh, North Sumatra, West Sumatra, Banten, West Java, Central Java, East Java, and Bali. For example, the city of Padang in West Sumatra has been registered as a participant in the ISWMP program, but it has a daily waste generation volume of less than 150 tons and is located more than 100 km from the off-taker, and is classified in the "low" fiscal capacity category.

All districts/cities shown have been or are currently part of national waste management programs such as ISWMP, SWM-SUD, LSDP, or KfW. This involvement indicates the potential for institutional support that can be further utilized, but limited waste volumes and remote locations remain major challenges in the context of efficient RDF facility development.

From a fiscal perspective, several districts/cities are known to have very low capacity, such as those in Aceh and Central Java provinces. This condition further reinforces the urgency of affirmative policy approaches and financial support from the central government and development partners. This support is expected to not only strengthen institutions and basic infrastructure, but also create the minimum prerequisites for the involvement of the industrial sector as end users of RDF.

Taking these indicators into account, these regions are positioned as targets for advanced intervention requiring integrated support, whether through technical assistance, provision of basic infrastructure, or alternative financing schemes to bridge the gap between waste management potential and existing fiscal constraints.

PHASING CONSIDERATIONS	PHASE I 2026 - 2030	PHASE 2 2031 - 2035	PHASE 3 2036 - 2040	PHASE 4 2041 - 2045
Offtaker Distance	<100 km	<100 km	<100 km	<100 km
Annual Waste Generation	>150.000 tons/year	>100.000 tons/year	>50.000 tons/year	>50.000 tons/year
Minimum Fiscal Capacity	Very High, and High	Very High, and High	High	Medium
Infrastructure Readiness Condition	Good Readiness Criteria	Good Readiness Criteria	Good Readiness Criteria	Good Readiness Criteria
National Waste Management Program	Priority of Presidential Regulation No. 35/2018, LSDP, ISWMP, SWM-SUD	Priority of Presidential Regulation No. 35/2018, LSDP, ISWMP, SWM-SUD	Priority of Presidential Regulation No. 35/2018, LSDP, ISWMP, SWM-SUD	-

Figure 2. 3 Distribution Areas with Potential RDF Implementation

Based on **Figure 2.3**, it is conveyed that the strategic consideration framework in the phased implementation process of RDF facilities nationally for the period 2026–2045. This strategy is divided into four implementation phases, designed based on five key indicators: (1) the radius of industrial users (offtakers) relative to districts/cities, (2) annual waste generation volume, (3) minimum fiscal capacity of the region, (4) readiness of basic infrastructure such as electricity, water, and others, and (5) participation in national programs related to waste management.

In phase I (2026–2030), priority will be given to districts/cities located less than 100 km from off-taker industries, with a waste volume of over 150,000 tons per year, as well as good infrastructure readiness and very high to high fiscal capacity. Additionally, this phase focuses on districts/cities facing waste emergencies and/or listed in the Minister of Environment and Forestry's Circular Letter regarding landfill management. In this phase, national programs such as Presidential Regulation No. 35/2018, LSDP, ISWMP, and SWM-SUD play a crucial role in strengthening institutional capacity and funding. This phase is focused on areas that are most systemically ready, while also facing significant logistical challenges..

Entering Phase II (2031–2035), the RDF facility implementation strategy is designed to reach more administrative areas with similar characteristics to the previous phase, but with more inclusive parameters. In this phase, development efforts are focused on districts/cities where the distance to RDF user industrial sites (offtakers) remains less than 100 km, with annual waste generation exceeding 100,000 tons. Good infrastructure readiness criteria remain the primary requirement, accompanied by high or very high fiscal capacity, and inclusion in the list of districts/cities with waste emergencies and/or those listed in the Minister of Environment and Forestry's Circular Letter. In its implementation, national programs such as LSDP and SWM-SUD remain involved to ensure the sustainability of fiscal support and the enhancement of local institutional capacity..

Furthermore, in Phase III (2036–2040), the RDF approach will be implemented more inclusively, targeting areas with an annual waste volume of more than 50,000 tons. Although the radius to the off-taker location will remain less than 100 km, the fiscal capacity criteria will be expanded to include areas with "high" fiscal capacity. Good infrastructure readiness requirements remain the main parameter in regional selection, while national program support is more focused through the LSDP instrument. This phase reflects a transition in approach from prioritizing regions with high potential to regions with adequate institutional and technical readiness for the gradual implementation of RDF..

Phase IV (2041–2045) is designed as a long-term expansion phase targeting districts/cities with "medium" fiscal capacity. Technical criteria related to the radius to the user industry location (<100 km) and annual waste generation (>50,000 tons) are maintained as the basis for identifying regions. However, at this stage, there will no longer be direct intervention through specific national programs. Target areas in this phase are expected to have sufficient institutional, technical, and fiscal capacity to develop RDF facilities independently with minimal support from the central government. Good infrastructure readiness remains an essential component to ensure the sustainability of development.

In general, this RDF phasing scheme is designed to be structured, gradual, and adaptive, to ensure that the development of RDF facilities is in line with the required criteria (fiscal capacity, infrastructure readiness, and the technical and institutional potential of each region). This strategy is expected to accelerate the achievement of a modern, efficient, and energy-based national waste management system, as well as support the transition toward sustainable low-carbon development..

2.2.1 RDF Targets and Phase 1 Strategy 2026-2030

Regencies/cities with a radius of less than 100 km from the off-taker and with a very large amount of waste generated (>150,000 tons per

At this stage, the implementation of RDF is focused on 58 cities/districts[8] spread across 14 provinces, namely West Java, Special Region of Jakarta, Central Java, East Java, Banten, Bali, Nanggroe Aceh Darussalam, North Sumatra, West Sumatra, Riau, South Sumatra, Lampung, North Sulawesi, and South Sulawesi. These areas are prioritized in the first phase based on several considerations, including: high waste generation rates, relatively close proximity to potential energy off-takers (coal-fired power plants or industries using alternative fuels), adequate fiscal and institutional capacity at the local level, as well as the readiness of basic infrastructure and the local government's commitment to implementing energy-based waste processing technology.

In addition to distance from potential off-takers, the volume of waste generated in districts/cities is also a consideration in the phased scenario as it is one of the indicators of the urgent need for waste management solutions. Provinces with cities/districts that meet these criteria are: Special Capital Region of Jakarta (West Jakarta, East Jakarta, South Jakarta, North Jakarta), West Java Province (Depok City, Sukabumi City, Indramayu District, Cirebon District, Bogor District, Bogor City), Central Java Province (Semarang City, Jepara District, Cilacap District, Magelang District, Banyumas District), East Java Province (Tuban Regency), Banten Province (South Tangerang City, Serang Regency, Serang City, Lebak Regency, Pandeglang Regency), North Sumatra Province (Simalungun Regency), West Sumatra Province (Padang City), Riau Province (Pekanbaru City), South Sumatra Province (Palembang City), Lampung Province. (Bandar Lampung City, South Lampung Regency), and South Sulawesi Province (Makassar City).

Districts/cities with landfills that are already full or have received attention from the Ministry of Environment for landfill remediation or are experiencing other landfill emergencies are the top priority at this stage. RDF facilities are expected to help reduce the amount of waste sent to landfills

Regencies/cities with Waste Final Processing Facility Emergency Status

Regencies/cities that have received attention from the Ministry of Environment for landfill improvement (on Java Island) or landfills that are already full or experiencing other landfill emergencies are the top priority at this stage.

The districts/cities that meet these criteria are: Kota Tangerang, Kota Depok, Kota Palembang, Kota Semarang, Kota Tangerang Selatan, Kota Pekanbaru, Kota Bandar Lampung, Kota Padang, Kota Manado and its surrounding areas, Kabupaten Bogor, and Kabupaten Tangerang.

Fiscal Capacity: Very High and High

Provinces with high and very high fiscal capacity are expected to ensure the sustainability of projects to support the long-term operation and maintenance of facilities. The regencies/cities that meet these criteria are: DKI Jakarta, Kota Bogor, Kota Tangerang, Kota Tangerang Selatan, Kota Cilegon, Kota Serang, Kota Palembang, Kota Semarang, Kota Makassar, Kota Malang, Kota Pekanbaru, Kota Denpasar, and Kota Kediri.

Infrastructure Readiness: Good

Supporting infrastructure, such as transportation access, electricity supply, and telecommunications, must be taken into account. The readiness of this infrastructure is assessed based on areas that already have adequate infrastructure and are ready to accelerate the development and operation processes..

The provinces that meet these criteria are: Provinsi DKI Jakarta, Provinsi Jawa Barat, Provinsi Jawa Tengah, Provinsi Jawa Timur, Provinsi Banten, Provinsi Sumatera Barat, Provinsi Riau, Provinsi Sumatera Selatan, Provinsi Lampung, and Provinsi Sulawesi Selatan.

Included in the National Priority Program

Several provinces or districts/cities have been included in the National Program, both as a priority under Presidential Regulation No. 35 of 2018 and as a priority for receiving support from the Central Government through the Ministry of Public Works for the construction of RDF TPSTs with support from the LSDP, ISWMP, SWM-SUD, or other programs, thereby increasing the speed and effectiveness of project implementation.

The districts/cities with these criteria are:

- Priority Presidential Regulation No. 35 of 2018: Provinsi DKI Jakarta, Kota Tangerang, Kota Tangerang Selatan, Kota Bekasi, Kota Palembang, Kota Semarang, Kota Makassar, Kota Surabaya, Kota Manado, and surrounding areas.
- National LSDP Program: Kabupaten Lebak, Toba Regency
- National ISWMP Program: Depok City, Tuban Regency, Cilegon City, Padang City, and Indramayu Regency.
- National SWM-SUD Program: Cirebon Regency, Rembang Regency, Jepara Regency, Magelang Region, Banyuwangi Regency, and Aceh Region.

Notes

In this study, several districts/cities included in the national program received assistance from the Central Government for the construction of RDF TPSTs during the 2025-2030 period. These districts/cities are still counted as RDF providers for that period. However, it should be noted that currently there are no off-takers within a distance that meets the economic viability criteria for these districts/cities. Therefore, to continue promoting the implementation of RDF, a logistics study and accelerated improvement of the supporting environment are necessary.

The regencies/cities in question are as follows: Denpasar City (ISWMP), Gianyar Regency (ISWMP), Bandung City (ISWMP), Tasikmalaya (LSDP), Garut Regency (SWM-SUD), Surakarta City (LSDP), Malang City (LSDP) and Batu City (LSDP), Kediri City (LSDP), Banyuwangi Regency (SWM-SUD), and Bukittinggi City (LSDP).

Figure 2. 4 Distribution Areas with Potential RDF Implementation Phase 1

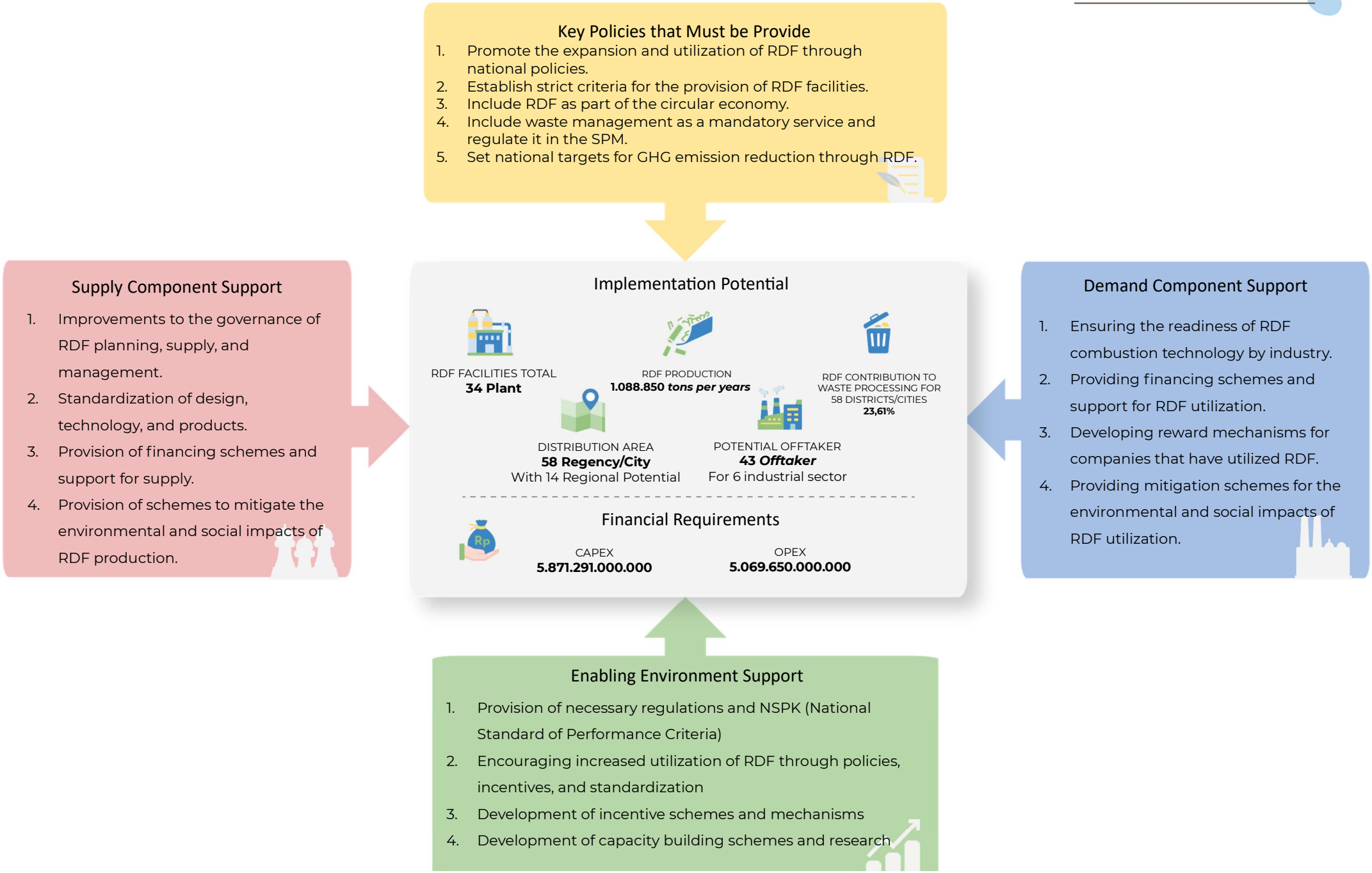


Figure 2. 5 RDF Implementation Potential of Phase 1

Based on **Figure 2.5**, it can be seen that in the period 2026-2029, the potential of RDF facilities will become the main focus in the development of alternative energy in Indonesia. This initial stage aims to build a more mature RDF infrastructure and ensure the industry's readiness to utilize RDF as a sustainable alternative fuel.

At this stage, the implementation of RDF is planned to include the construction of 35 RDF facilities spread across 58 districts/cities, covering 14 regional potentials. These facilities consist of RDF TPSTs with various capacities, both at the regional and regency/city levels. From the total waste processed, it is projected that the RDF produced will reach 1.088.850 tons per year, contributing 23,61% to national waste management. Additionally, the potential for utilizing RDF as an alternative fuel is supported by the presence of 43 off-takers from 6 industrial sectors, indicating significant opportunities for integrating RDF into Indonesia's industrial energy systems. To support this potential, CAPEX funding of IDR 5,871,291,000,000 and OPEX funding of IDR 5,069,650,000,000 are required.

To support this implementation, several key policies must be in place to ensure access to and utilization of RDF through policies that support investment and clear regulations. The government needs to establish strict criteria for the management of RDF facilities, including standards and requirements for their provision and utilization. In addition, cooperation agreements with various parties must also consider the sustainability of investments, while RDF must begin to be integrated into the circular economy system.

On the supply side, the initial stage of RDF implementation emphasises improvements in the governance of RDF planning, provision and management to ensure more efficient operations. Standardisation of design, technology, and regulations is also a key factor in ensuring RDF quality that meets industry needs. The provision of financing schemes and support is crucial for the sustainability of RDF production, while environmental and social impact mitigation aspects of RDF production must be considered from the planning stage onwards.

On the demand side, the readiness of RDF combustion technology in industry must be ensured so that RDF can be used optimally as an alternative fuel. The provision of financing schemes and support is also an important factor in encouraging industry to switch to RDF. In addition, schemes to mitigate the environmental and social impacts of RDF use must be implemented to ensure environmental sustainability and the health of surrounding communities.

An enabling environment is also an important factor in the successful implementation of RDF at this stage. Technical regulations related to norms, standards, procedures, and criteria (NSPK) for RDF must be updated regularly to ensure alignment with industry developments and environmental needs. The development of technical regulations and policies related to the utilisation of RDF must be continuously strengthened to enhance industry confidence in RDF as an alternative fuel. Additionally, efforts should be made to develop capacity-building schemes and research support to make RDF technology more efficient and scalable for broader application.

2.2.2 RDF Targets and Phase 2 Strategy 2031-2035

At this stage, the implementation of RDF is focused on 47 regencies/cities[9] spread across 16 provinces, namely West Java, Central Java, Special Region of Yogyakarta, East Java, Banten, North Sumatra, West Sumatra, Riau, South Sumatra, Lampung, Bangka Belitung, East Kalimantan, South Kalimantan, North Sulawesi, South Sulawesi, West Nusa Tenggara, and

[9] Ibid, Daftar informasi mengenai daftar kota/kabupaten lainnya dapat dilihat pada lampiran

East Nusa Tenggara. These regencies/cities have been prioritised for the second phase based on several considerations, including:

Regencies/cities with a radius of less than 100 km from the offtaker and with a large amount of waste (>100,000 tonnes per year).

In addition to the distance from potential off-takers, districts/cities with large amounts of waste generation are a top priority because they have an urgent need for waste management solutions to help reduce the burden of handling large volumes of waste.

The provinces with regencies/cities that meet these criteria are: Provinsi Jawa Barat (Kota Bekasi, Kabupaten Bekasi, Kabupaten Bandung, Kabupaten Bandung Barat), Provinsi Jawa Tengah (Kabupaten Semarang, Kabupaten Grobogan, Kabupaten Tegal, Kabupaten Brebes), Provinsi Jawa Timur (Kabupaten Pasuruan, Kota Surabaya, Kabupaten Gresik), Provinsi Banten (Kota Tangerang, Kabupaten Tangerang), Provinsi Sumatera Utara (Kota Medan, Kabupaten Deli Serdang, Kabupaten Serdang Bedagai), Provinsi Riau (Kabupaten Siak, Kabupaten Pelalawan), Provinsi Sumatera Selatan (Kabupaten Ogan Komering Ulu), Provinsi Kalimantan Timur (Kota Samarinda, Kota Balikpapan, Kabupaten Kutai Kartanegara), Provinsi Kalimantan Selatan (Kota Banjarmasin, Kabupaten Banjar), Provinsi Sulawesi Utara (Kabupaten Minahasa), Provinsi Sulawesi Selatan (Kabupaten Gowa, Kabupaten Pangkajene dan Kepulauan), dan Provinsi Nusa Tenggara Timur (Kabupaten Ende).

Regencies/cities with Waste Final Processing Facility Emergency Status

Regencies/cities with landfills that are already full or have received attention from the Ministry of Environment for landfill improvement or are experiencing other landfill emergencies are the top priority at this stage. RDF facilities are expected to help reduce the amount of waste sent to landfills.

Regencies/cities that meet these criteria are: Kota Bekasi, Kabupaten Tangerang, Kabupaten Bekasi, dan Kota Samarinda..

Fiscal Capacity: Very High and High

Provinces with high and very high fiscal capacity are expected to ensure the sustainability of projects to support the long-term operation and maintenance of facilities. Regencies/cities with these criteria are: Kota Bekasi, Kabupaten Bekasi, Kabupaten Bandung, Kota Semarang, Kota Makassar, Kabupaten Sleman, Kota Yogyakarta, Kota Pasuruan, Kabupaten Pasuruan, Kabupaten Gresik, Kota Surabaya, Kabupaten Tangerang, Kota Tangerang, Kota Medan, Kabupaten Deli Serdang, Kabupaten Pelalawan, Kota Samarinda, Kota Balikpapan, Kabupaten Kutai Kartanegara, Kabupaten Kutai Timur, Kota Banjarmasin, Kota Banjarbaru, dan Kota Mataram..

Infrastructure Readiness

Supporting infrastructure, such as transport access, electricity supply, and telecommunications, is assumed to have been developed at this stage. The selected cities/districts are assumed to already have adequate infrastructure and are ready to accelerate the development and operation process.

The provinces with these criteria are: Provinsi Jawa Barat, Provinsi Jawa Timur, Provinsi Jawa Tengah, Provinsi Banten, Provinsi Sumatera Utara, Provinsi Riau, Provinsi Sumatera Selatan, dan Provinsi Sulawesi Selatan.

Included in National Program Priorities

Provinces included in the national programme, both priority areas under Presidential Regulation No. 35 and regencies/cities that have passed the selection process, receive support from the central government for the development of TPSTs through the LSDP, ISWMP, SWM-SUD loan programmes or other programmes, thereby increasing the speed and effectiveness of project implementation. Regencies/cities with these criteria are:

- Priorities of Presidential Regulation Number 35 2018: Medan
- LSDP Programme: Kabupaten Lebak, Kabupaten Toba
- SWM-SUD Programme: Kabupaten Cirebon, Kabuupaten Tasikmalaya, Kabupaten Temanggung, Kabupaten Rembang, Kabupaten Jepara, Kabupaten Magelang Regency, Kabupaten Banyuwangi, Regional Ace, and Tabalong.

Notes

In this study, several districts/cities included in the national programme that received assistance from the Central Government for the construction of RDF TPSTs were still counted as RDF providers. However, it should be noted that currently there are no off-takers within a distance that meets the economic viability criteria for these cities/districts. Therefore, to continue promoting the implementation of RDF, a logistics study and accelerated improvement of the supporting environment are necessary. The districts/cities in question include Sleman District, Bantul District, and the Special Region of Yogyakarta.

Figure 2. 6 RDF Implementation Potential of Phase 1

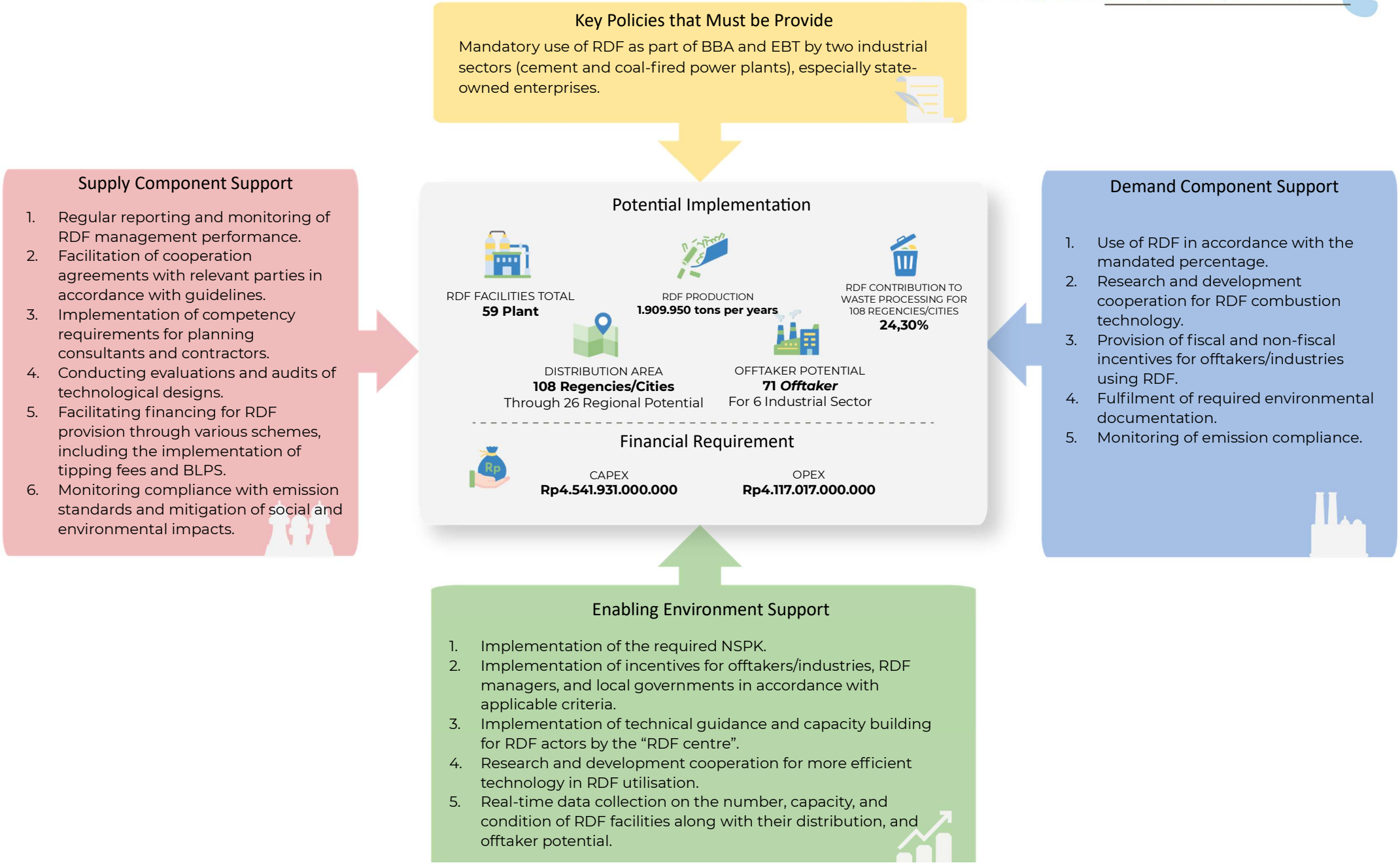


Figure 2. 7 Potential Implementation of RDF Phase 2

During the period 2031-2035, the potential of RDF facilities in Indonesia will continue to grow, with targets for increasing production capacity and expanding distribution coverage. The primary focus of this phase is to accelerate the utilisation of RDF as part of Alternative Fuels (AF) and Renewable Energy (RE) in the industrial sector, particularly for state-owned enterprises (SOEs) operating in the cement and power plant sectors. This initiative aims to reduce dependence on fossil fuels, enhance waste management efficiency, and promote energy sustainability in Indonesia.

The advanced stage of the RDF development plan includes the construction of 59 RDF facilities spread across 108 regencies/cities, with support from 20 regional potential areas. This initiative aims to significantly increase waste processing capacity and RDF utilisation across various regions in Indonesia. With the planned capacity, RDF production is estimated to reach 1,606,500 tonnes per year, contributing to the management of 24,30% of total waste. This demonstrates the increased effectiveness of RDF in supporting sustainable national waste management. In terms of utilisation, the produced RDF has the potential to be absorbed by 71 off-takers from 6 industrial sectors, reinforcing RDF's role as an alternative energy source in production processes. To support this implementation, financing is required with an estimated CAPEX of Rp 4,541,931,000,000 and OPEX of Rp 4,117,017,000,000, reflecting the scale and complexity of the investment in the construction and operation of RDF facilities nationwide.

In order to achieve this target, key policies must be in place, including the consolidation of regulations on the use of RDF as part of BBA and EBT, especially in industries dominated by state-owned enterprises. The government needs to issue policies that encourage the use of RDF in industry, either through mandatory use or by providing incentives for industries that use RDF as an alternative fuel. In addition, collaboration between the government and the private sector is needed to ensure that policy implementation runs optimally.

In supply aspect, reporting and monitoring of RDF management performance needs to be carried out regularly to ensure the efficiency and effectiveness of RDF production. Facilitating cooperation between industry players and the government is also crucial in accelerating RDF. The implementation of competency standards for workers, especially for RDF planning consultants and contractors, must continue to be improved to ensure that the quality of RDF included the established standards. Additionally, evaluations and audits of RDF technology must be conducted on a regular basis to ensure that the technology used remains efficient and aligned with industry developments.

On the demand side, improved regulation of RDF practice in industry is needed to optimise its utilisation. In addition, research and development cooperation in the field of RDF combustion technology needs to be strengthened in order to improve efficiency and reduce the environmental impact of RDF combustion. The government also needs to provide fiscal and non-fiscal incentives for industries that use RDF and strengthen policies to reduce fossil fuels through the substitution of RDF in industrial operations.

An enabling environment is also an important factor at this phase. Technical regulations related to RDF NSPK need to be updated regularly to ensure compliance with international standards and industry needs. In addition, technical guidance and capacity building for RDF actors through the “RDF centre” programme must continue to be encouraged to ensure competent human resources in RDF management. Collaboration in RDF technology research and development should be expanded to create more environmentally friendly innovations and improve efficiency in the RDF combustion process. Real-time monitoring of the quantity, capacity, and quality of RDF should be implemented to ensure the effectiveness of RDF production and distribution in various regions.

2.2.3 RDF Targets and Strategy Phase 3 2036-2040

At this stage, the implementation of RDF is focused on 25 districts/cities spread across four provinces, namely West Java, Central Java, East Java, Riau Islands, Jambi, Lampung, West Kalimantan, South Kalimantan, North Kalimantan, North Sulawesi, and Southeast Sulawesi. These districts/cities are prioritised in the fourth stage based on several considerations, include::

Regencies/cities with a radius of less than 100 km from the off-taker and with a significant amount of waste generation (>50,000 tonnes

Aside from the distance to prospective offtakers, the waste generation volume at the regency/city level is considered in the phasing scenario, as it reflects the level of urgency in addressing local waste management challenges..

The provinces with regencies/cities that meet these criteria are: Provinsi Jawa Barat (Kabupaten Sumedang, Kabupaten Majalengka), Provinsi Jawa Tengah (Kabupaten Kebumen, Kabupaten Purworejo, Kabupaten Kudus, Kabupaten Pati, Kabupaten Demak), Provinsi Jawa Timur (Kabupaten Jombang, Kabupaten Mojokerto, Kabupaten Magetan, Kabupaten Ngawi, Kabupaten Pacitan, Kabupaten Madiun), Provinsi Kepulauan Riau (Kota Batam), Provinsi Jambi (Kota Jambi), Provinsi Lampung (Kabupaten Lampung Selatan), Provinsi Kalimantan Barat (Kota Pontianak), Provinsi Kalimantan Selatan (Kabupaten Tabalong, Kabupaten Balangan, Kabupaten Hulu Sungai Utara), Provinsi Sulawesi Utara (Kabupaten Bolaang Mongondow, Kota Kotamobagu), dan Provinsi Sulawesi Tenggara (Kota Kendari).

Regencies/cities with Waste Final Processing Facility Emergency Status

Regencies/cities with landfills that are already full or experiencing other landfill emergencies remain a top priority at this stage. RDF facilities are expected to help reduce the amount of waste sent to landfills. Regencies/cities with these criteria are: Kota Batam, Kota Pontianak and its surroundings.

Fiscal Capacity: High

Provinces with high fiscal capacity are expected to ensure the sustainability of projects to support the long-term operation and maintenance of facilities. The regencies/cities that

meet these criteria are: Kota Madiun, Kota Blitar, Kota Jambi, Kota Pontianak, Kabupaten Tabalong, Kabupaten Balangan, and Kabupaten Bolaang Mongondow.

Good Infrastructure Readiness

Supporting infrastructure, such as transport access, electricity supply, and telecommunications, is assumed to have been developed at this stage. The selected districts/cities are assumed to already have adequate infrastructure and are ready to accelerate the development and operation process.

The provinces that meet these criteria are as follows: Provinsi Jawa Barat, Provinsi Jawa Tengah, Provinsi Jawa Timur, Provinsi Kepulauan Riau, Provinsi Jambi, and Provinsi Lampung.

Included in the National Priority Programme

Provinces included in the national programme, both priority areas under Presidential Regulation No. 35 of 2018 and districts/cities that have passed the selection process, receive support from the Central Government for TPST development through the LSDP, ISWMP, SWM-SUD loan programmes or other programmes, thereby increasing the speed and effectiveness of project implementation. The districts/cities meeting these criteria are: the National LSDP Programme in Kota Batam and Kota Pontianak.

Notes

In this study, several districts/cities included in the National Programme that received assistance from the Central Government for the construction of RDF TPSTs are still counted as RDF providers. However, it should be noted that currently there are no offtakers within a distance that meets the economic feasibility criteria for these cities/districts. Therefore, in order to continue to encourage the implementation of RDF, it is necessary to conduct a logistical study and accelerate the improvement of the supporting environment. These districts/cities are Tarakan City (LSDP).

Figure 2. 8 Distribution of Areas with Potential for RDF Implementation Phase 3

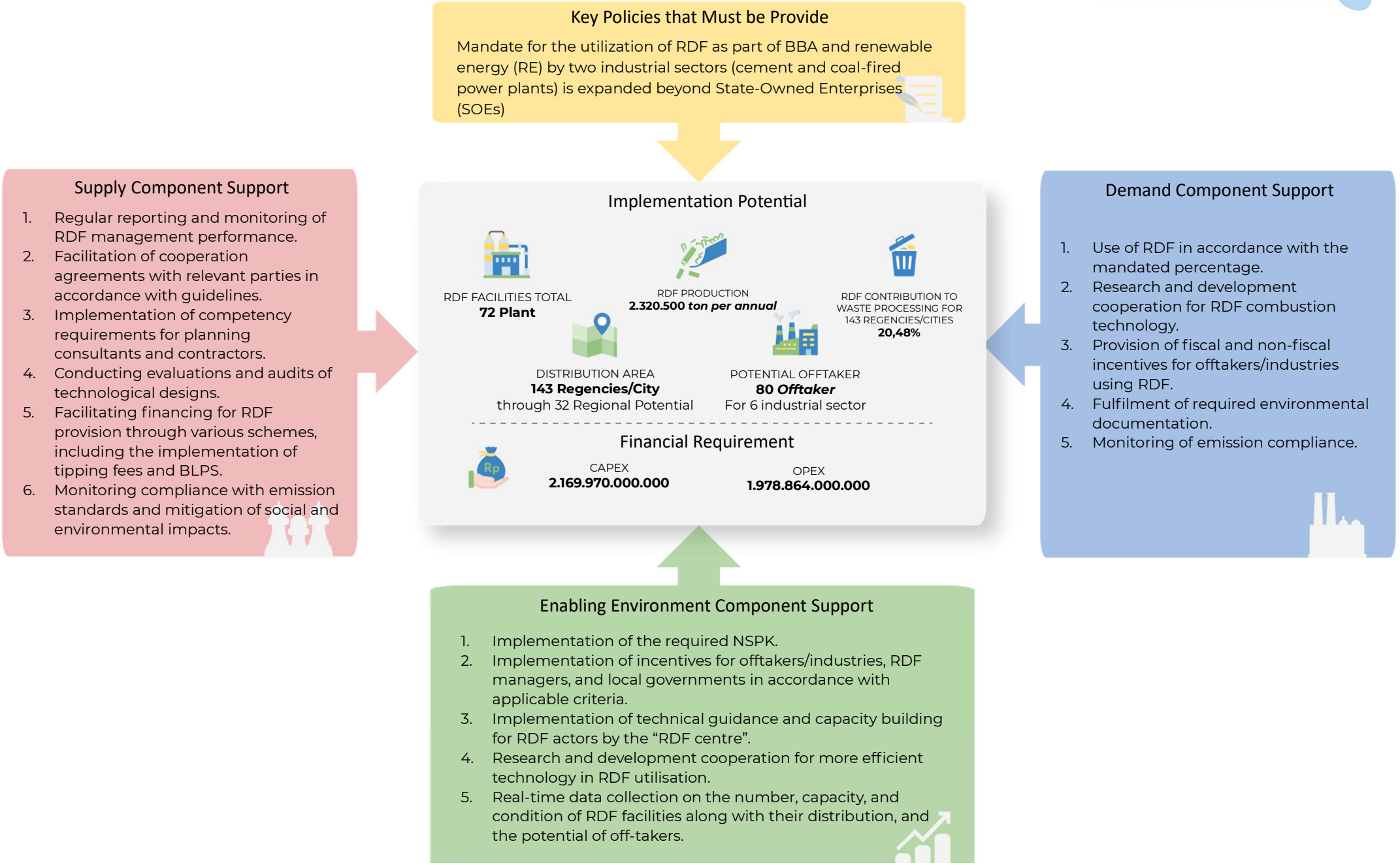


Figure 2. 9 RDF Potential Implementation of Phase 3

During the period 2036-2040, the development and implementation of RDF in Indonesia is expected to reach an optimal stage with increased production capacity, distribution, and utilisation in the industrial sector. This aims to accelerate the energy transition towards the use of more environmentally friendly alternative fuels, while reducing dependence on fossil fuels. To achieve this, stricter policies and greater financial support are key factors in the successful implementation of RDF in this third phase.

The government needs to strengthen policies that require the use of RDF in the cement industry and coal-fired power plants as an effort to reduce carbon emissions and improve energy efficiency. In addition, regulations regarding RDF technical standards must be updated to keep pace with technological developments and industry needs. Fiscal and non-fiscal incentives should also be expanded, such as providing subsidies, tax breaks, and streamlined permitting processes for companies that adopt RDF as part of their operational fuel mix. The role of State-Owned Enterprises (SOEs) in RDF management should also be strengthened to ensure the sustainability of RDF supply and price stability in the market.

At this stage, the expansion of RDF is targeted to achieve a wider coverage with a total of 72 RDF facilities spread across 132 districts/cities, supported by 32 regional potentials. This demonstrates a strong commitment to expanding the scope of waste management through the RDF approach in various regions. With this installed capacity, the RDF produced is estimated to reach 2,320.500 tonnes per year, contributing 20,48% to waste management. This reflects the strategic role of RDF in reducing the burden on landfills and strengthening sustainable waste management systems. In terms of utilisation, the RDF produced has the potential to be absorbed by 80 off-takers from 6 industrial sectors, expanding the scope of RDF utilisation as an alternative fuel in the energy industry sector. To realise this plan, the estimated funding requirements include CAPEX of Rp 2,169,970,000,000 and OPEX of Rp 1,978,864,000,000, which are necessary for the construction of infrastructure and the optimal operation of RDF facilities..

This expansion not only focuses on increasing the number of RDF facilities, but also on optimising the supply chain and distribution of RDF to various industrial areas that require alternative fuels. With supportive regulations and coordination between the government and the private sector, RDF can be increasingly relied upon as a solution for waste management while supporting national clean energy targets.

In order to ensure that RDF is available in sufficient quantities and of high quality, it is necessary to improve the reporting and monitoring systems for RDF management performance in order to increase operational efficiency. Facilitating cooperation agreements with the private sector is necessary to accelerate investment in RDF infrastructure. In addition, increasing the capacity of the workforce through training for planning consultants and RDF contractors is very important in order to maintain RDF production standards. Audits and evaluations of RDF technology must be conducted regularly to ensure technical feasibility and optimise production processes. Monitoring RDF emissions and mitigating social and environmental impacts are also important aspects to ensure that RDF implementation remains aligned with global sustainability standards.

In order for RDF to be utilised to its full potential by industry, strengthening regulations that require certain industries to use RDF in their operations is a strategic step. In addition, cooperation in research and development of RDF combustion technology must be improved to make it more efficient and in line with environmental standards. Fiscal and non-fiscal incentives for industries committed to using RDF as an energy source should be expanded to enhance RDF's appeal as an alternative fuel. Enhanced coordination between the government, academia, and the industrial sector is also necessary to accelerate the adoption of RDF technology across various industrial sectors. Regular environmental impact assessments must be implemented to ensure RDF remains a sustainable solution for waste management and energy transition.

The environment supporting RDF implementation must be further strengthened through more detailed technical regulations related to RDF standards, licensing procedures, and monitoring mechanisms. Education and socialisation to industry and stakeholders are needed to increase understanding of the benefits of RDF. In addition, technical guidance and capacity building for industry players must be strengthened so that RDF adoption can be carried out widely. The development of more efficient and environmentally friendly RDF technology innovations through research collaboration is also an important step at this stage. The implementation of a digital-based monitoring system will ensure transparency and optimisation of RDF utilisation across various industrial sectors.

2.2.4 RDF Target and Strategy Phase 4 2041-2045

Implementation of RDF is focused on 11 regencies/cities spread across three provinces, namely Central Java, East Java, and South Kalimantan. These districts/cities are prioritised in the fourth phase based on several considerations, including:

Regencies/cities with a radius of less than 100 km from the off-taker and with a significant amount of waste generation (>50,000 tonnes

In addition to the distance from potential off-takers, districts/cities with large amounts of waste generation are a top priority because they have an urgent need for waste management solutions to help reduce the burden of handling large volumes of waste.

The provinces with districts/cities that meet these criteria are: Provinsi Jawa Tengah, Provinsi Jawa Tengah (Kabupaten Pemalang, Kabupaten Batang, Kabupaten Kendal, Kabupaten Pekalongan), Jawa Timur (Kabupaten Probolinggo, Kabupaten Probolinggo, Kabupaten Bondowoso, Kabupten Jember), Provinsi Kalimantan Selatan (Kabupetan Kotabaru, Kabupaten Tanah Bumbu)

Fiscal Capacity: Moderate

Provinces with moderate fiscal capacity are expected to ensure the sustainability of projects to support the long-term operation and maintenance of facilities.

The regencies/cities that meet these criteria are: Kabupaten Kotabaru, Kabupaten Tanah Bumbu, Kota Palu, and Kota Probolinggo City.

Good Infrastructure Readiness

Supporting infrastructure, such as transport access, electricity supply, and telecommunications, is assumed to have been developed at this stage. The selected regencies/cities are assumed to already have adequate infrastructure and are ready to accelerate the development and operation process. The provinces that meet these criteria are Central Java Province and East Java Province.

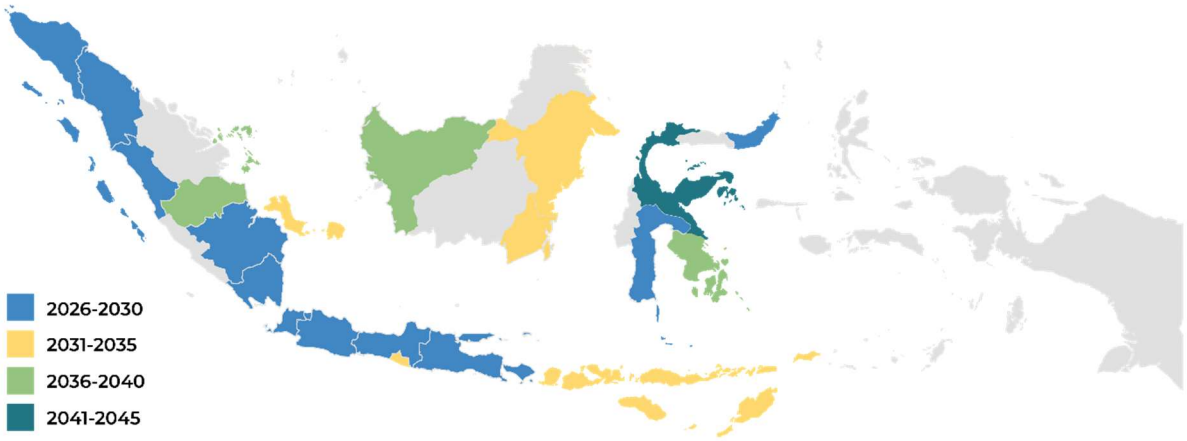


Figure 2. 10 Distribution of Areas with Potential for RDF Implementation Phase 4

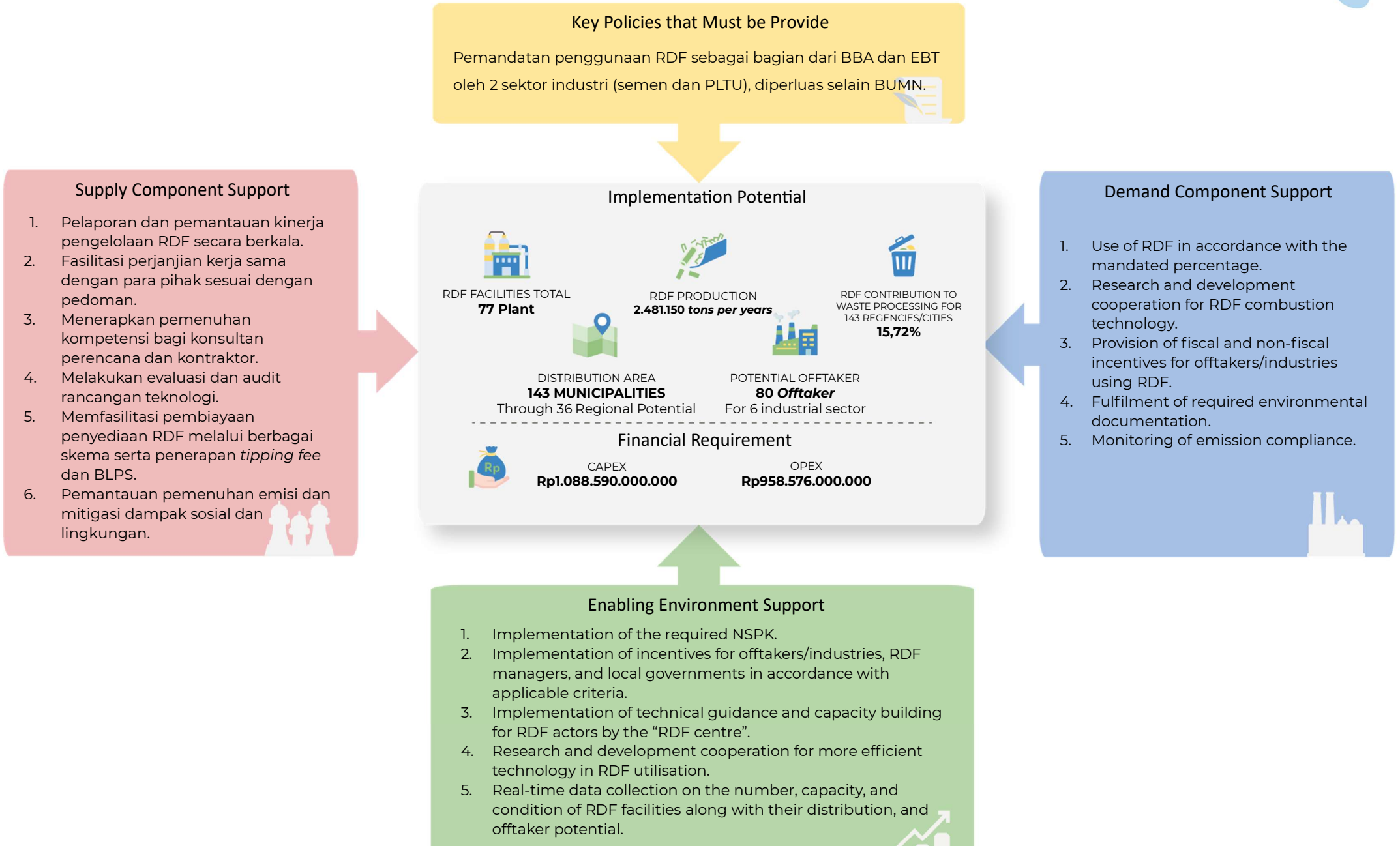


Figure 2. 11 RDF Potential Implementation of Phase 4

During the period 2041-2045, RDF facilities in Indonesia are expected to reach a more advanced stage with an increase in the number of facilities, coverage area, and optimisation of RDF utilisation in the industrial sector. This step aims to reduce dependence on fossil fuels and strengthen a more sustainable waste management system. In this phase, the role of government policy, investment, and technological innovation will be the key factors determining the success of RDF in Indonesia.

Targets RDF facility at this phase is 80 RDF plants spread across 143 regencies/cities in 36 potential regional areas. This number indicates an increase in coverage compared to previous stages. Total RDF production is estimated to reach 2,481,150 tons per year, equivalent to a contribution of 15,72% of waste volume processing. This increase is expected to support the reduction of landfill burden and improve waste management systems in the region. The RDF produced has the potential to be utilised by 85 off-takers from 6 industrial sectors. The estimated funding requirements for implementing this programme include CAPEX of Rp 1,088,590,000,000 and OPEX of Rp 958,576,000,000, covering the construction and operational needs of the facilities.

Strengthening regulations is an aspect that can support the implementation of RDF. The government needs to encourage the application of stricter NSPK to ensure that RDF quality complies with industry standards. In addition, stricter regulations on the obligation to use RDF in the industrial sector need to be implemented to increase market demand. Fiscal and non-fiscal incentives should also be expanded to attract more private investment in RDF infrastructure development. Collaboration between the government, academia, and the industrial sector in RDF technology research and development needs to be strengthened to improve combustion efficiency and reduce the environmental impact of RDF utilisation.

In terms of operational, supervision of the RDF supply chain must be tightened through a system of regular reporting and performance monitoring. RDF processing facilities must apply higher competency standards for their workforce, including training and certification for RDF consultants and contractors. RDF technology evaluations and audits must be conducted regularly to ensure the efficiency and effectiveness of the waste-to-RDF processing system. In addition, monitoring of emissions generated from RDF combustion is necessary to reduce negative impacts on the environment and maintain ecosystem sustainability.

On the demand side, policies are needed to encourage the use of RDF in industry. The expansion of incentive schemes for industries that use RDF as fuel must be strengthened to make industries more interested in switching to RDF. In addition, there needs to be closer collaboration in research and development of RDF technology to make it more efficient and in line with global environmental standards. Increasing fiscal and non-fiscal incentives is also an important strategy in accelerating the adoption of RDF in the industrial sector.

In addition to policy and demand aspects, strengthening the enabling environment must also be a priority. Technical regulations related to RDF NSPK need to be updated regularly in line with technological developments and industry needs. Technical guidance and capacity building for RDF actors must continue to be carried out to ensure that RDF production standards are maintained. Furthermore, collaboration in research and development of more efficient and environmentally friendly RDF technology must be strengthened to make RDF more competitive compared to conventional fuels. Real-time monitoring of RDF production capacity and quality must be implemented to ensure its distribution and utilisation are optimised.

2.3 RDF Implementation Preparation Process

In order to implement RDF technology as a more sustainable waste management solution, a systematic and structured preparation procedure is required to ensure that each phase runs effectively. This process not only ensures that each proposed location for an RDF plant meets the feasibility criteria but also optimises the potential for utilising waste as an alternative fuel. With clear and focused procedures in place, the risk of failure in implementation can be minimised, while also supporting the achievement of waste processing targets, thereby reducing the volume of waste ending up in landfills. Therefore, each stage must undergo a comprehensive evaluation, starting from feasibility studies, thorough technical planning, to monitoring the performance of the facility after it begins operations. With the proper application of procedures, RDF not only serves as a solution for waste reduction but also contributes to creating a more environmentally friendly and sustainable energy source.

The process of preparing for the implementation of RDF begins with the planning stage, in which the local government conducts a preliminary feasibility study to ensure the availability of waste supply, the suitability of the processing method with local policies, and the availability of land. At this stage, the cooperation mechanism and the amount of BLPS assistance required are also determined. At this stage, the cooperation mechanism and the amount of BLPS assistance required are also determined. To ensure the region's overall readiness, the evaluation also covers several key indicators packaged in the form of a Regional Readiness Checklist or verification/audit by the relevant ministries/agencies, including: (a) fiscal capacity and governance; (b) availability of human resources, particularly RDF operators; (c) availability of regulations and readiness to meet operational and maintenance costs, including tipping fees; and (d) planning support, such as the integration of the RDF programme into the RPJMD document, the Environmental Agency's Strategic Plan, or related sectors such as PUPR. The checklist is designed to provide an initial measurable overview of the institutional and operational readiness of local governments to implement RDF sustainably.

If the initial assessment indicates that the area is feasible and ready, the process continues with a feasibility study to assess technical, financial and economic feasibility as considerations in investment decision-making, including the preparation of detailed engineering designs, cost-benefit analysis, funding schemes, and others. Following that, if the feasibility study deems the project viable, the local government, in collaboration with the relevant ministries, will proceed with the selection of an RDF operator through the assignment of a state-owned enterprise (BUMD) or state-owned company (BUMN), or through a tender process if no party meets the criteria. The next stage is the licensing process, which involves obtaining environmental permits and other permits/requirements covering compliance with the Regional Spatial Plan (RTRW), Business Field Compliance, Offtaker Cooperation Agreement, Local Government Cooperation Agreement, Tipping Fee Commitment, BLPS Commitment, and Environmental Documents. Once the permits are obtained, the Detailed Engineering Design (DED) is prepared, which includes the Basic Design, DED, Design Notes, and Bill of Quantities (BoQ).

The next phase involves a commissioning process in the form of verifying the results against the initial design, before moving on to the handover stage, which involves drafting and signing cooperation agreements between the local government and the selected partners/operators and offtakers, including RDF sale and purchase agreements.

Once the RDF facility begins operating, the local government is responsible for conducting an annual evaluation of the facility's performance. The results of this evaluation will form

the basis for applying for BLPS assistance for the following year and will serve as a tool for monitoring the overall sustainability of the RDF facility.

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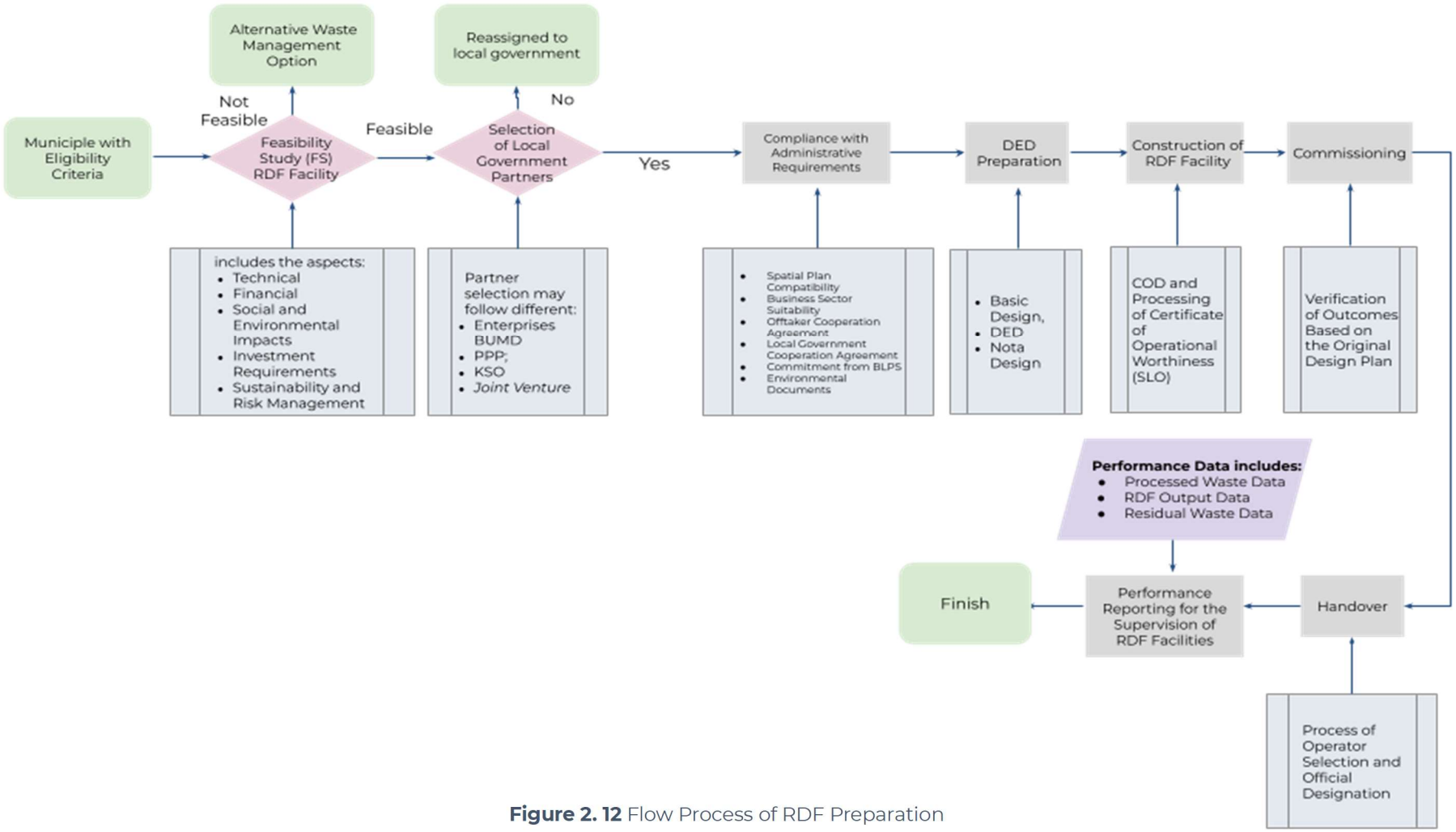

Figure 2. 12 Flow Process of RDF Preparation

Description:

- Initial Stage or Final Outcome
- Decision-Making for RDF Implementation Preparation
- Stages of RDF Implementation Preparation
- Required Information Details
- Necessary Data Inputs
- Considerations of Applicable Reference Documents

03.

Strategy and Program of RDF Implementation in Indonesia

3.1 Principles of RDF Implementation

RDF is one option for waste processing, whereby non-recyclable waste (refuse) is converted into fuel (derived fuel). However, RDF is only one of several technological options that can be used for waste processing. It is therefore important for local governments to consider whether RDF is a technology that suits the needs and characteristics of their region.

The main principle of RDF implementation is to contribute to waste management without neglecting other efforts such as prevention, reduction, reuse, and recycling. RDF is not intended to be a commodity or source of regional income. In addition, regions or areas that will use RDF as one of their waste treatment options must meet the following **prerequisites**:

1. **The urgency of the waste problem**: Areas with landfill problems can implement RDF to reduce the volume of waste sent to landfills, taking into account the availability of off-takers as a key prerequisite. RDF needs to be promoted so that it is produced from waste that cannot be recycled or reused. By processing non-recyclable waste into RDF, the volume of waste sent to landfills is expected to decrease significantly, thereby helping regions address landfill capacity constraints and extend the lifespan of landfill sites..
2. **Availability/potential of off-takers**: RDF is a process of converting non-recyclable waste into fuel that is then used by off-takers, which are generally industries, as an alternative fuel or renewable energy source to replace some of the fossil fuels. Areas or regions that will utilise RDF should have potential off-takers such as cement industries, coal-fired power plants, and other industries[10] within a distance of less than 100 km. Areas without off-takers within the specified distance are not recommended to build RDF facilities as this would result in economic viability not being met.
3. **Economies of scale**: The production and use of RDF must be economically viable. In addition to providing an alternative to fossil fuels, RDF facilities must be able to operate sustainably. The construction of RDF facilities that do not take economic scale into account will burden the costs of operation and maintenance, given that the selling price of RDF still has to compete with the prices of other energy sources and cannot be the main source for covering operational and maintenance costs. Therefore, it is recommended that RDF facilities be built to process waste with a minimum capacity of 150 tonnes per day. This scale is based on feasibility studies of several regions that will implement RDF.

If these three prerequisites are met, the implementation of RDF must still be supported by the necessary policies and strategies to ensure that RDF can operate and be managed sustainably. The strategy to support RDF is explained in the next section.

3.2 Strategies and Programs

The implementation of RDF needs to be supported by strategies to ensure sustainable operation and management. Currently, of the approximately 18 mapped RDF managers,

[10] Fertilizer, Steel & Nickel, Pulp & Paper, and Chemical Industries.

most are not functioning optimally (56%), only 28% are functioning well, and 17% are not functioning at all. This shows that RDF governance still requires significant improvement and enhancement before expansion efforts can be undertaken. The strategy to support improvements in RDF governance is as follows:

1. **Provision of necessary national policies**
   The implementation of RDF in Indonesia cannot yet be driven by market mechanisms (demand-driven), so it must be driven by national policies (policy-driven) that cover its use and also mandate potential users to utilise RDF as an alternative fuel. Some key policies that are needed are: affirming RDF as one of the sources of renewable energy, affirming RDF as part of the circular economy, clear criteria for regions/areas that will implement RDF, and mandating the use of RDF by potential industries.

2. **Improvements in supply and management**
   The reasons why RDF facilities in Indonesia are not functioning and not functioning optimally are due to various aspects, ranging from unmet planning standards, inappropriate technology selection, unmet operating and maintenance costs, and poor management performance. These aspects need to be standardised and developed into guidelines, implementation instructions, or technical instructions for relevant actors. In addition, some processes require verification or audits to ensure their reliability, such as the technology selected for the RDF production process. Local government contributions to RDF operational and maintenance costs in the form of tipping fees are essential, as RDF is part of waste management rather than commodity production.

3. **Increased utilisation by potential industries (demand)**
   Implementation of RDF cannot be carried out if its utilisation by potential industries is not increased. Therefore, in addition to key policies, aspects that influence industries to use RDF as an alternative source of raw materials need to be considered, such as the readiness of infrastructure and combustion technology, financing for retrofitting, and the ease of obtaining environmental permits, including the required emission quality standards.

4. **Provision of an enabling environment**
   The provision, management, and utilization of Refuse-Derived Fuel (RDF) must be supported by an enabling environment. It is imperative to formulate technical regulations and national standards, guidelines, and procedures (NSPK) to serve as authoritative references for the planning, development, management, production, and utilization of RDF. Furthermore, incentive schemes and mechanisms must be developed to support both local governments and RDF-utilizing industries (offtakers). The development of markets and business models for RDF application should also be pursued in order to expand the potential user base. Capacity-building initiatives for stakeholders involved in RDF management are essential, one of which may include the establishment of an “RDF Center” under the auspices of the relevant technical Ministry or Agency. Additionally, research and development must be given due attention to facilitate the advancement of local technologies as well as the adoption of more efficient and innovative technologies for RDF utilization.

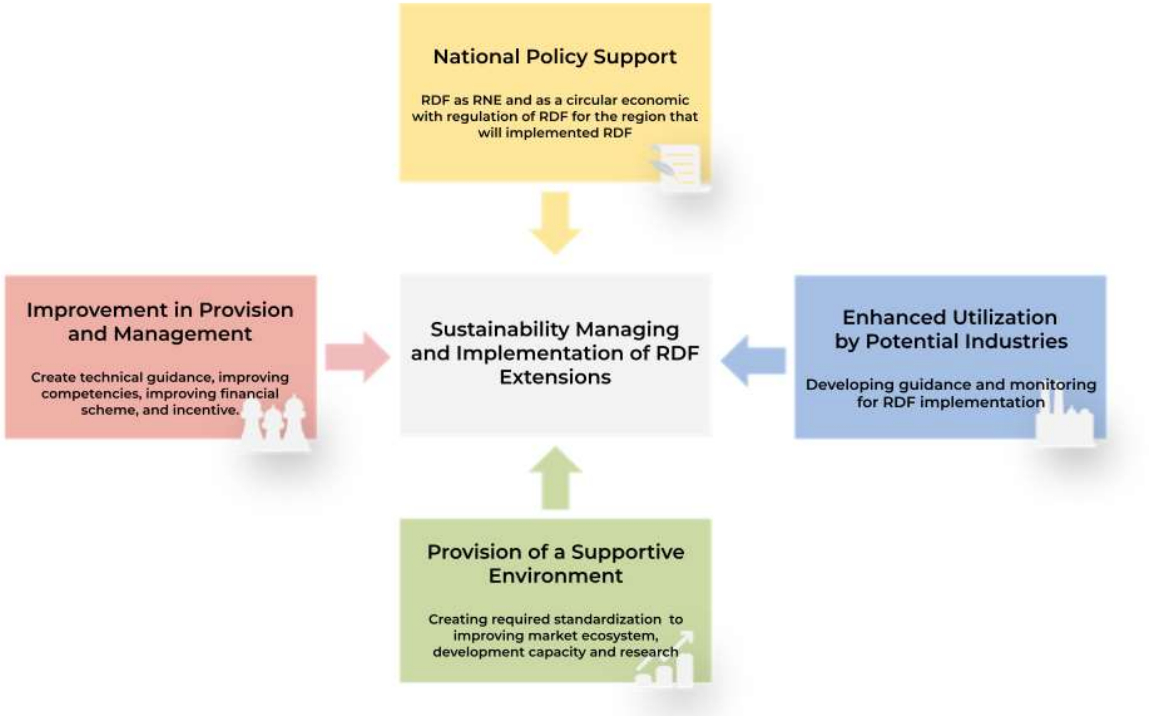

Figure 3. 1 Strategic of RDF Implementation

Details of the programmes, responsible ministries and agencies, and implementation targets for each programme can be found in Table 8 in the Annex.

3.3 Risk Analysis and Mitigation Strategy

As part of the national strategy for sustainable RDF implementation, it is important to identify various risks that could hinder the achievement of implementation targets. This section outlines the risks that could potentially affect the success of the RDF program, as well as mitigation strategies that can be applied.

1. **Supply Constraint**
   One of the risks in supplying RDF raw materials is the potential conflict between waste sorting activities for recycling purposes and the need for RDF supply. If sorting practices are carried out properly, the volume of residue that can be converted into RDF will decrease. When this condition is achieved, it actually indicates that waste management is improving.
   Nevertheless, mitigation strategies to address the risk of supply constraints still need to be prepared. This can begin with the development of a national policy that clearly positions RDF as a solution for non-recyclable residues. When waste sorting practices are already being carried out effectively, the government can begin preparing technical guidelines that serve as a reference for classifying types of waste that must be recycled and types of waste suitable as RDF feedstock. This approach can help avoid raw material competition and optimize each function of waste management according to its hierarchy..

2. **Dependence on Government Grants**

   So far, RDF facilities in Indonesia have generally been built through assistance schemes from the central government or donor agencies. If dependence on these two sources continues, operations are at risk of being halted when funding ends, especially for RDF production facilities and technology, which require long-term operation and maintenance.

   To mitigate this risk, blended finance strategies can be strengthened from the outset of project development. This approach may include private sector involvement through public-private partnership (PPP) schemes, as well as the development of business models based on RDF revenue and tipping fees. Then, revenue projections and operational and maintenance cost requirements need to be carried out so that RDF facilities and technology can generate economic value from every sale of RDF and waste processing services, which can be used to finance operational needs after government support is discontinued. In addition, post-grant transition planning can be developed, for example, including strengthening the capacity of local institutions to manage RDF independently and sustainably.

3. **Community Resistance**

   The implementation of RDF, particularly during the waste-to-RDF processing stage, may face public resistance due to environmental issues such as air pollution, odor, and concerns about health impacts. For example, the case that occurred at the Rorotan Waste Management Facility in March 2025. The black smoke and odor that emerged caused discomfort for the surrounding community and led to protests over the issue. Issues that have occurred in one location can influence the general public's perception of RDF implementation.

   Mitigation strategies for environmental, health, and social risks should focus on enhancing transparency, public engagement, and risk communication. Public involvement can begin at the planning stage through public consultation forums. The local government, together with the operational implementers at the RDF TPST, also need to ensure that all activities are carried out in accordance with operational standards and develop a complaint handling mechanism in the event of environmental and health issues arising from operational inconsistencies in waste processing at the RDF facility. An environmental monitoring system can also be developed and involve the community as an effort to increase public trust and strengthen the legitimacy of RDF implementation.

4. **Long Term Challenges**

   The implementation of RDF requires adaptive and responsive planning to various dynamics, such as technological developments, regulatory changes, and so on. Mitigation strategies can be carried out through the development of a continuous monitoring and evaluation system with performance indicators that have been set at each stage of planning. Additionally, it is important to encourage cross-regional learning to share knowledge and best practices from RDF implementation. Strengthening research and innovation can also be a key element in maintaining the relevance of RDF in the future. The government can encourage collaboration with universities, research institutions, and industry players to develop more efficient, environmentally friendly RDF technology that aligns with the characteristics of waste in each region..

3.4 *Gender Equality and Social Inclusion* (GESI) in RDF Implementation

The development of RDF as part of the national waste management strategy also needs to consider the principles of gender equality and social inclusion (GESI). These principles are important to ensure that the benefits of the RDF program are felt equally by all levels of society, including vulnerable groups such as women, the poor, and informal communities. The GESI approach not only contributes to social justice but also strengthens the effectiveness and sustainability of the program through increased participation and a sense of ownership from various community groups.

In general, RDF as part of the waste management ecosystem has great potential to create a more inclusive space for participation, especially for women who are culturally more often involved in household waste management activities. There are also many female waste pickers. With a more participatory and gender-responsive approach, the involvement of women's groups and marginalized communities in the planning and implementation of RDF can strengthen the social and economic aspects of this program.

Furthermore, the role of women can be strengthened in various RDF value chains. At the front line, women can be empowered in waste sorting activities, which are a critical initial stage in ensuring the quality of RDF raw materials. Training and capacity-building programs can be designed specifically for women to improve their skills and access to more decent jobs at RDF TPST facilities.

Additionally, the involvement of informal groups such as waste pickers can be channeled into formal employment through a transition process supported by training, social protection, and institutional integration. Cooperative partnership schemes or village-owned enterprises (BUMDes) in RDF management, particularly at the regional level, can also serve as a means to strengthen the role of women and local communities. Their involvement not only enhances the social sustainability of RDF projects but also strengthens the economic value added that returns to the community.

04.

Monitoring, Evaluation, and Knowledge Management

4.1 Monitoring

Monitoring and evaluation of the implementation of the program for the development and expansion of WtE in Indonesia (RDF case study) for the period 2026-2045 will be carried out annually by all relevant ministries and agencies in accordance with their respective duties and authorities. Bappenas plays a role in monitoring the implementation of RDF in relation to the achievement of national waste management targets. The Ministry of Environment and Forestry is responsible for monitoring effluent, leachate, and emission standards at TPSTs. Meanwhile, the Ministry of Public Works is responsible for monitoring the provision of TPST infrastructure.

Integrated inter-sectoral monitoring meetings should be held regularly to discuss the progress of program implementation and activities within each ministry and agency, including agreeing on solutions and follow-up actions to address implementation challenges. Monitoring and evaluation of program implementation must be a collaborative effort involving all stakeholders, including government agencies, development partners, non-governmental organizations or civil society, and the private sector through relevant associations. Progress will be monitored using the indicators and achievements listed and summarized in Table 8 of Annex V.

4.2 Evaluation

Strategies for monitoring and evaluating the implementation progress of the WtE (RDF case) program in Indonesia from 2026 to 2045 are outlined as follows

- Regular reporting on the formulation of key national policies, financing plan, technical regulations, NSPK, incentive mechanisms, capacity-building systems, and research and development support by relevant ministries and agencies, delivered both in writing and during periodic monitoring meetings coordinated by Bappenas.
- Ongoing reports on the development, management, and utilization of RDF facilities, submitted by local governments to the relevant ministries through established systems such as SIINSAN and SIPSN.
- Joint field monitoring by ministries and agencies to provinces or cities with RDF facilities to assess on-site progress, identify implementation challenges, and provide direct feedback to local governments and RDF managers.
- Evaluation and performance assessments conducted in the context of incentive provision for local governments, RDF operators, and RDF-utilizing industries.

4.3 Knowledge Managemenet

Experiences and lessons learned from RDF implementation must be documented and managed as valuable references for all relevant stakeholders. Key success factors should serve as guidance in replicating enabling conditions, while barriers leading to failure must be identified to prevent repetition elsewhere. Both positive and negative experiences will generate new insights that enhance continuous learning and capacity development. Therefore, knowledge management is essential to:

- Capture and collect experiences and lessons learned (knowledge capturing)
- Document experiences and lessons learned using various media (knowledge documenting)

- Share and disseminate experiences and lessons learned to relevant stakeholders and actors (knowledge sharing and dissemination), either directly through horizontal learning or via platforms such as websites and social media.

This process is an integrated part of knowledge management. To ensure systematic and organized handling of experiences from RDF implementation, a dedicated institution is essential. The establishment of an RDF Center would serve this purpose, with the potential to lead knowledge management efforts.

Annex

Annex I – Waste Management for Priorities Location

Table 1 Priority Areas for Immediate Waste Management

No.	Regencies/Cities	Waste Generation (*ton per hari*)	DESCRIPTION
1	Kota Adm. Jakarta Timur	2.333	Included the priority areas listed in Presidential Regulation No. 35 of 2018
2	Kota Adm. Jakarta Barat	2.050	Included the priority areas listed in Presidential Regulation No. 35 of 2018
3	Kota Adm. Jakarta Selatan	1.971	Included the priority areas listed in Presidential Regulation No. 35 of 2018
4	Kota Surabaya	1.800	Included the priority areas listed in Presidential Regulation No. 35 of 2018
5	Kota Medan	1.769	Included the priority areas listed in Presidential Regulation No. 35 of 2018
6	Kota Bekasi	1.747	A total of 343 regional heads (306 plus 37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
7	Kota Bandung	1.610	A total of 343 regional heads (306 plus 37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
8	Kota Tangerang	1.410	A total of 343 regional heads (306 plus 37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
9	Kota Adm. Jakarta Utara	1.382	Included the priority areas listed in Presidential Regulation No. 35 of 2018
10	Kota Depok	1.352	A total of 343 regional heads (306 plus 37) received official letters regarding landfill (TPA) improvement.
11	Kota Palembang	1.241	A total of 343 regional heads (306 plus 37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
12	Kota Semarang	1.182	A total of 343 regional heads (306 plus 37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
13	Kota Makassar	1.032	Included the priority areas listed in Presidential Regulation No. 35 of 2018
14	Kota Adm. Jakarta Pusat	853	Included the priority areas listed in Presidential Regulation No. 35 of 2018
15	Kota Batam	1.159	A total of 343 regional heads (306 plus 37) received official letters regarding landfill (TPA) improvement

No.	Regencies/Cities	Waste Generation (*ton per hari*)	DESCRIPTION
16	Kota Tangerang Selatan	1.011	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
17	Kota Pekanbaru	1.011	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
18	Kota Denpasar	981	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
19	Kota Bandar Lampung	787	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
20	Kota Bogor	780	-
21	Kota Malang	778	-
22	Kota Padang	647	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
23	Kota Samarinda	600	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
24	Kota Balikpapan	529	-
25	Kota Banjarmasin dan sekitarnya	±1.000	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
26	Kota Jambi dan sekitarnya	±1.000	-
27	Kota Pontianak dan sekitarnya	±1.000	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
28	Kota Surakarta dan sekitarnya	±1.000	Included the priority areas listed in Presidential Regulation No. 35 of 2018
29	Kota Yogyakarta dan sekitarnya	±1.000	Disurati Ilegal Dumping
30	Kota Manado dan sekitarnya	±1.000	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement. Included the priority areas listed in Presidential Regulation No. 35 of 2018
31	Kabupaten Bogor	2.813.50	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
32	Kabupaten Tangerang	2.346.70	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.
33	Kabupaten Bekasi	2.219.00	A total of 343 regional heads (306 +37) received official letters regarding landfill (TPA) improvement.

Sumber:

1. *Kementerian Pekerjaan Umum, 2025*
2. *Surat Edaran (SE) SE.14/MENLHK/PSLB3/PLB.0/2/2025 tentang Instruksi dan Arahan terkait Penutupan Bertahap TPA Open Dumping*

Annex II – RDF Utilizing Industry Profile

No	Type of Industry	Profile of Industry	RDF Clasification & Spesification	Description
1	Cement Indsutry	16 cement companies with a total capacity of 120 million tons per year. Coal demand is around 8-11 million tons per year.	• RDF fluff, maximum size 50 mm • Minimum calorific value 3000 kcal/kg	TSR 5% of kiln heat requirement, with assumption 300 days of factory operation per year for direct use as a heat energy source.
2	Fertilizer Industry	-	• **Pulverized Type:** RDF in powder form **Circulating Fluidized Boiler Type**: RDF in pellet form • **Spesification**:Solid Fuel (BBJB)	A 5% substitution of coal consumption by the Indonesian Fertilizer Group, consisting of PT Pupuk Kaltim (34,299 tons), PT Petrokimia Gresik (12,000 tons), and PT Pupuk Sriwidjaja (35,522 tons), is planned using RDF as a co-firing material in boilers, assuming 300 operating days per year.
3	Pulp and Paper Industry	-	• **Circulating Fluidized Boiler Type**: RDF in pellet form • **Spesification**:Solid Fuel (BBJB)	• **Pulp Industry**: 5% of the plant's heat requirement is planned to be met through external biomass substitution, assuming 300 operation days per year. • **Paper Industry**: RDF is used to replace 5% of coal demand through co-firing in boilers, producing steam for turbine-driven electricity generation and supporting steam requirements in production processes, including paper machinery.
4	Iron and Steel Industry	-	• Hot gas generated through the RDF fluff combustion process (hot gas generator). • Specifications:	Assuming a heat substitution rate of 1% of industrial thermal energy requirements, equivalent to 230,000 GJ supplied by RDF.
5	Coal-Fired Power Plant Industry	It is publicly known that Indonesia operates 52 coal-fired power plants.	• **Pulverized Coal Boiler Type**: RDF Fluff **Circulating Fluidized Boiler Type**: Pellet Type **Stoke Boiler Type**: Bricket Type • **Spesifikasi: Solid Fuel (BBJB)**	
6	Chemical Industry		• **Circulating Fluidized Boiler Type**: RDF in pellet form • **Spesification**:Solid Fuel (BBJB)	

Annex III – RDF Potential Implementation

Table 2 Summary of RDF Implementation Potential at Each Phase

Phase	Number of Cities	Number of Province	Annual RDF Demand Potential	Annual Requirement of Demand RDF Addition	Number of Regional	Number of Non Regional	RDF Plant Requirement in Regency/City		RDF Plamt Requirement in Regional Areas with Capacity 300 tons per day	RDF Plant Total Built
							Capacity: 150 tons per day	Capacity: 300 ton per day		
2026-2030	**58**	**13**	1.593.883	1.593.883	**14**	**20**	**7**	**13**	**14**	**34**
2031-2035	**50**	**16**	2.072.636	478.753	**12**	**13**	**4**	**9**	**12**	**25**
accumulation	108				26	33	11	22	26	59
2036-2040	**24**	**10**	2.766.863	694.227	**6**	**7**	**3**	**4**	**6**	**13**
accumulation	132				32	20	14	26	32	72
2040-2045	**11**	**4**	**3.769.383**	1.002.519	**4**	**1**	**1**	**-**	**4**	**5**
accumulation	143				36	21	15	26	36	77
Total	**143**				**36**	**21**	**15**	**26**	**36**	**77**

Phase	RDF Production Annual in Regencies/Cities		RDF Plamt Requirement Annual in Regional Areas with Capacity 300 tons per day	Total Annual RDF Production	Annual Accumulation of RDF Production in every phase	Waste Generation in 2023 (tons per year)	% into generation	Offtaker		Target for Processed Waste (Material & Energy Recovery) Source: Bappenas	Total Estimated Waste Processing Based on Targets (tons per year)	Total Estimated Waste Processing into RDF (tons per year)	RDF's Contribution to National Waste Management through Material & Energy Recovery
	Capacity: 150 tons per day	Capacity: 300 tons per day						Offtaker Type	Number of Offtakers				
2026-2030	124.950	464.100	499.800	1.088.850	1.088.850	18.201.985	17,09	PLTU, Semen, Pulp dan Kertas, "Logam (Baja, Nikel)", Kimia, Pupuk	**43**	18%	13.176.000	3.111.000	23,61%
								6					
2031-2035	71.400	321.300	428.400	821.100	1.909.950	28.187.312	19,36	PLTU, Semen, Pulp dan Kertas, "Logam (Baja, Nikel)", Kimia, Pupuk	**24**	30%	22.452.719	5.457.000	24,30%
accumulation									67				
								6					
2036-2040	53.550	142.800	214.200	410.550	2.320.500	32.053.132	20,68	PLTU, Semen, Pulp dan Kertas, "Logam (Baja, Nikel)", Kimia, Pupuk	**7**	41%	32.366.375	6.630.000	20,48%
accumulation									74				
								6					
2040-2045	17.850	-	142.800	160.650	2.481.150	33.622.572	21,08	PLTU, Semen, Pulp dan Kertas, "Logam (Baja, Nikel)",	**6**	55%	45.100.000	7.089.000	15,72%

Phase	RDF Production Annual in Regencies/Cities		RDF Plamt Requirement Annual in Regional Areas with Capacity 300 tons per day	Total Annual RDF Production	Annual Accumulation of RDF Production in every phase	Waste Generation in 2023 (tons per year)	% into generation	Offtaker		Target for Processed Waste (Material & Energy Recovery) Source: Bappenas	Total Estimated Waste Processing Based on Targets (tons per year)	Total Estimated Waste Processing into RDF (tons per year)	RDF's Contribution to National Waste Management through Material & Energy Recovery
	Capacity: 150 tons per day	Capacity: 300 tons per day						Offtaker Type	Number of Offtakers				
								Kimia, Pupuk					
accumulation									80				
								6					
Total									**80**				

Table 3 Information of Potential RDF Implementation on Phase I (2026-2030)

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
1	Jawa Barat + DKJ	DKI Jakarta		Semen	PT Indocement Citeureup, PT SBI Narogong	3.141.650	852.330
		Kota Depok	ISWMP	Semen	PT Indocement Citeureup	538.947	435.038
		Kota Karawang		Pulp dan Kertas	PT Indah Kiat, PT Pindo Deli, PT Jui Shin	373.765	277.595
		Kota Bandung	ISWMP	Semen	PT Indocement Palimanan	503.627	419.219
		Kab Sukabumi	Sudah Berjalan	Semen, PLTU	PT Semen Jawa, PLTU Pelabuhan Ratu	1.974.000	1.445.165
		Kab. Indramayu	ISWMP	Semen	PT Indocement Palimanan, PLTU Indramayu	418.818	208.069
		REGIONAL					
		Kab. Cirebon	ISWMP	Semen	PT Indocement Palimanan	465.243	158.694
		Kota Cirebon	KFW			83.856	60.183
		REGIONAL					
		Kota Bogor		Semen	PT SBI Narogong, PT Indocement Citeureup	284.632	200.096
		Kab Bogor	KFW	Semen		1.026.931	287.335
		REGIONAL					
		Kab. Tasikmalaya	SWM-SUD	Semen	PT Indocement Palimanan	117.955	76.919

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
		Kab. Garut		Semen		409.465	89.960
Total		12		3	9	9.338.890	4.510.604
Accumulative Total		12		Semen, Pulp dan Kertas, PLTU	9		
Number of Regional		3					
2	Jawa Tengah	Kota Semarang		Semen	PT Semen Grobogan	431.535	310.748
		REGIONAL					
		Kab Rembang	SWM-SUD	Semen, PLTU	PLTU Rembang, PT SG Rembang	92.770	16.031
		Kab Jepara	SWM-SUD	Semen, PLTU	PLTU Tanjung Jati	154.572	62.509
		Kab Blora	Sudah MoU	Semen, PLTU	PLTU Rembang, PT SG Rembang	141.433	101.874
		REGIONAL					
		Kota Magelang	SWM-SUD	Semen	PT Semen Grobogan	49.154	30.642
		Kab Temanggung	SWM-SUD	Semen	PT Semen Grobogan	147.358	45.548
		Kab Magelang		Semen	PT Semen Grobogan	241.768	65.422
		Kab Cilacap	Sudah Berjalan	Semen, PLTU	PLTU Adipala, PT SBI Cilacap	348.407	226.952
		Kab Banyumas	Sudah Berjalan	Semen	PT Semen Bima	197.758	63.738

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
		Kota Surakarta		PLTU	PLTU Tanjung Jati	152.975	120.009
Total		10		3	7	1.957.729	1.043.473
Accumulative Total		10		Semen, PLTU	7		
Number of Regional		2					
3	DIY						

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
Total		0		0	0		
Accumulative Total		0					
Number of Regional		0					
4	Jawa Timur	Kab. Tuban	ISWMP	Semen, PLTU	PLTU TJ Awar Awar, PT Semen Indonesia Tuban, PT SBI Tuban	185.423	68.569
		REGIONAL					
		Kota Malang		Pulp dan Kertas	PT Tjiwi Kimia	284.095	203.014
		Kota Batu		Pulp dan Kertas		52.063	39.042
		Kab Malang		Pulp dan Kertas		352.927	149.676
		REGIONAL					
		Kota Kediri		Pulp dan Kertas	PT Tjiwi Kimia	241.779	191.779
		Kab. Nganjuk		Pulp dan Kertas		163.088	129.361
		Kab. Tulungagung		Pulp dan Kertas		204.029	161.836
		Kab Banyuwangi	SWM-SUD	Semen	PT SBI Tuban	305.313	82.892

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
Total		**8**		**3**	**4**	**1.788.717**	**1.026.171**
Accumulative Total		**8**		**Semen, PLTU, Pulp dan Kertas**	**4**		
Number of Regional		**2**					
5	**Banten**	Kota Tangerang Selatan		PLTU	PLTU Lontar Extension	369.178	265.217
		Kota Cilegon	ISWMP	"Logam (Baja, Nikel)", Kimia, PLTU	PLTU Suralaya 1, 7, 8,PT Krakatau Posco, PT Krakatau Steel Tbk, Meratus Jaya Iron, PT Asahimas Chemical	101.773	86.140
		REGIONAL					
		Kab. Serang		Kimia	PT Chandra Asri Chemical	428.963	31.443
		Kota Serang		PLTU	PLTU Lontar	219.503	128.782

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
		REGIONAL					
		Kab. Lebak	LSDP	Semen	PT Cemindo Gemilang, PLTU Labuan Pandeglang	218.267	43.435
		Kab. Pandeglang		PLTU	PT Cemindo Gemilang, PLTU Labuan Pandeglang	185.812	64.198
Total		**6**		**4**	**10**	**1.523.495**	**619.216**
Accumulative Total		**6**		**PLTU, Logam (Baja, Nikel), Kimia, Semen**	**10**		
Number of Regional		**2**					
6	**Bali**	**Kota Denpasar**	ISWMP	PLTU	PLTU Celukan Bawang	**357.985**	**286.567**
		Kab. Gianyar	ISWMP	PLTU	PLTU Celukan Bawang	**196.699**	**169.731**
Total		**2**		**1**	**1**	**554.683**	**456.298**
Accumulative Total		**2**		**PLTU**	**1**		
Number of Regional		**0**					
7	**NAD**	**REGIONAL**			PT Solusi Bangun Andalas		
		Kota Banda Aceh		Semen		**93.371**	**58.207**
		Reg. Aceh	SWM-SUD	Semen		**26.841**	**16.732**
Total		**2**		**1**	**1**	**120.211**	**74.940**
Accumulative Total		**2**		**Semen**	**1**		

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
Number of Regional		**1**					
8	**Sumatera Utara**	**REGIONAL**					
		Kab. Toba	LSDP	Pulp dan Kertas	Toba Pulp Lestari Tbk.	40.522	25.261
		Kab Samosir		Pulp dan Kertas		98.776	61.577
		Kab. Humbang Hasudutan		Pulp dan Kertas		22.416	13.974
		Kab. Simalungun		Pulp dan Kertas		186.445	116.230
		Kota Pematang Siantar		Pulp dan Kertas		57.665	35.948
		Kab. Tapanuli Utara		Pulp dan Kertas		71.441	44.536
Total		**6**		**1**	**1**	**477.265**	**297.527**
Accumulative Total		**6**		**Pulp dan Kertas**	**1**		
Number of Regional		**1**					
9	**Sumatera Barat**	**Kota Padang**	ISWMP	Semen	PT Semen Padang	**236.297**	**174.482**
		Kota Bukittinggi		PLTU	PLTU Ombilin	**47.238**	**38.371**

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
Total		2		2	2	283.535	212.853
Accumulative Total		2		Semen, PLTU	2		
Number of Regional		0					
10	Riau	Kota Pekanbaru		Pulp dan Kertas	PT Indah Kiat Perawang (Sinarmas)	369.020	257.207
Total		1		1	1	369.020	257.207
Accumulative Total		1		pulp dan kertas	1		
Number of Regional		0					
11	Kepulauan Riau						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
12	Jambi						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
13	Sumatera Selatan	Kota Palembang		Pulp dan Kertas, Pupuk	PT Oki Pulp and Paper, PT Pupuk Sriwidjaja	466.205	352.125

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
Total		**1**		**2**	**2**	**466.205**	**352.125**
Accumulative Total		**1**		**Pulp dan Kertas, Pupuk**	**2**		
Number of Regional		**0**					
14	**Lampung**	**REGIONAL**					
		Kota Bandar Lampung		PLTU	PLTU Tarahan, PLTU Sebalang	**287.058**	**266.447**
		Kab Lampung Selatan		PLTU	PLTU Tarahan, PLTU Sebalang	**442.000**	**176.800**
		Kab. Pesawaran		PLTU	PLTU Tarahan, PLTU Sebalang	**70.908**	**19.712**
Total		**3**		**1**	**2**	**799.966**	**462.960**
Accumulative Total		**3**		**PLTU**	**2**		
Number of Regional		**1**					
15	**Bangka Belitung**						
Total		**0**			**0**		
Accumulative Total		**0**					
Number of Regional		**0**					

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
16	Kalimantan Barat						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
17	Kalimantan Timur						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
18	Kalimantan Selatan						

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
19	Sulawesi Utara	REGIONAL			PT Conch Cement Indonesia		
		Kota Manado		Semen		106.288	89.792
		Kab Minahasa Utara		Semen		43.976	17.591
Total		2	0	1	1	150.264	107.383
Accumulative Total		2		Semen	1		
Number of Regional		1					
20	Sulawesi Tengah						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
21	Sulawesi Tenggara						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
22	Sulawesi Selatan	REGIONAL			Semen Bosowa Maros		

No	Province	PHASE 1: 2026-2030					
		Number of Cities in 2026-2030	National Program	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (ton/tahun)	Waste Treatment in 2023 (ton/tahun)
		Kota Makassar	Perpres 35/2018	Semen		313.872	94.162
		Kab. Maros				33.051	9.915
		Kab. Luwu Timur		"Logam (Baja, Nikel)"	PT Vale Indonesia	25.082	7.525
Total		3		2	2	372.005	111.602
Accumulative Total		3		Semen, Logam (Baja, Nikel)	2		
Number of Regional		1					
23	Nusa Tenggara Barat						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
24	Nusa Tenggara Timur						
Total		0			0		
Accumulative Total		0					
Number of Regional		0					
TOTAL		58			43	18.201.985	9.532.357
AGGREGATE OF REGENCIES/CITIES		58			43		

Table 4 Information of Potential RDF Implementation on Phase II (2031-2035)

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	**Offtaker Type**	**Offtaker Name**	**Waste Generatiion in 2023 (tons per year)**	**Waste Treatment in 2023 (tons per year)**
1	Jawa Barat + DKJ	DKI JAKARTA	Semen	PT Indocement Citeureup, PT SBI Narogong	3.141.650	852.330
		Kota Depok	Semen	PT Indocement Citeureup	538.947	435.038
		Kota Karawang	Pulp dan Kertas	PT Indah Kiat, PT Pindo Deli, PT Jui Shin	373.765	277.595
		Kota Bandung	Semen	PT Indocement Palimanan	503.627	419.219
		Kab Sukabumi	Semen, PLTU	PT Semen Jawa, PLTU Pelabuhan Ratu	1.974.000	1.445.165
		Kab. Indramayu	Semen	PT Indocement Palimanan, PLTU Indramayu	418.818	208.069
		REGIONAL				
		Kab. Cirebon	Semen	PT Indocement Palimanan	465.243	158.694
		Kota Cirebon			83.856	60.183
		REGIONAL				
		Kota Bogor	Semen	PT SBI Narogong, PT Indocement Citeureup	284.632	200.096
		Kab Bogor	Semen		1.026.931	287.335
		REGIONAL				
		Kab. Tasikmalaya	Semen	PT Indocement Palimanan	117.955	76.919
		Kab. Garut	Semen		409.465	89.960
		REGIONAL				

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab Bekasi	Pulp dan Kertas	PT Pindo Deli, PT Jui Shin, PT Gunung Raja Paksi, PT. Toyogiri Iron Steel	84.026	62.406
		Kota Bekasi	Pulp dan Kertas		503.627	419.219
		REGIONAL		PT Indocement Palimanan		
		Kab Bandung Barat	Semen		271.100	58.178
		Kab Bandung	Semen		475.059	163.373
Total		4	3	2	10.672.702	5.213.780
Accumulative Total		16	Semen, PLTU, Pulp dan Kertas	11	20.011.591	9.724.384
Number of Regional		5				
2	Jawa Tengah	Kota Semarang	Semen	PT Semen Grobogan	431.535	310.748
		REGIONAL				
		Kab Rembang	Semen, PLTU	PLTU Rembang, PT SG Rembang	92.770	16.031
		Kab Jepara	Semen, PLTU	PLTU Tanjung Jati	154.572	62.509
		Kab Blora	Semen, PLTU	PLTU Rembang, PT SG Rembang	141.433	101.874
		REGIONAL				
		Kota Magelang	Semen	PT Semen Grobogan	49.154	30.642
		Kab Temanggung	Semen	PT Semen Grobogan	147.358	45.548
		Kab Magelang	Semen	PT Semen Grobogan	241.768	65.422
		Kab Cilacap	Semen, PLTU	PLTU Adipala, PT SBI Cilacap	348.407	226.952
		Kab Banyumas	Semen	PT Semen Bima	197.758	63.738
		Kota Surakarta	PLTU	PLTU Tanjung Jati	152.975	120.009

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		REGIONAL				
		Kab Semarang	Semen	PT Semen Grobogan	267.885	28.235
		Kab Grobogan	Semen		366.938	61.352
		Purwodadi	Semen		220.494	113.885
		REGIONAL				
		Kota Tegal	Semen	PT Indocement Palimanan	68.301	50.720
		Kab Tegal	Semen		220.494	113.885
		Kab. Brebes	Semen		366.938	61.352
Total		9		1	3.468.776	1.472.902
Accumulative Total		16		8		
Number of Regional		4				
3	DIY	REGIONAL				
		Kab. Sleman			219.654	71.541
		Kab. Bantul			162.114	71.411
		Kota Yogyakarta			109.704	66.590

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Total		**3**			**491.472**	**209.543**
Accumulative Total		**3**				
Number of Regional		**1**				
4	**Jawa Timur**	Kab. Tuban	Semen, PLTU	PLTU TJ Awar Awar, PT Semen Indonesia Tuban, PT SBI Tuban	185.423	68.569
		REGIONAL				
		Kota Malang	Pulp dan Kertas	PT Tjiwi Kimia	284.095	203.014
		Kota Batu	Pulp dan Kertas		52.063	39.042
		Kab Malang	Pulp dan Kertas		352.927	149.676
		REGIONAL				
		Kota Kediri	Pulp dan Kertas	PT Tjiwi Kimia	241.779	191.779
		Kab. Nganjuk	Pulp dan Kertas		163.088	129.361
		Kab. Tulungagung	Pulp dan Kertas		204.029	161.836
		Kab Banyuwangi	Semen	PT SBI Tuban	305.313	82.892
		REGIONAL				
		Kota Pasuruan	PLTU	**PLTU Indonesia Power**	**53.830**	**38.795**
		Kab Pasuruan	PLTU		**653.608**	**261.443**
		Kab. Gresik	Pupuk, Semen	PT Petrokimia Gresik, PT Semen Indonesia Tuban, PT SBI Tuban, PT Gunawan Gunandjaya Steel	**185.423**	**68.569**
		Kota Surabaya	Pupuk, Semen		**657.017**	**613.325**

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Total		**4**	**4**	**3**	**3.338.595**	**2.008.304**
Accumulative Total		**12**	**Semen, PLTU, Pulp dan Kertas, Pupuk**	**7**		
Number of Regional		**3**				
5	**Banten**	Kota Tangerang Selatan	PLTU	PLTU Lontar Extension	514.478	386.527
		Kota Cilegon	"Logam (Baja, Nikel)", Kimia, PLTU	PLTU Suralaya 1, 7, 8,PT Krakatau Posco, PT Krakatau Steel Tbk, Meratus Jaya Iron, PT Asahimas Chemical	101.773	86.140
		REGIONAL				

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab. Serang	Kimia	PT Chandra Asri Chemical	428.963	31.443
		Kota Serang	PLTU	PLTU Lontar	219.503	128.782
		REGIONAL				
		Kab. Lebak	Semen	PT Cemindo Gemilang, PLTU Labuan Pandeglang	218.267	43.435
		Kab. Pandeglang	PLTU	PT Cemindo Gemilang, PLTU Labuan Pandeglang	185.812	64.198
		Kota Tangerang	PLTU	PLTU Lontar Extension	**514.478**	**386.527**
		Kab Tangerang	PLTU	PLTU Lontar Extension	**875.158**	**518.531**
Total		**2**	**4**	**0**	**3.058.431**	**1.645.585**
Accumulative Total		**8**	**PLTU, Logam (Baja, Nikel), Kimia, Semen**	**10**		
Number of Regional		**2**				
6	**Bali**	Kota Denpasar	PLTU	PLTU Celukan Bawang	357.985	286.567
		Kab. Gianyar	PLTU	PLTU Celukan Bawang	196.699	169.731
Total		**0**	**1**	**0**	**554.683**	**456.298**
Accumulative Total		**2**	**PLTU**	**1**		
Number of Regional		**0**				
7	**NAD**	REGIONAL		PT Solusi Bangun Andalas		

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Banda Aceh	Semen		93.371	58.207
		Reg. Aceh	Semen		26.841	16.732
Total		**0**	**1**	**0**	**120.211**	**74.940**
Accumulative Total		**2**		**1**		
Number of Regional		**1**				
8	**Sumatera Utara**	REGIONAL				
		Kab. Toba	Pulp dan Kertas	Toba Pulp Lestari Tbk.	40.522	25.261
		Kab Samosir	Pulp dan Kertas		98.776	61.577
		Kab. Humbang Hasudutan	Pulp dan Kertas		22.416	13.974
		Kab. Simalungun	Pulp dan Kertas		186.445	116.230
		Kota Pematang Siantar	Pulp dan Kertas		57.665	35.948
		Kab. Tapanuli Utara	Pulp dan Kertas		71.441	44.536
		Kota Medan	PLTU, "Logam (Baja, Nikel)"	PLTU Langkat, PT Growth Sumatra Industry, PT Gunung Gahapi Sakti	**645.661**	**402.505**
		Kab. Deli Serdang			**411.211**	**164.484**
		Kab. Serdang Begadai			**273.167**	**109.267**
Total		**3**	**3**	**3**	**1.807.305**	**973.784**
Accumulative Total		**9**	**Pulp dan Kertas, PLTU, Logam (Baja, Nikel)**	**4**		
Number of Regional		**1**				
9	**Sumatera Barat**	Kota Padang	Semen	PT Semen Padang	**236.297**	174.482

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Bukittinggi	PLTU	PLTU Ombilin	47.238	38.371
		REGIONAL				
		Kab. Padang Pariaman	PLTU	PLTU Teluk Sirih	79.594	5.062
		Kota Pariaman	PLTU	PLTU Ombilin	14.525	10.512
		Kab Tanah Datar	PLTU	PLTU Ombilin	47.383	18.953
Total		3	2	1	425.037	247.380
Accumulative Total		5	Semen, PLTU	3		
Number of Regional		1				
10	Riau	Kota Pekanbaru	Pulp dan Kertas	PT Indah Kiat Perawang (Sinarmas)	369.020	257.207
		Kab. Siak	Pulp dan Kertas	PT Riau Andalan Pulp & Paper	69.722	27.889
		Kab Pelalawan	Pulp dan Kertas		163.417	65.367
Total		2	1	1	602.160	350.463
Accumulative Total		3	pulp dan kertas	2		
Number of Regional		0				
11	Kepulauan Riau					
Total		0		0		
Accumulative Total						
Number of Regional						
12	Jambi					
Total		0		0		
Accumulative Total						
Number of Regional						

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
13	Sumatera Selatan	Kota Palembang	Pulp dan Kertas, Pupuk	PT Oki Pulp and Paper, PT Pupuk Sriwidjaja	466.205	352.125
		REGIONAL				
		Kab Ogan Komering Ulu Selatan	PLTU	PLTU Bukit Asam	171.814	64.430
		Kab Ogan Komering Ulu Timur	PLTU	PLTU Bukit Asam	102.610	46.534
		Kab Ogan Komering Ulu	Semen	PT Semen Baturaja	55.479	20.805
Total		3	4	2	329.903	131.769
Accumulative Total		4	Pulp dan Kertas, Pupuk, PLTU, Semen	4		
Number of Regional		1				
14	Lampung	REGIONAL				
		Kota Bandar Lampung	PLTU	PLTU Tarahan, PLTU Sebalang	287.058	266.447
		Kab Lampung Selatan	PLTU	PLTU Tarahan, PLTU Sebalang	442.000	176.800
		Kab. Pesawaran	PLTU	PLTU Tarahan, PLTU Sebalang	70.908	19.712
Total		0	1	0	799.966	462.960
Accumulative Total		3	PLTU	2		

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Number of Regional		1				
15	Bangka Belitung	Kota Pangkal Pinang	PLTU	PLTU Air Anyir	90.934	47.031
		Kab. Bangka			49.791	25.752
Total		2	1	1	140.725	72.783
Accumulative Total		2	PLTU	1		
Number of Regional		0				
16	Kalimantan Barat					
Total		0		0		
Accumulative Total				0		
Number of Regional						
17	Kalimantan Timur	Kota Samarinda	PLTU	PLTU Embalut	218.800	174.559
		Kota Balikpapan		PLTU Balikpapan	193.038	139.875
		REGIONAL		PT Kobexindo Cement		
		Kab Kutai Timur	Semen		77.706	41.720
		Kab. Kutai Kartanegara			117.121	78.940
Total		4	2	3	606.665	435.094
Accumulative Total		4	PLTU, Semen	3		
Number of Regional		1				
18	Kalimantan Selatan	REGIONAL		PLTU Asam-Asam		
		Kota Banjarmasin	PLTU		170.275	123.194

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Banjarbaru			67.854	49.995
		Kab Banjar			132.335	66.168
Total		3	1	1	370.464	239.356
Accumulative Total		3	PLTU	1		
Number of Regional		1				
19	Sulawesi Utara	REGIONAL		PT Conch Cement Indonesia		
		Kota Manado	Semen		106.288	89.792
		Kab Minahasa Utara	Semen		43.976	17.591
		REGIONAL				
		Kab. Minahasa	Semen	PT Conch Cement Indonesia	126.368	50.547
		Kota Tomohon	Semen		41.228	16.491
Total		2	1	0	317.860	107.383
Accumulative Total		4	Semen	1		

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Number of Regional		2				
20	Sulawesi Tengah					
Total		0				
Accumulative Total						
Number of Regional						
21	Sulawesi Tenggara					
Total		0				
Accumulative Total						
Number of Regional						
22	Sulawesi Selatan	REGIONAL		Semen Bosowa Maros		
		Kota Makassar	Semen		313.872	94.162
		Kab. Maros			33.051	9.915
		Kab. Luwu Timur	"Logam (Baja, Nikel)"	PT Vale Indonesia	25.082	7.525
		Kab. Gowa			146.000	80.300
		REGIONAL		PT Semen Tonasa, PLTU Barru		
		Kabupaten Pangkajene dan Kepulauan	Semen, PLTU		142.244	56.898
		Kab Barru			28.403	13.625
Total		3	3	2	688.652	262.424
Accumulative Total		6	Semen, Logam (Baja, Nikel), PLTU	4		
Number of Regional		2				
23	Nusa Tenggara Barat	Kota Mataram	PLTU	PLTU Jeranjang	99.166	75.336
Total		1	1	1	99.166	75.336

No	Province	PHASE 2: 2031-2035				
		Number of Cities in 2031-2035	Offtaker Type	Offtaker Name	Waste Generatiion in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Accumulative Total		0	PLTU	1		
Number of Regional		0				
24	Nusa Tenggara Timur	Kota Kupang	PLTU, Semen	PLTU Bolok, PT Semen Kupang	6.422	4.561
		Kab Ende	PLTU	PLTU ROPA	288.116	174.022
Total		2	2	3	294.538	178.583
Accumulative Total		2	pltu, semen	3		
Number of Regional		0				
TOTAL		50		24	28.187.312	14.618.666
AGGREGATE OF REGENCIES/CITIES		108		67		

Tabel 5 Information of Potential RDF Implementation on Phase III (2036-2040)

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	**Offtaker Type**	**Offtaker Name**	**Waste Generation in 2023 (tons per year)**	**Waste Treatment in 2023 (tons per year)**
1	**Jawa Barat + DKJ**	DKI JAKARTA	Semen	PT Indocement Citeureup, PT SBI Narogong	3.141.650	852.330
		Kota Depok	Semen	PT Indocement Citeureup	538.947	435.038
		Kota Karawang	Pulp dan Kertas	PT Indah Kiat, PT Pindo Deli, PT Jui Shin	373.765	277.595
		Kota Bandung	Semen	PT Indocement Palimanan	503.627	419.219
		Kab Sukabumi	Semen, PLTU	PT Semen Jawa, PLTU Pelabuhan Ratu	1.974.000	1.445.165
		Kab. Indramayu	Semen	PT Indocement Palimanan, PLTU Indramayu	418.818	208.069
		REGIONAL				
		Kab. Cirebon	Semen	PT Indocement Palimanan	465.243	158.694
		Kota Cirebon			83.856	60.183
		REGIONAL				
		Kota Bogor	Semen	PT SBI Narogong, PT Indocement Citeureup	284.632	200.096
		Kab Bogor	Semen		1.026.931	287.335
		REGIONAL				
		Kab. Tasikmalaya	Semen	PT Indocement Palimanan	117.955	76.919
		Kab. Garut	Semen		409.465	89.960

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		REGIONAL		PT Pindo Deli, PT Jui Shin, PT Gunung Raja Paksi, PT. Toyogiri Iron Steel		
		Kab Bekasi	Pulp dan Kertas		84.026	62.406
		Kota Bekasi	Pulp dan Kertas		503.627	419.219
		REGIONAL		PT Indocement Palimanan		
		Kab Bandung Barat	Semen		271.100	58.178
		Kab Bandung			475.059	163.373
		Kab Sumedang	Semen	**PT Indocement Palimanan**	**174.806**	**52.739**
		Kab Majalengka			**342.528**	**113.205**
Total		**2**	**3**	**0**	**10.847.508**	**5.266.519**
Accumulative Total		**18**	**Semen, PLTU, Pulp dan Kertas**	**11**		
Number of Regional		**5**				
2	**Jawa Tengah**	Kota Semarang	Semen	PT Semen Grobogan	431.535	310.748
		REGIONAL				
		Kab Rembang	Semen, PLTU	PLTU Rembang, PT SG Rembang	92.770	16.031
		Kab Jepara	Semen, PLTU	PLTU Tanjung Jati	154.572	62.509
		Kab Blora	Semen, PLTU	PLTU Rembang, PT SG Rembang	141.433	101.874
		REGIONAL				
		Kota Magelang	Semen	PT Semen Grobogan	49.154	30.642
		Kab Temanggung	Semen		147.358	45.548
		Kab Magelang	Semen		241.768	65.422
		Kab Cilacap	Semen, PLTU	PLTU Adipala, PT SBI Cilacap	348.407	226.952

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab Banyumas	Semen	PT Semen Bima	197.758	63.738
		Kota Surakarta	PLTU	PLTU Tanjung Jati	152.975	120.009
		REGIONAL			108.374	**32.079**
		Kab Semarang	Semen	PT Semen Grobogan	267.885	**28.235**
		Kab Grobogan	Semen		366.938	**61.352**
		Purwodadi	Semen		220.494	**113.885**
		REGIONAL				
		Kota Tegal	Semen	PT Indocement Palimanan	68.301	50.720
		Kab Tegal	Semen		220.494	113.885
		Kab. Brebes	Semen		366.938	61.352
		REGIONAL				
		Kab Kebumen	Semen	PT SBI Cilacap	**176.364**	**64.426**
		Kab Purworejo	Semen		**117.433**	**30.720**
		REGIONAL				
		Kab Kudus	Semen	PT SG Rembang	**159.061**	**58.105**
		Kab Pati	Semen		**251.093**	**156.531**
		Kab Demak	Semen		**267.885**	**82.803**
Total		**5**	**2**	**0**	**4.548.985**	**1.897.566**
Accumulative Total		**21**	**Semen, PLTU**	**8**		
Number of Regional		**2**				
3	**DIY**	REGIONAL				
		Kab. Sleman			219.654	71.541

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab. Bantul			162.114	71.411
		Kota Yogyakarta			109.704	66.590
Total		**0**			**491.472**	**209.543**
Accumulative Total		**3**				
Number of Regional		**1**				
4	**Jawa Timur**	Kab. Tuban	Semen, PLTU	PLTU TJ Awar Awar, PT Semen Indonesia Tuban, PT SBI Tuban	185.423	68.569
		REGIONAL				
		Kota Malang	Pulp dan Kertas	PT Tjiwi Kimia	284.095	203.014
		Kota Batu	Pulp dan Kertas		52.063	39.042
		Kab Malang	Pulp dan Kertas		352.927	149.676
		REGIONAL				
		Kota Kediri	Pulp dan Kertas	PT Tjiwi Kimia	241.779	191.779
		Kab. Nganjuk	Pulp dan Kertas		163.088	129.361
		Kab. Tulungagung	Pulp dan Kertas		204.029	161.836
		Kab Banyuwangi	Semen	PT SBI Tuban	305.313	82.892
		REGIONAL				
		Kota Pasuruan	PLTU	**PLTU Indonesia Power**	53.830	38.795
		Kab Pasuruan	PLTU		653.608	261.443
		Kab. Gresik	Pupuk, Semen	PT Petrokimia Gresik, PT Semen Indonesia Tuban, PT SBI Tuban, PT Gunawan Gunandjaya Steel	185.423	68.569
		Kota Surabaya	Pupuk, Semen		657.017	613.325
		REGIONAL				

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab. Jombang	Pupuk		193.583	55.926
		Kab. Mojokerto	Pulp dan Kertas, Pupuk	PT Tjiwikimia Tbk	172.984	39.700
		REGIONAL	PLTU	PLTU Pacitan		
		Kab Magetan			100.725	19.208
		Kab Ngawi			135.298	32.539
		Kab Pacitan			105.346	14.032
		Kota Blitar			27.988	22.970
		Kab Madiun			109.148	20.618
Total		7	4	1	4.183.667	2.213.298
Accumulative Total		19	Semen, PLTU, Pulp dan Kertas, Pupuk	8		
Number of Regional		5				
5	Banten	Kota Tangerang Selatan	PLTU	PLTU Lontar Extension	514.478	386.527

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Cilegon	"Logam (Baja, Nikel)", Kimia, PLTU	PLTU Suralaya 1, 7, 8,PT Krakatau Posco, PT Krakatau Steel Tbk, Meratus Jaya Iron, PT Asahimas Chemical	101.773	86.140
		REGIONAL				
		Kab. Serang	Kimia	PT Chandra Asri Chemical	428.963	31.443
		Kota Serang	PLTU	PLTU Lontar	219.503	128.782
		REGIONAL				
		Kab. Lebak	Semen	PT Cemindo Gemilang, PLTU Labuan Pandeglang	218.267	43.435
		Kab. Pandeglang	PLTU	PT Cemindo Gemilang, PLTU Labuan Pandeglang	185.812	64.198
		Kota Tangerang	PLTU	PLTU Lontar Extension	514.478	386.527
		Kab Tangerang	PLTU	PLTU Lontar Extension	875.158	518.531
Total		**0**	**4**	**0**	**3.058.431**	**1.645.585**
Accumulative Total		**8**	**PLTU, Logam (Baja, Nikel), Kimia, Semen**	**10**		
Number of Regional		**2**				
6	**Bali**	Kota Denpasar	PLTU	PLTU Celukan Bawang	357.985	286.567

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab. Gianyar	PLTU	PLTU Celukan Bawang	196.699	169.731
Total		**0**	**1**	**0**	**554.683**	**456.298**
Accumulative Total		**2**	**PLTU**	**1**		
Number of Regional		**0**				
7	**NAD**	REGIONAL		PT Solusi Bangun Andalas		
		Kota Banda Aceh	Semen		93.371	58.207
		Reg. Aceh	Semen		26.841	16.732
Total		**0**	**1**	**0**	**120.211**	**74.940**
Accumulative Total		**2**	**Semen**	**1**		
Number of Regional		**1**				
8	**Sumatera Utara**	REGIONAL				
		Kab. Toba	Pulp dan Kertas	Toba Pulp Lestari Tbk.	40.522	25.261
		Kab Samosir	Pulp dan Kertas		98.776	61.577
		Kab. Humbang Hasudutan	Pulp dan Kertas		22.416	13.974
		Kab. Simalungun	Pulp dan Kertas		186.445	116.230
		Kota Pematang Siantar	Pulp dan Kertas		57.665	35.948
		Kab. Tapanuli Utara	Pulp dan Kertas		71.441	44.536
		Kota Medan	PLTU, "Logam (Baja, Nikel)"	PLTU Langkat, PT Growth Sumatra Industry, PT Gunung Gahapi Sakti	645.661	402.505
		Kab. Deli Serdang			411.211	164.484
		Kab. Serdang Begadai			273.167	109.267

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Total		**0**	**3**	**0**	**1.807.305**	**973.784**
Accumulative Total		**9**	**Pulp dan Kertas, PLTU, Logam (Baja, Nikel)**	**4**		
Number of Regional		**1**				
9	**Sumatera Barat**	Kota Padang	Semen	PT Semen Padang	236.297	174.482
		Kota Bukittinggi	PLTU	PLTU Ombilin	47.238	38.371
		REGIONAL				
		Kab. Padang Pariaman	PLTU	PLTU Teluk Sirih	**79.594**	5.062
		Kota Pariaman	PLTU	PLTU Ombilin	**14.525**	10.512
		Kab Tanah Datar	PLTU	PLTU Ombilin	47.383	18.953
Total		**0**	**2**	**0**	**425.037**	**247.380**
Accumulative Total		**5**	**Semen, PLTU**	**3**		
Number of Regional		**1**				
10	**Riau**	Kota Pekanbaru	Pulp dan Kertas	PT Indah Kiat Perawang (Sinarmas)	369.020	257.207
		Kab. Siak	Pulp dan Kertas	PT Riau Andalan Pulp & Paper	69.722	27.889
		Kab Pelalawan	Pulp dan Kertas		163.417	65.367
Total		**0**	**1**	**0**	**602.160**	**350.463**
Accumulative Total		**3**	**pulp dan kertas**	**2**		
Number of Regional		**0**				
11	**Kepulauan Riau**	**Kota Batam**	PLTU	PLTU Tanjung Kasam	**423.054**	**327.909**
Total		**1**	**1**	**1**	**423.054**	**327.909**
Accumulative Total		**1**	**pltu**	**1**		

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Number of Regional						
12	**Jambi**	**Kota Jambi**	PLTU	PLTU Selincah	**161.898**	**119.724**
Total		**1**	**1**	**1**	**161.898**	**119.724**
Accumulative Total		**1**	**3**	**1**		
Number of Regional						
13	**Sumatera Selatan**	Kota Palembang	Pulp dan Kertas, Pupuk	PT Oki Pulp and Paper, PT Pupuk Sriwidjaja	**466.205**	352.125
		REGIONAL				
		Kab Ogan Komering Ulu Selatan	PLTU	PLTU Bukit Asam	171.814	64.430
		Kab Ogan Komering Ulu Timur	PLTU	PLTU Bukit Asam	102.610	46.534
		Kab Ogan Komering Ulu	Semen	PT Semen Baturaja	55.479	20.805
Total		**0**	**4**	**0**	**796.108**	**483.893**
Accumulative Total		**4**	**Pulp dan Kertas, Pupuk, PLTU, Semen**	**4**		
Number of Regional		**1**				
14	**Lampung**	REGIONAL				
		Kota Bandar Lampung	PLTU		287.058	266.447
		Kab Lampung Selatan		PLTU Tarahan, PLTU Sebalang	442.000	176.800

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab. Pesawaran		PLTU Tarahan, PLTU Sebalang	70.908	19.712
		Kab Lampung Tengah		PLTU Lampung Tengah	**251.851**	**52.712**
Total		**1**	**1**	**1**	**1.051.817**	**515.672**
Accumulative Total		**4**	**PLTU**	**3**		
Number of Regional		**1**				
15	**Bangka Belitung**	Kota Pangkal Pinang	PLTU	PLTU Air Anyir	90.934	47.031
		Kab. Bangka			49.791	25.752
Total		**0**	**1**	**0**	**140.725**	**72.783**
Accumulative Total		**2**	**PLTU**	**1**		
Number of Regional		**0**				
16	**Kalimantan Barat**	**Kota Pontianak**	PLTU	**PLTU 1 Kalbar**	**161.287**	**161.238**
Total		**1**	**1**	**1**	**161.287**	**161.238**
Accumulative Total		**1**	**PLTU**	**1**		
Number of Regional		**0**				
17	**Kalimantan Timur**	Kota Samarinda	PLTU	PLTU Embalut	**218.800**	174.559
		Kota Balikpapan		PLTU Balikpapan	**193.038**	139.875
		REGIONAL				
		Kab Kutai Timur	Semen	PT Kobexindo Cement	**77.706**	41.720
		Kab. Kutai Kartanegara			**117.121**	78.940
Total		**0**	**2**	**0**	**606.665**	**435.094**

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Accumulative Total		**4**	**PLTU, Semen**	**3**		
Number of Regional		**1**				
18	**Kalimantan Selatan**	REGIONAL		PLTU Asam-Asam		
		Kota Banjarmasin	PLTU		170.275	123.194
		Kota Banjarbaru			67.854	49.995
		Kab Banjar			132.335	66.168
		REGIONAL		PT Conch Semen (Tabalong)		
		Kab. Tabalong	Semen		**42.927**	**35.913**
		Kab Balangan			**21.178**	**8.471**
		Kab. Hulu Sungai Utara			**33.905**	**18.634**
Total		**3**	**2**	**1**	**468.475**	**302.375**
Accumulative Total		**6**	**PLTU, Semen**	**2**		
Number of Regional		**2**				
19	**Sulawesi Utara**	REGIONAL	Semen	PT Conch Cement Indonesia		
		Kota Manado			106.288	89.792
		Kab Minahasa Utara			43.976	17.591
		REGIONAL				
		Kab. Minahasa			126.368	50.547
		Kota Tomohon			41.228	16.491
		REGIONAL				

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab Bolaang Mongondow			63.923	10.119
		Kota Kotamobagu			51.084	20.434
Total		2	1	0	432.867	107.383
Accumulative Total		6	Semen	1		
Number of Regional		3				
20	Sulawesi Tengah					
Total		0				
Accumulative Total		0				
Number of Regional		0				
21	Sulawesi Tenggara	Kota Kendari	PLTU	PLTU Kendari 3	88.421	73.646
Total		1	1	1	88.421	73.646
Accumulative Total		1	1	1		
Number of Regional		0				
22	Sulawesi Selatan	REGIONAL		Semen Bosowa Maros		
		Kota Makassar	Semen		313.872	94.162
		Kab. Maros			33.051	9.915
		Kab. Luwu Timur	"Logam (Baja, Nikel)"	PT Vale Indonesia	25.082	7.525
		Kab. Gowa			146.000	80.300
		REGIONAL		PT Semen Tonasa, PLTU Barru		
		Kabupaten Pangkajene dan Kepulauan	Semen, PLTU		142.244	56.898
		Kab Barru			28.403	13.625
Total		0	3	0	688.652	262.424

No	Province	PHASE 3: 2036-2040				
		Number of Cities in 2036-2040	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Accumulative Total		6	Semen, Logam (Baja, Nikel), PLTU	4		
Number of Regional		2				
23	Nusa Tenggara Barat	Kota Mataram	PLTU	PLTU Jeranjang	99.166	75.336
Total		0	1	0	99.166	75.336
Accumulative Total		1	PLTU	1		
Number of Regional		0				
24	Nusa Tenggara Timur	Kota Kupang	PLTU, Semen	PLTU Bolok, PT Semen Kupang	6.422	4.561
		Kab Ende	PLTU	PLTU ROPA	288.116	174.022
Total		0	2	0	294.538	178.583
Accumulative Total		2	pltu, semen	3		
Number of Regional		0				
TOTAL		24		7	32.053.132	16.451.434
AGGREGATE OF REGENCIES/CITIES		132		74		

Tabel 6 Information of RDF Potential Implementation at Phase IV (2041-2045)

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
1	Jawa Barat + DKJ	DKI JAKARTA	Semen	PT Indocement Citeureup, PT SBI Narogong	3.141.650	852.330
		Kota Depok	Semen	PT Indocement Citeureup	538.947	435.038
		Kota Karawang	Pulp dan Kertas	PT Indah Kiat, PT Pindo Deli, PT Jui Shin	373.765	277.595
		Kota Bandung	Semen	PT Indocement Palimanan	503.627	419.219
		Kab Sukabumi	Semen, PLTU	PT Semen Jawa, PLTU Pelabuhan Ratu	1.974.000	1.445.165
		Kab. Indramayu	Semen	PT Indocement Palimanan, PLTU Indramayu	418.818	208.069
		REGIONAL				
		Kab. Cirebon	Semen	PT Indocement Palimanan	465.243	158.694
		Kota Cirebon			83.856	60.183
		REGIONAL				
		Kota Bogor	Semen	PT SBI Narogong, PT Indocement Citeureup	284.632	200.096
		Kab Bogor	Semen		1.026.931	287.335
		REGIONAL				
		Kab. Tasikmalaya	Semen	PT Indocement Palimanan	117.955	76.919
		Kab. Garut	Semen		409.465	89.960
		REGIONAL		PT Pindo Deli, PT Jui Shin, PT Gunung Raja Paksi, PT. Toyogiri Iron Steel		
		Kab Bekasi	Pulp dan Kertas		84.026	62.406
		Kota Bekasi	Pulp dan Kertas		503.627	419.219

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		REGIONAL		PT Indocement Palimanan		
		Kab Bandung Barat	Semen		271.100	58.178
		Kab Bandung			475.059	163.373
		Kab Sumedang	Semen	PT Indocement Palimanan	174.806	**52.739**
		Kab Majalengka			342.528	113.205
Total		**0**	**3**	**0**	**10.847.508**	**5.266.519**
Accumulative Total		**18**	**Semen, PLTU, Pulp dan Kertas**	**11**		
Number of Regional		**5**				
2	**Jawa Tengah**	Kota Semarang	Semen		431.535	310.748
		REGIONAL				
		Kab Rembang	Semen, PLTU	PLTU Rembang, PT SG Rembang	92.770	16.031
		Kab Jepara	Semen, PLTU	PLTU Tanjung Jati	154.572	62.509
		Kab Blora	Semen, PLTU	PLTU Rembang, PT SG Rembang	141.433	101.874
		REGIONAL				
		Kota Magelang	Semen	PT Semen Grobogan	49.154	30.642
		Kab Temanggung	Semen	PT Semen Grobogan	147.358	45.548
		Kab Magelang	Semen	PT Semen Grobogan	241.768	65.422
		Kab Cilacap	Semen, PLTU	PLTU Adipala, PT SBI Cilacap	348.407	226.952
		Kab Banyumas	Semen	PT Semen Bima	197.758	63.738
		Kota Surakarta	PLTU	PLTU Tanjung Jati	152.975	120.009
		REGIONAL			108.374	**32.079**
		Kab Semarang	Semen	PT Semen Grobogan	267.885	**28.235**
		Kab Grobogan	Semen		366.938	**61.352**
		Purwodadi	Semen		220.494	**113.885**
		REGIONAL				

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Tegal	Semen	PT Indocement Palimanan	68.301	50.720
		Kab Tegal	Semen		220.494	113.885
		Kab. Brebes	Semen	PT Semen Grobogan	366.938	61.352
		REGIONAL				
		Kab Kebumen	Semen	PT SBI Cilacap	176.364	64.426
		Kab Purworejo	Semen		117.433	30.720
		REGIONAL				
		Kab Kudus	Semen	PT SG Rembang	159.061	58.105
		Kab Pati	Semen		251.093	156.531
		Kab Demak	Semen		267.885	82.803
		REGIONAL				
		Kab Pemalang	PLTU	**PLTU Batang**	**219.110**	**130.370**
		Kab Batang			**154.572**	**62.509**
		Kab Kendal			**153.796**	**64.410**
		Kab Pekalongan			**144.022**	**47.455**
Total		**4**	**2**	**1**	**5.220.486**	**2.202.311**
Accumulative Total		**25**	**Semen, PLTU**	**9**		
Number of Regional		**3**				
3	**DIY**	REGIONAL				
		Kab. Sleman			219.654	**71.541**
		Kab. Bantul			162.114	**71.411**
		Kota Yogyakarta			109.704	**66.590**
Total		**0**	**0**	**0**	**491.472**	**209.543**
Accumulative Total		**3**		**0**		
Number of Regional		**1**				
4	**Jawa Timur**	Kab. Tuban	Semen, PLTU	PLTU TJ Awar Awar, PT Semen Indonesia Tuban, PT SBI Tuban	185.423	68.569
		REGIONAL				
		Kota Malang	Pulp dan Kertas	PT Tjiwi Kimia	284.095	203.014

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Batu	Pulp dan Kertas		52.063	39.042
		Kab Malang	Pulp dan Kertas		352.927	149.676
		REGIONAL				
		Kota Kediri	Pulp dan Kertas	PT Tjiwi Kimia	241.779	191.779
		Kab. Nganjuk	Pulp dan Kertas		163.088	129.361
		Kab. Tulungagung	Pulp dan Kertas		204.029	161.836
		Kab Banyuwangi	Semen	PT SBI Tuban	305.313	82.892
		REGIONAL				
		Kota Pasuruan	PLTU	**PLTU Indonesia Power**	53.830	38.795
		Kab Pasuruan	PLTU		653.608	261.443
		Kab. Gresik	Pupuk, Semen	PT Petrokimia Gresik, PT Semen Indonesia Tuban, PT SBI Tuban, PT Gunawan Gunandjaya Steel	185.423	68.569
		Kota Surabaya	Pupuk, Semen		657.017	613.325
		REGIONAL				
		Kab. Jombang	Pupuk		193.583	55.926
		Kab. Mojokerto	Pulp dan Kertas, Pupuk	PT Tjiwikimia Tbk	172.984	39.700
		REGIONAL	PLTU	PLTU Pacitan		
		Kab Magetan			100.725	19.208
		Kab Ngawi			135.298	32.539
		Kab Pacitan			105.346	14.032
		Kota Blitar			27.988	22.970
		Kab Madiun			109.148	20.618
		REGIONAL		PLTU Paiton 1, 2, 9		
		Kota Probolinggo	PLTU		**35.706**	**22.898**
		Kab Probolinggo	PLTU		**169.355**	**43.880**

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		REGIONAL		PT. Semen Imasco Asiatic		
		Kab Bondowoso	PLTU		**115.049**	**24.897**
		Kab Jember	Semen		**377.298**	**299.273**
Total		**4**	**4**	**2**	**4.881.075**	**2.604.245**
Accumulative Total		**23**	**Semen, PLTU, Pulp dan Kertas, Pupuk**	**10**		
Number of Regional		**7**				
5	**Banten**	Kota Tangerang Selatan	PLTU	PLTU Lontar Extension	514.478	386.527
		Kota Cilegon	"Logam (Baja, Nikel)", Kimia, PLTU	PLTU Suralaya 1, 7, 8,PT Krakatau Posco, PT Krakatau Steel Tbk, Meratus Jaya Iron, PT Asahimas Chemical	101.773	86.140
		REGIONAL				
		Kab. Serang	Kimia	PT Chandra Asri Chemical	428.963	31.443
		Kota Serang	PLTU	PLTU Lontar	219.503	128.782
		REGIONAL				
		Kab. Lebak	Semen	PT Cemindo Gemilang, PLTU Labuan Pandeglang	218.267	43.435
		Kab. Pandeglang	PLTU	PT Cemindo Gemilang, PLTU Labuan Pandeglang	185.812	64.198
		Kota Tangerang	PLTU	PLTU Lontar Extension	514.478	386.527
		Kab Tangerang	PLTU	PLTU Lontar Extension	875.158	518.531

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Total		**0**	**4**	**0**	**3.058.431**	**1.645.585**
Accumulative Total		**8**	**PLTU, Logam (Baja, Nikel), Kimia, Semen**	**10**		
Number of Regional		**2**				
6	**Bali**	Kota Denpasar	PLTU	PLTU Celukan Bawang	357.985	286.567
		Kab. Gianyar	PLTU	PLTU Celukan Bawang	196.699	169.731
Total		**0**	**1**	**0**	**554.683**	**456.298**
Accumulative Total		**2**	**PLTU**	**1**		
Number of Regional		**0**				
7	**NAD**	REGIONAL		PT Solusi Bangun Andalas		
		Kota Banda Aceh	Semen		**93.371**	58.207
		Reg. Aceh	Semen		**26.841**	16.732
Total		**0**	**1**	**0**	**120.211**	**74.940**
Accumulative Total		**2**	**Semen**	**1**		
Number of Regional		**1**				
8	**Sumatera Utara**	REGIONAL				
		Kab. Toba	Pulp dan Kertas	Toba Pulp Lestari Tbk.	40.522	25.261
		Kab Samosir	Pulp dan Kertas		98.776	61.577
		Kab. Humbang Hasudutan	Pulp dan Kertas		22.416	13.974
		Kab. Simalungun	Pulp dan Kertas		186.445	116.230
		Kota Pematang Siantar	Pulp dan Kertas		57.665	35.948
		Kab. Tapanuli Utara	Pulp dan Kertas		71.441	44.536

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Medan	PLTU, "Logam (Baja, Nikel)"	PLTU Langkat, PT Growth Sumatra Industry, PT Gunung Gahapi Sakti	645.661	402.505
		Kab. Deli Serdang			411.211	164.484
		Kab. Serdang Begadai			273.167	109.267
Total		**0**	**1**	**0**	**1.807.305**	**973.784**
Accumulative Total		**9**	**Pulp dan Kertas, PLTU, Logam (Baja, Nikel)**	**4**		
Number of Regional		**1**				
9	**Sumatera Barat**	Kota Padang	Semen	PT Semen Padang	236.297	174.482
		Kota Bukittinggi	PLTU	PLTU Ombilin	47.238	38.371
		REGIONAL				
		Kab. Padang Pariaman	PLTU	PLTU Teluk Sirih	79.594	5.062
		Kota Pariaman	PLTU	PLTU Ombilin	14.525	10.512
		Kab Tanah Datar	PLTU	PLTU Ombilin	47.383	18.953
Total		**0**	**2**	**0**	**425.037**	**247.380**
Accumulative Total		**5**	**Semen, PLTU**	**3**		
Number of Regional		**1**				
10	**Riau**	Kota Pekanbaru	Pulp dan Kertas	PT Indah Kiat Perawang (Sinarmas)	369.020	257.207
		Kab. Siak	Pulp dan Kertas	PT Riau Andalan Pulp & Paper	69.722	27.889
		Kab Pelalawan	Pulp dan Kertas		163.417	65.367
Total		**0**	**1**	**0**	**602.160**	**350.463**
Accumulative Total		**3**	**pulp dan kertas**	**2**		
Number of Regional		**0**				
11	**Kepulauan Riau**	Kota Batam	PLTU	PLTU Tanjung Kasam	423.054	327.909
Total		**0**	**0**	**0**	**423.054**	**327.909**

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Accumulative Total			pltu	1		
Number of Regional						
12	Jambi	Kota Jambi	PLTU	PLTU Selincah	161.898	119.724
Total		0	0	0	161.898	119.724
Accumulative Total			pltu	1		
Number of Regional						
13	Sumatera Selatan	Kota Palembang	Pulp dan Kertas, Pupuk	PT Oki Pulp and Paper, PT Pupuk Sriwidjaja	466.205	352.125
		REGIONAL				
		Kab Ogan Komering Ulu Selatan	PLTU	PLTU Bukit Asam	171.814	64.430
		Kab Ogan Komering Ulu Timur	PLTU	PLTU Bukit Asam	102.610	46.534
		Kab Ogan Komering Ulu	Semen	PT Semen Baturaja	55.479	20.805
Total		0	4	0	796.108	483.893
Accumulative Total		4	Pulp dan Kertas, Pupuk, PLTU, Semen	4		
Number of Regional		1				
14	Lampung	REGIONAL				-
		Kota Bandar Lampung	PLTU	PLTU Tarahan, PLTU Sebalang	287.058	266.447
		Kab Lampung Selatan		PLTU Tarahan, PLTU Sebalang	442.000	176.800
		Kab. Pesawaran		PLTU Tarahan, PLTU Sebalang	70.908	19.712

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kab Lampung Tengah		PLTU Lampung Tengah	251.851	52.712
Total		**0**	**1**	**0**	**1.051.817**	**515.672**
Accumulative Total		**4**	**PLTU**	**3**		
Number of Regional		**1**				
15	**Bangka Belitung**	Kota Pangkal Pinang	PLTU	PLTU Air Anyir	90.934	47.031
		Kab. Bangka			49.791	25.752
Total		**0**	**1**	**0**	**140.725**	**72.783**
Accumulative Total		**2**	**PLTU**	**1**		
Number of Regional		**0**				
16	**Kalimantan Barat**	Kota Pontianak	PLTU	**PLTU 1 Kalbar**	161.287	161.238
Total		**0**	**1**	**0**	**161.287**	**161.238**
Accumulative Total		**1**	**PLTU**	**1**		
Number of Regional		**0**				
17	**Kalimantan Timur**	Kota Samarinda	PLTU	PLTU Embalut	218.800	174.559
		Kota Balikpapan		PLTU Balikpapan	193.038	139.875
		REGIONAL		PT Kobexindo Cement		
		Kab Kutai Timur	Semen		77.706	41.720
		Kab. Kutai Kartanegara			117.121	78.940
Total		**0**	**2**	**0**	**606.665**	**435.094**
Accumulative Total		**4**	**PLTU, Semen**	**3**		
Number of Regional		**1**				
18	**Kalimantan Selatan**	REGIONAL		PLTU Asam-Asam		
		Kota Banjarmasin	PLTU		170.275	123.194

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
		Kota Banjarbaru			67.854	49.995
		Kab Banjar			132.335	66.168
		REGIONAL		PT Conch Semen (Tabalong)		
		Kab. Tabalong	Semen		42.927	35.913
		Kab Balangan			21.178	8.471
		Kab. Hulu Sungai Utara			33.905	18.634
		REGIONAL		PT Indocement Tunggal Prakarsa Tbk. - Tarjun, PLTU Asam Asam		
		Kab Kotabaru	Semen		**67.082**	**16.012**
		Kab Tanah Bumbu	PLTU		**62.733**	**14.974**
Total		**2**	**2**	**2**	**598.289**	**333.361**
Accumulative Total		**8**	**PLTU, Semen**	**4**		
Number of Regional		**3**				
		REGIONAL				
		Kota Manado	Semen	PT Conch Cement Indonesia	106.288	89.792
		Kab Minahasa Utara			43.976	17.591
		REGIONAL				
19	**Sulawesi Utara**	Kab. Minahasa			126.368	50.547
		Kota Tomohon			41.228	16.491
		REGIONAL				
		Kab Bolaang Mongondow			63.923	10.119
		Kota Kotamobagu			51.084	20.434
Total		**0**	**1**	**0**	**432.867**	**204.974**
Accumulative Total		**6**	**Semen**	**1**		
Number of Regional		**3**				
20	**Sulawesi Tengah**	**Kota Palu**	PLTU	**PLTU Tawaili**	**70.717**	**68.221**
Total		**1**	**1**	**1**	**70.717**	**68.221**

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Accumulative Total		1	PLTU	1		
Number of Regional		0				
21	Sulawesi Tenggara	Kota Kendari	PLTU	PLTU Kendari 3	88.421	73.646
Total		0		0	88.421	73.646
Accumulative Total		1		1		
Number of Regional		0				
22	Sulawesi Selatan	REGIONAL		Semen Bosowa Maros		
		Kota Makassar	Semen		313.872	94.162
		Kab. Maros			33.051	9.915
		Kab. Luwu Timur	"Logam (Baja, Nikel)"	PT Vale Indonesia	25.082	7.525
		Kab. Gowa			146.000	80.300
		REGIONAL		PT Semen Tonasa, PLTU Barru		
		Kabupaten Pangkajene dan Kepulauan	Semen, PLTU		142.244	56.898
		Kab Barru			28.403	13.625
Total		0	3	0	688.652	262.424
Accumulative Total		6	Semen, Logam (Baja, Nikel), PLTU	4		
Number of Regional		2				
23	Nusa Tenggara Barat	Kota Mataram	PLTU	PLTU Jeranjang	99.166	75.336
Total		0	1	0	99.166	75.336
Accumulative Total		1	PLTU	1		
Number of Regional		0				
24	Nusa Tenggara Timur	Kota Kupang	PLTU, Semen	PLTU Bolok, PT Semen Kupang	6.422	4.561
		Kab Ende	PLTU	PLTU ROPA	288.116	174.022
Total		0	2	0	294.538	178.583
Accumulative Total			pltu, semen	3		

No	Province	PHASE 4: 2041-2045				
		Number of Cities in 2041-2045	Offtaker Type	Offtaker Name	Waste Generation in 2023 (tons per year)	Waste Treatment in 2023 (tons per year)
Number of Regional						
TOTAL		11		6	33.622.572	17.343.925
AGGREGATE OF REGENCIES/CITIES		143		80		

No	Province	RDF Supply from TPST RDF until 2025 (tons per year)	Solid Fuel Demnd Demand BBJP (PLTU PLN+IPP) 2026 s/d 2030 (tons per year) assumptio 1 %	Demand BBJP (PLTU PLN+IPP) 2031 s/d 2036 (ton per tahun) asumsi 3%	Demand BBJP (PLTU PLN+IPP) 2036 s/d 2040 (ton per tahun) asumsi 5%	Demand BBJP (PLTU PLN+IPP) s/d 2045 (ton per tahun) asumsi 5%	Demand BBJP(Boiler Industri) 2026 s/d 2030 (ton per tahun)	Demand BBJP(Boiler Industri) 2031 s/d 2035 (ton per tahun)	Demand BBJP(Boiler Industri) 2036 s/d 2040 (ton per tahun)	Demand BBJP(Boiler Industri) 2041 s/d 2045 (ton per tahun)
1	Jawa Barat + DKJ	306,250	61,250	183,750	306,250	306,250				
		35,000	7,000	21,000	35,000	35,000	18,410	20,230	22,050	22,050
		7,000	1,400	4,200	7,000	7,000				
		35,000	7,000	21,000	35,000	35,000				
			37,587	**112,760**	**187,934**	**187,934**				
			42,797	128,392	213,987	213,987				
							1,976	5,928	9,880	9,880
		245,000	49,000	147,000	245,000	245,000				
Total		**628,250**	**206,034**	**618,103**	**1,030,171**	**1,030,171**	**20,386**	**26,158**	**31,930**	**31,930**
Accumulative Total										
Number of Regional										
2	Jawa Tengah									
			14,456	**43,369**	**72,281**	**72,281**				
		21,000								
		3,500								
			18	54	91	91				
			85594.74	256,784	427,974	427,974				
			85200	255,600	426,000	426,000				

No	Province	RDF Supply from TPST RDF until 2025 (tons per year)	Solid Fuel Demnd Demand BBJP (PLTU PLN+IPP) 2026 s/d 2030 (tons per year) assumptio 1 %	Demand BBJP (PLTU PLN+IPP) 2031 s/d 2036 (ton per tahun) asumsi 3%	Demand BBJP (PLTU PLN+IPP) 2036 s/d 2040 (ton per tahun) asumsi 5%	Demand BBJP (PLTU PLN+IPP) s/d 2045 (ton per tahun) asumsi 5%	Demand BBJP(Boiler Industri) 2026 s/d 2030 (ton per tahun)	Demand BBJP(Boiler Industri) 2031 s/d 2035 (ton per tahun)	Demand BBJP(Boiler Industri) 2036 s/d 2040 (ton per tahun)	Demand BBJP(Boiler Industri) 2041 s/d 2045 (ton per tahun)
Total		24,500	185,269	555,807	926,345	926,345	0	0	0	0
Accumulative Total										
Number of Regional										
3	DIY									
Total		0	0	0	0	0	0	0	0	0
Accumulative Total										
Number of Regional										
							13,200	39,600	66,000	66,000
							4,752	14,256	23,760	23,760
		1,400								
							326	979	1,631	1,631
4	Jawa Timur									
							PT Beton Jaya Manunggal			
			22,415	67,245	112,075	112,075				
			27,229	81,688	136,146.95	136,146.95				
			17,197	51,590	85,984	85,984				
No	Provinsi									
Total		1,400	66,841	200,523	334,206	334,206	18,278	54,835	91,391	91,391
Accumulative Total										
Number of Regional										
			118,546	355,637	592,728	592,728	21,950	65,850	109,750	109,750
			16,236	48,709	81,181	81,181		28,500	47,500	47,500

No	Province	RDF Supply from TPST RDF until 2025 (tons per year)	Solid Fuel Demnd Demand BBJP (PLTU PLN+IPP) 2026 s/d 2030 (tons per year) assumptio 1 %	Demand BBJP (PLTU PLN+IPP) 2031 s/d 2036 (ton per tahun) asumsi 3%	Demand BBJP (PLTU PLN+IPP) 2036 s/d 2040 (ton per tahun) asumsi 5%	Demand BBJP (PLTU PLN+IPP) s/d 2045 (ton per tahun) asumsi 5%	Demand BBJP(Boiler Industri) 2026 s/d 2030 (ton per tahun)	Demand BBJP(Boiler Industri) 2031 s/d 2035 (ton per tahun)	Demand BBJP(Boiler Industri) 2036 s/d 2040 (ton per tahun)	Demand BBJP(Boiler Industri) 2041 s/d 2045 (ton per tahun)
5	Banten		40,016	120,049	200,081	200,081	9,500	12,000	20,000	20,000
							4,000			
							6,814	20,443	34,072	34,072
			23,619	70,857	118,095	118,095	8,910	26,729	44,548	44,548
Total		-	198,417	595,251	992,085	992,085	51,174	153,522	255,870	255,870
Accumulative Total										
Number of Regional										
6	Bali	84,000	6,879	20,636	34,393	34,393.44				
		16,800								
Total		100,800	6,879	20,636	34,393	34,393	-	-	-	-
Accumulative Total										
Number of Regional										
7	NAD									
Total		-	-	-	-	-	-	-	-	-
Accumulative Total										
Number of Regional										
8	Sumatera Utara									
							2,020	6,060	10,100	10,100
			30,244	90,731	151,219	151,219	2,862	8,585	14,308	14,308
							1,008	3,024	5,040	5,040
Total		-	30,244	90,731	151,219	151,219	5,890	17,669	29,448	29,448
Accumulative Total										
Number of Regional										
9	Sumatera Barat									
			3,703	11,110	18,517	18,517				
			9,040	27,120	45,200	45,200				
Total			12,743	38,230	63,717	63,717	-	-	-	-
Accumulative Total										
Number of Regional										
							4,600	13,800	23,000	23,000
10	Riau						5,236	15,707	26,179	26,179
Total		-	-	-	-	-	9,836	29,507	49,179	49,179
Accumulative Total										
Number of Regional										
11	Kepulauan Riau		5,236	15,707	26,179	26,179				

No	Province	RDF Supply from TPST RDF until 2025 (tons per year)	Solid Fuel Demnd Demand BBJP (PLTU PLN+IPP) 2026 s/d 2030 (tons per year) assumptio 1 %	Demand BBJP (PLTU PLN+IPP) 2031 s/d 2036 (ton per tahun) asumsi 3%	Demand BBJP (PLTU PLN+IPP) 2036 s/d 2040 (ton per tahun) asumsi 5%	Demand BBJP (PLTU PLN+IPP) s/d 2045 (ton per tahun) asumsi 5%	Demand BBJP(Boiler Industri) 2026 s/d 2030 (ton per tahun)	Demand BBJP(Boiler Industri) 2031 s/d 2035 (ton per tahun)	Demand BBJP(Boiler Industri) 2036 s/d 2040 (ton per tahun)	Demand BBJP(Boiler Industri) 2041 s/d 2045 (ton per tahun)
Total			5,236	15,707	26,179	26,179				
Accumulative Total										
Number of Regional										
12	Jambi		5,186	15,559	25,931	25,931				
Total			5,186	15,559	25,931	25,931				
Accumulative Total										
Number of Regional										
13	Sumatera Selatan									
							7,104	21,313	35,522	35,522
			9,336	28,009	46,682	46,682				40,026
Total		-	9,336	28,009	46,682	46,682	7,104	21,313	35,522	75,548
Accumulative Total										
Number of Regional										
14	Lampung									
			1,268	3,803	6,339	6,339				
			8,005	24,016	40,026	40,026				
			10,935	32,806	54,677	54,677				
Total			20,208	60,625	101,042	101,042	-	-	-	-
Accumulative Total										
Number of Regional										
15	Bangka Belitung									
			3,407	10,222	17,036	17,036				
Total		-	3,407	10,222	17,036	17,036	-	-	-	-
Accumulative Total										
Number of Regional										
16	Kalimantan Barat		5,186	15,559	25,931	25,931				
Total		-	5,186	15,559	25,931	25,931	-	-	-	-
Accumulative Total										
Number of Regional										
17	Kalimantan Timur									
			4,920	14,760	24,600	24,600	6,860	20,579	34,299	34,299
			5,186	15,559	25,931	25,931				
Total		-	10,106	30,319	50,531	50,531	6,860	20,579	34,299	34,299
Accumulative Total										
Number of Regional										
18	Kalimantan Selatan									

No	Province	RDF Supply from TPST RDF until 2025 (tons per year)	Solid Fuel Demnd Demand BBJP (PLTU PLN+IPP) 2026 s/d 2030 (tons per year) assumptio 1 %	Demand BBJP (PLTU PLN+IPP) 2031 s/d 2036 (ton per tahun) asumsi 3%	Demand BBJP (PLTU PLN+IPP) 2036 s/d 2040 (ton per tahun) asumsi 5%	Demand BBJP (PLTU PLN+IPP) s/d 2045 (ton per tahun) asumsi 5%	Demand BBJP(Boiler Industri) 2026 s/d 2030 (ton per tahun)	Demand BBJP(Boiler Industri) 2031 s/d 2035 (ton per tahun)	Demand BBJP(Boiler Industri) 2036 s/d 2040 (ton per tahun)	Demand BBJP(Boiler Industri) 2041 s/d 2045 (ton per tahun)
			14,177	42,532	70,886	70,886				
Total		-	14,177	42,532	70,886	70,886	-	-	-	-
Accumulative Total										
Number of Regional										
19	Sulawesi Utara									
Total		-	-	-	-	-	-	-	-	-
Accumulative Total										
Number of Regional										
20	Sulawesi Tengah		2,611	7,833	13,056	13,056				
Total		-	2,611	7,833	13,056	13,056	-	-	-	-
Accumulative Total										
Number of Regional										
21	Sulawesi Tenggara		5,573	16,719	27,864	27,864				
Total		-	5,573	16,719	27,864	27,864	-	-	-	-
Accumulative Total										
Number of Regional										
22	Sulawesi Selatan									
							924	2,772	4,620	4,620
			5,573	16,719	27,864	27,864				
Total		-	5,573	16,719	27,864	27,864	924	2,772	4,620	4,620
Accumulative Total										
Number of Regional										
23	Nusa Tenggara Barat	14,850	16,763	16,763	27,938	27,938				
Total		14,850	16,763	16,763	27,938	27,938	-	-	-	-
Accumulative Total										
Number of Regional										
24	Nusa Tenggara Timur		2,852	8,556	14,261	14,261				
			55,303	165,908	276,514	276,514				
Total			58,155	174,465	290,775	290,775	-	-	-	-
Accumulative Total										
Number of Regional										
TOTAL		669,000	867,945	2,570,311	4,283,851	4,283,851	120,452	326,355	532,259	572,285

Annex IV – Financial Model Calculation

Table 7 Financial Requirement of RDF Plant Facility

Period	Number of		RDF Capacity 150 Ton/Hari				RDF Capacity 300 Ton/Hari			
			Capex Co Konstan Rp. Juta	Bop Harga Konstan Rp.Juta/ Tahun)	Bps Harga Konstan (Rp.Juta /Tahun)	Capex Harga Konstan Rp. Juta	Capex Harga Konstan Rp.Juta	Bop Harga Konstan Rp.Juta /Tahun)	Bps Harga Konstan (Rp.Juta /Tahun)	Capex Harga Konstan Rp. Juta
2026-2030	7	Kab/Kota	684.250	273.656	415.270	652				
	13	Kab/Kota					3.219.061	1.064.646	1.730.869	897
	14	Regional					3.466.681	1.016.938	1.734.409	897
	34	**Kab/Kota/Regional**	**684.250**	**273.656**	**415.270**	**652**	**6.685.742**	**2.081.584**	**3.465.278**	**897**
2031-2035	4	Kab/Kota	391.000	156.375	237.297	652				
	9	Kab/Kota					2.228.581	737.062	1.198.294	897
	12	Regional					2.971.441	982.750	1.597.725	897
	25	**Kab/Kota/Regional**	**391.000**	**156.375**	**237.297**	**652**	**5.200.022**	**1.719.812**	**2.796.019**	**897**
2036-2040	3	Kab/Kota	293.250	117.281	177.973	652				
	4	Kab/Kota					990.480	327583	532575	897
	6	Regional					1.485.720	491.375	798.563	897
	13	**Kab/Kota/Regional**	**293.250**	**117.281**	**177.973**	**652**	**2.476.200**	**818.958**	**1.331.138**	**897**
2041-2045	1	Kab/Kota	97.750	39.094	59.324	652				
	4	Regional					990.840	327.583	532.575	897
	5	**Kab/Kota/Regional**	**97.750**	**39.094**	**59.324**	**652**	**990.840**	**327.583**	**532.575**	**897**
Jumlah	**77**	**Kab/Kota/Regional**	**1.466.250**	**586.406**	**889.864**	**652**	**15.352.804**	**4.947.937**	**8.125.010**	**897**

Annex V – Strategic and Program

Tabel 8 Strategy and Program for RDF Implementation in Indonesia 2026-2045

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
Promoting the Expansion and Utilization of RDF in Indonesia	Establishment of RDF Facilities in Areas with Prospective Offtakers Located Less Than 100 km Away	· Constructed RDF facility · RDF facility that is functional and operating efficiently	· Ministry of Public Works · Ministry of Environment · Ministry of Home Affairs	· 34 Plant (7 Plant @150 tons per days and 27 Plant @300 tons per days) in 58 regency/city · There is potential across 14 regions, of which 90% are currently operational and demonstrating good performance.	· 25 plants (4 plants with a capacity of 150 tons per day and 21 plants with a capacity of 300 tons per day) across 50 regencies/cities · Regional potential: 12 regions · 90% are operational and performing well	· 13 RDF plants (3 plants with a capacity of 150 tons per day and 10 plants with a capacity of 300 tons per day) across 24 regencies/cities · Regional potential: 6 regions · 90% are operational and performing well	· 5 RDF plants (1 plant with a capacity of 150 tons per day and 4 plants with a capacity of 300 tons per day) across 11 regencies/cities · Regional potential: 4 regions · 90% are operational and performing well
	Utilization of RDF by Priority and Potential Industries[11]	· Jumlah RDF yang dimanfaatkan oleh industri · Jumlah industri memanfaatkan RDF	· Kem. Perindustrian · Kem. Energi dan Sumber Daya Mineral	· 910.350 *ton per tahun* · 43 *offtaker* (PLTU, semen, pupuk, baja, pulp & paper, kimia)	· 1.606.500 *ton per tahun* · 71 *offtaker* (PLTU, semen, pupuk, baja, pulp & paper, kimia)	· 2.106.300 *ton per tahun* · 80 *offtaker* (PLTU, semen, pupuk, baja, pulp & paper, kimia)	· 2.106.300 *ton per tahun* · 80 *offtaker* (PLTU, semen, pupuk, baja, pulp & paper, kimia)

[11] Pabrik Semen, PLTU, Pupuk, Baja, Pulp & Paper, Kimia

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
Provision of Key Policies to Support RDF Expansion	Formulation of a National Policy to Promote the Expansion and Utilization of RDF	· Enactment of the Renewable Energy Law · Revision of Presidential Regulation No. 35/2018 · Enactment of Presidential Regulation on Waste Management Transformation	·Ministry of Energy and Mineral Resources (MEMR) · Ministry of National Development Planning (Bappenas)				
	Establishment of Clear Criteria for the Provision of RDF Facilities through Ministerial Regulation	Revision of Ministerial Regulation of Public Works and Housing (Permen PUPR) No. 3/2013, incorporating RDF as an option and three prerequisites for regions intending to utilize RDF	Ministry of Public Works				
	Integrating RDF into the Circular Economy and EPR Framework	Revision of Ministry of Environment and Forestry Regulation (Permen LHK) No. 75/2019, incorporating RDF utilization into the annex as part of the implementation of Article 8 paragraph (2)(c).	Ministry of Environment				

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Mandating RDF Utilization as Part of Biomass and Renewable Energy in Two Industrial Sectors (Cement and Coal Power Plants), Especially State-Owned Enterprises (SOEs)	· Integrate a mandate for RDF utilization (minimum 5%) into the industrial decarbonization roadmap. · Revise Ministry of Energy and Mineral Resources (MoEMR) Regulation No. 12/2013 to include RDF utilization (minimum 5%) as part of biomass fuel in coal-fired power plants (CFPPs).	·Ministry of Industry ·Ministry of Energy and Mineral Resources				
	Integrating Waste Management into Mandatory Affairs Classified as Basic Public Services of Local Governments and Regulated under Minimum Service Standards	·Revise Government Regulation (PP) No. 2/2018 on Minimum Service Standards (SPM) to include waste management as a mandatory government affair and basic public service. · Revise Ministry of Home Affairs Regulation (MoHA) No. 59/2021 on the Implementation of SPM to include waste management as a mandatory affair and basic public service.	Ministry of Home Affairs				

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Formulating National Targets for Waste Reduction and GHG Emission Reduction through RDF in National Strategic Documents	Incorporate the contribution of GHG emission reduction through RDF into derivative guidelines of MoEF Regulation No. 12/2024.	Ministry of Environment				
Improving RDF Supply and Management)	Develop guidelines for determining the form of RDF management entities/institutions, taking into account capacity, technology, and offtaker needs.	Guidelines for determining RDF management entities/institutions are established.	Ministry of Home Affairs				
	Developing guidelines for assessing RDF management performance	Guidelines for assessing RDF management performance are established	Ministry of Public Works				

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Developing a reporting mechanism for RDF facility and management performance	Incorporating RDF facility and management performance reporting parameters into the SIINSAN and SIPSN portals	Ministry of Public Works and Ministry of Environment and Forestry				
	Reporting and monitoring RDF management performance	Percentage of RDF management performance categorized as good (in accordance with standards)	Ministry of Public Works and Ministry of Environment and Forestry	50%	75%	90%	100%
	Developing guidelines for preparing SOPs for system and equipment operation and maintenance	Guidelines for preparing SOPs for system and equipment operation and maintenance are established	Ministry of Public Works				
	Developing guidelines for regulating and managing cooperation in RDF management and utilization	Guidelines for regulating and managing cooperation in RDF management and utilization are established	Ministry of Home Affairs				
	Preparing technical planning guidelines for RDF (feasibility study and detailed engineering design)	Technical planning guidelines for RDF (FS and DED) are established	Ministry of Public Works				

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Providing technical assistance to local governments in preparing RDF planning documents	Percentage of regions mapped for RDF expansion potential that receive technical assistance in preparing RDF planning documents	Ministry of Public Works	75%	90%	100%	100%
	Developing competency standards and certification procedures for RDF managers	National Qualification Framework (KKNI) & Indonesian National Work Competency Standards (SKKNI) on waste management are revised (Minister of Manpower Decree No. 61/2018), incorporating RDF management competencies	Ministry of Public Works and Ministry of Manpower				
	Development of financing schemes for RDF facilities (Public-Private Partnership, green finance, carbon credit, etc.)	Clear schemes for financing RDF facilities (Public-Private Partnership, green finance, carbon credit, etc.) are available	Ministry of Finance				
	Preparation of implementation guidelines for calculating OPEX costs of RDF facilities	Implementation guidelines for calculating OPEX costs of RDF facilities, as a derivative of Ministry of Home Affairs Regulation No. 7/2021, are established	Ministry of Home Affairs				

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Preparation of guidelines on determining tipping fees for RDF and BLPS for RDF	· Guidelines on determining tipping fees for RDF are established · Regulation and guidelines on BLPS for RDF are established	· Ministry of Home Affairs · Ministry of National Development Planning (Bappenas) and · Ministry of Environment and Forestry				
	Monitoring the implementation of tipping fees by local governments that own RDF facilities	Percentage of regions with RDF facilities that allocate tipping fees in accordance with the guidelines	Ministry of Home Affairs	75%	90%	100%	100%
	Preparation of guidelines for the design, evaluation, and audit of RDF technology designs	Guidelines for the design, evaluation, and audit of RDF technology designs are established	Ministry of Public Works				
	Developing a technology evaluation mechanism and establishing criteria for evaluating RDF technology designs	A technology evaluation mechanism and criteria for evaluating RDF technology designs are available	Ministry of Public Works				
	Conducting evaluation and audit of RDF technology designs	Percentage of RDF facilities that have undergone evaluation and audit of technology designs	Ministry of Public Works	50%	75%	90%	100%

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Developing competency standards and certification procedures for RDF technology designers in configuring and selecting equipment	National Qualification Framework (KKNI) and Indonesian National Work Competency Standards (SKKNI) for RDF technology designers are established	· Ministry of Public Works and Housing · Ministry of Manpower				
	Implementation of competency requirements for RDF planning consultants and technology designers	Percentage of RDF planning consultants and contractors that meet the established competencies	Ministry of Public Works and Housing Professional Associations (e.g., IATPI)	50%	75%	100%	100%
	Mapping the number, capacity, condition, and distribution of RDF facilities to calculate the need for additional RDF infrastructure capacity (new or expanded)	Detailed data on the number, capacity, condition, and distribution of RDF facilities are mapped	Ministry of Public Works				
	Revitalization of RDF facilities that are damaged, non-operational, and underperforming	Percentage of RDF facilities that are damaged, non-operational, and underperforming that have been revitalized	Ministry of Public Works	50%	75%	90%	100%

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Provision of technical guidance and assistance to improve operational performance during the transition of RDF facility ownership	Percentage of RDF facilities receiving technical guidance and assistance to improve operational performance	Ministry of Public Works	75%	90%	100%	100%
	Developing guidelines on calculating estimated GHG emission reductions from waste processing into RDF for local governments	Guidelines on calculating estimated GHG emission reductions from waste processing into RDF are established	Ministry of Environment				
	Developing guidelines and schemes for green jobs, gender equality, and community involvement in RDF production activities	Guidelines and schemes for green jobs, gender equality, and community involvement in RDF production activities are established	· Ministry of National Development Planning (Bappenas) · Development Partners (UNDP, World Bank, GIZ, etc.)				
	Preparation of guidelines for environmental and social impact mitigation of RDF facilities	Guidelines for environmental and social impact mitigation of RDF facilities are established	Ministry of Environment				
	Monitoring compliance of RDF facilities with emission standards	Percentage of RDF facilities and management meeting the required emission standards	Ministry of Environment	75%	90%	100%	100%

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
Enhancing utilization by potential industries (demand)	Encouraging industries to utilize RDF through Green Industry Standards	Inclusion of RDF in Green Industry Standards, e.g., if there are minimum utilization criteria for alternative fuels, including biomass such as RDF	Ministry of Industry				
	Monitoring the use of RDF by priority industries as mandated (min. 5%)	Percentage of industries using RDF according to mapped potential	· Ministry of Industry · Ministry of Energy and Mineral Resources		75%	90%	100%
	Preparation of technical specification guidelines for RDF for potential industries[12]	Technical specification guidelines for RDF for other potential industries are established	Ministry of Industry				
	Facilitating knowledge and technology transfer on RDF utilization in industries from other countries	International cooperation in training and technical assistance related to RDF facilitated and implemented	Ministry of Industry				
	Developing a reward mechanism for companies that successfully reduce fossil fuels through RDF utilization	Reward mechanism for companies that successfully reduce fossil fuels through RDF utilization is available	· Ministry of Industry · Ministry of Energy and Mineral Resources				

[12] Pedoman yang telah ada adalah untuk industri semen yang dikeluarkan oleh Kem. Perindustrian dan Asosiasi Semen Indonesia di tahun 2017.

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Developing fiscal incentive schemes such as tax reductions for RDF-using industries	Fiscal incentive schemes such as tax reductions for RDF-using industries are available	Ministry of Finance				
	Revising Ministry of Environment Regulation No. 19/2017 to adjust BME requirements for RDF users	Ministry of Environment Regulation No. 19/2017 revised (adjusting BME requirements for RDF users))	Ministry of Environment				
	Preparing guidelines on environmental requirements and documents that must be fulfilled by industries before utilizing RDF	Guidelines on environmental requirements and documents that must be fulfilled by industries before utilizing RDF are established	Ministry of Environment				
	Developing guidelines and training for offtakers on calculating GHG emission reductions from RDF combustion in industries	Guidelines for offtakers on calculating GHG emission reductions from RDF combustion in industries are established	Ministry of Environment				
	Monitoring compliance of RDF-using industries with emission standards	Percentage of RDF-using industries meeting the required emission standards	Ministry of Environment	75%	90%	100%	100%

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
Enabling Environment	Formulating technical regulations (Ministerial Regulations/Permen) and Norms, Standards, Procedures, and Criteria (NSPK) required for RDF provision and management (detailed NSPK needs in West Java are listed in Table 9 of the Annex)	Technical regulations (Permen) and NSPK required for RDF provision and management are established	Relevant Technical Ministries				
	Developing an information system that maps potential RDF offtakers in various regions and the required specifications	An information system that maps potential RDF offtakers in various regions and the required specifications is available	Ministry of National Development Planning/Bappenas and Ministry of Industry				
	Involvement, cooperation, and collaboration among the Government, business sector, and academia, as well as technology transfer from domestic and international sources to foster innovation and enhance capacity in RDF technology	Cooperation and collaboration among parties and across stakeholders are facilitated and implemented	Ministry of National Development Planning/ Bappenas				

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Developing an RDF market ecosystem that ensures balance between production and consumption	An effective business model for RDF management and utilization is available	· Ministry of National Development Planning/Bappenas · Development Partners (UNDP, WB, GIZ, etc.)				
	Enhancing RDF market certainty through long-term contracts between producers and industrial users	Percentage of RDF management that has implemented long-term contract schemes considering return on investment	· Ministry of Environment · Ministry of Industry	50%	90%	100%	100%
	Preparation of national standards (SNI) related to RDF specifications for priority industries [13]	National standards (SNI) related to RDF specifications for priority industries are established	Ministry of Energy and Mineral Resources				
	Developing fiscal incentive schemes such as tax holidays, carbon tax reductions, green bonds, and import duty exemptions for RDF equipment	Fiscal incentive schemes such as tax holidays, carbon tax reductions, green bonds, and import duty exemptions for RDF equipment are available	Ministry of Finance				

[13] Currently, there is an Indonesian National Standard (SNI) for BBJB and an SNI for RDF that are utilized by the cement industry..

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Developing non-fiscal incentive mechanisms, including licensing facilitation for RDF implementation and utilization	Non-fiscal incentive mechanisms (awards, licensing facilitation, etc.) are available	· Ministry of Environment · Ministry of Industry · Ministry of Energy and Mineral Resources				
	Developing an integrated RDF training and certification center (RDF Center)	An integrated RDF training and certification center (RDF Center) is established and operational	· Ministry of National Development Planning/Bappenas · Ministry of Industry · Ministry of Energy and Mineral Resources · Development Partners (UNDP, WB, GIZ, etc.)				
	Strengthening the capacity of RDF stakeholders through various methods (training, apprenticeships, horizontal learning, etc.) aligned with national standards	Capacity building for RDF stakeholders is implemented	· RDF Training and Certification Center (RDF Center) · Relevant Technical Ministries · Development Partners (UNDP, WB, GIZ, etc.)				
	Strengthening RDF research collaboration between Government, academia, and the industrial sector to develop more efficient RDF technologies	RDF research collaboration among stakeholders is facilitated and implemented	· RDF Training and Certification Center (RDF Center) · BRIN and BRIDA · Development Partners (UNDP, WB, GIZ, etc.)				

Strategy	Programme	Indicator	PIC	Target Implementation			
				2026-2030	2031-2035	2036-2040	2041-2045
	Promoting RDF research funding through research grants, endowment funds, and international cooperation to accelerate RDF technology development	RDF research funding schemes to accelerate RDF technology development are available	· Ministry of Science, Technology, and Higher Education (Ditjen Diktisaintek) · BRIN and BRIDA · Development Partners (UNDP, WB, GIZ, etc.)				

Table 9 Daftar Kebutuhan NSPK

No.	List of Regulation and Standards Guidelines (NSPK)
Technology Design and Standardization	
1.	Guidelines for RDF technology design covering process flow, configuration determination, and equipment selection, as well as their use, including references for preparing SOPs for local governments.
2.	Guidelines for evaluating technology designs, specifying evaluation items and criteria.
3.	Competency standards and certification procedures for RDF designers to ensure designer competence.
4.	Assessment system for measuring the competency of planning consultants and contractors in designing and constructing RDF facilities.
5.	Guidelines for the preparation of SOPs on system and equipment operation and maintenance.
6.	Indonesian National Standard (SNI) related to RDF specifications for priority industries.
Institutional Framework and Governance	
7.	Guidelines for determining the form of RDF management entities/institutions, either Local Governments (at minimum in the form of UPTD-BLUD) or the private sector, taking into account capacity, technology, and offtaker requirements.
8.	Inclusion of waste management as a mandatory function within the basic services of Local Governments, regulated under the Minimum Service Standards (SPM).
Performance Monitoring and Evaluation	
9.	Guidelines for assessing RDF management performance, based on the following parameters: • Type of technology; • Functionality (system and equipment operational criteria); • RDF production volume; • Percentage of production against design capacity (idle capacity); • Fulfillment of CAPEX and OPEX costs; • Managing entity; • Utilizers (Offtakers); • Percentage of RDF absorption; • Achievement of operational days target.. These guidelines are also expected to serve as a reference for audit processes by Local Governments/Audit Institutions, with monitoring conducted annually.
10.	Mechanism for performance reporting and integration into monitored parameters within SIINSAN (Ministry of Public Works) and SIPSN (Ministry of Environment). Examples: location, capacity, status (operational/non-operational/damaged).
Cooperation and Cooperation Agreements (PKS)	
11.	Guidelines for regulating and managing cooperation in RDF management and utilization, includes: • Stakeholders required to have a Cooperation Agreement (PKS); • Matters to be stipulated in the PKS; • Relevant phases, e.g., post-completion of infrastructure and technology provision; • Duration of the PKS.
Financing and Economic Incentives	
12.	Implementation guidelines for calculating RDF OPEX costs, referring to Minister of Home Affairs Regulation No. 7 of 2021 on Procedures for Calculating Tariff Charges in Waste Management, to provide references for Local Governments with varying fiscal capacities.
13.	Guidelines on determining: • RDF tipping fee, and • BLPS for RDF.
14.	Guidelines for RDF price formulation, based on calorific value (GAR).
Emission Reduction and Environmental Aspects	
15.	Guidelines for Local Governments and offtakers on calculating estimated GHG emission reductions from waste processing into RDF and its combustion in industry, in order to measure its contribution to GHG reduction or ENDC targets.
16.	Guidelines on environmental requirements and documentation that must be fulfilled by industries prior to utilizing RDF.