Comparison Analysis on the overall GHGs/SLCPs emissions from Various Types of RDF Facilities in Indonesia

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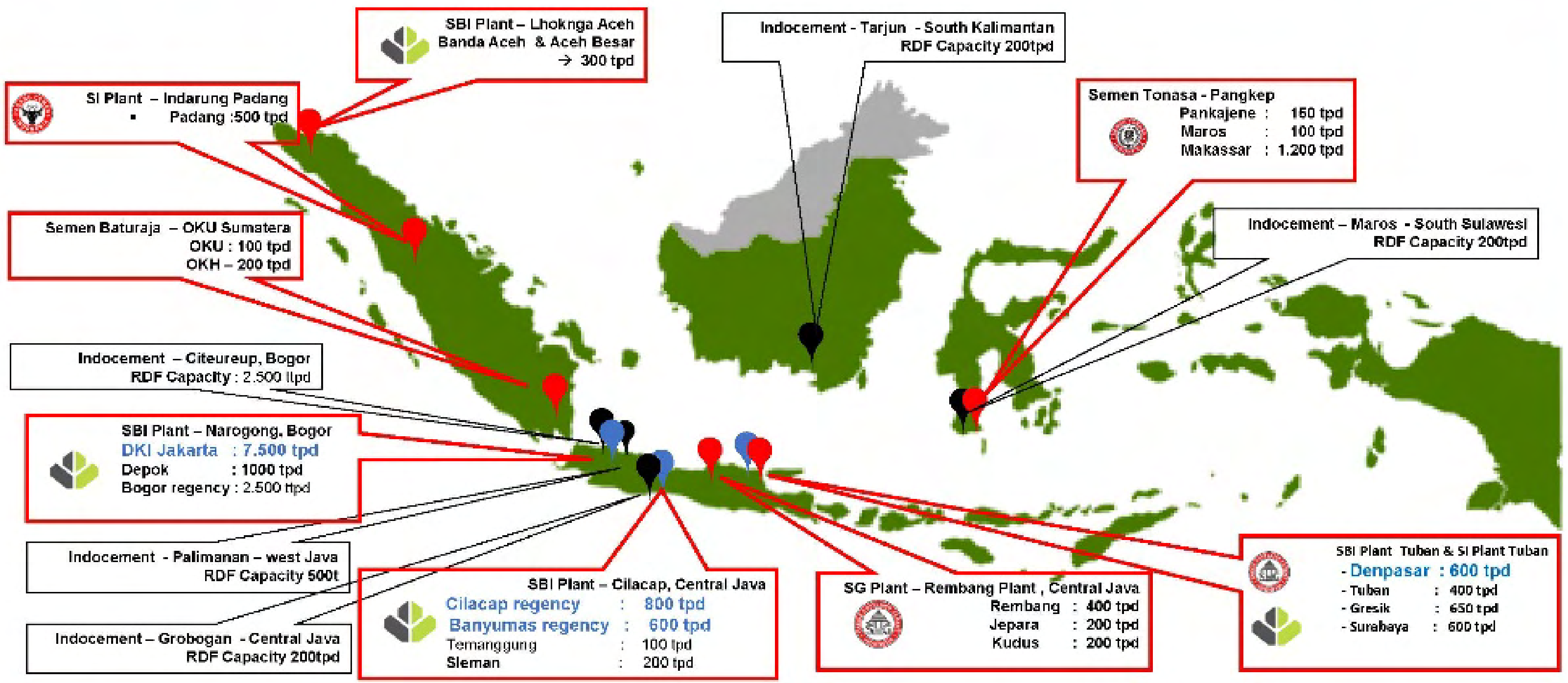
Institute for Global Environmental Strategies

Progress of utilization of RDF in Cement Industries

Initiative Examples of Switching to Alternative Fuel (3) MSW to RDF Development Project

Map of potential future development of MSW business for Cement Industries in Indonesia



NOTE :
Cement Plant use RDF
SIG
ITP

Development Completed & Continue for Operation Phase :

1. Cilacap : 70 – 80 ton/day RDF from 160 ton/day fresh MSW
2. DKI Jakarta : RDF Bantargebang (700 ton/day RDF), current production 400 tpd
3. Banyumas : Residue from ITF (10 – 15 ton/day RDF)
4. Sleman, Yogyakarta 200 tpd, current production 35 tpd

On Going & Next Project :

5. Aceh : 300 ton/day MSW
6. Padang : 300 ton/day MSW
   Tuban : 150 ton/day MSW
7. Temanggung : 100 ton/day MSW
8. Depok : 600 ton/day MSW
9. Purwakarta : 200 ton/day MSW
10. Magelang : 500 ton/day MSW
11. Rembang : 200 ton/day MSW
12. Citeureup – Bogor: 2,500 ton/day MSW
13. Palimanan-Cirebon : 500 ton/day MSW
14. Grobogan : 200 ton/day MSW
15. South Kalimantan : 200 ton/day MSW
16. South Sulawesi : 200 ton/day MSW

Cement Company	Clinker Capacity [ton per year]	TSR [%]	RDF Volume		MSW Equivalent Volume	
			Ton per year	Ton per day	Ton per year	Ton per day
Semen Indonesia Group	38,460,000	10	1,058,552	3,529	2,301,200	7,671
Other Cement Plant	35,820,432	10	933,247	3,111	2,028,799	6,762

Note : TSR = Thermal Substitution Rate

Roadmap Decarbonization to achieve Net Zero 2060 of Cement Sector & Contribute to Sectoral NDC Indonesia

INDONESIA CEMENT Decarbonization Roadmap (Draft)

		2010	2025	2030	2035	2050
Scope 1 Reduction of specific net CO_2	Reduction of clinker	81	69	68	65	60
	%TSR	3	11	23	28	40
	STEC - MJ/ton clinker	3725	3354	3358	3358	3358
	Specific net CO_2 - kg CO_2/ton cem eq	723	574	540	505	442
Scope 2	*Specific Electrical Energy Consumption (Kwh/ton Cem)*	110	95	91	90	89
Carbon capture & Other Innovative Technology *	Carbon removal through CCUS & Other Innovative Technology (Mio ton CO_2 removal)	-	-	-	2	59,2

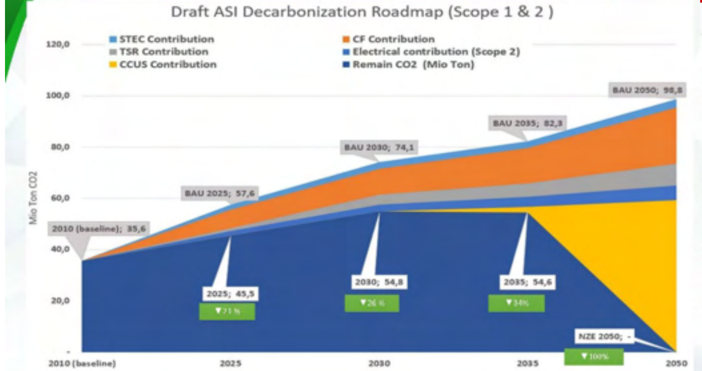
Source : Draft of Indonesia Cement Association Decarbonization Roadmap

* Note:
Depend on availability of government's role in funding research, development & demonstration programs and enabling policy related to innovative carbon reduction technology in the cement industry (e.g. hydrogen technology, carbon capture and storage technology, etc.)

FGD Roadmap Decarbonization Cement Sector, 15 Nov 2024

(DRAFT ASI) DECARBONIZATION ROAD MAP – SCOPE 1 AND SCOPE 2 (NET)

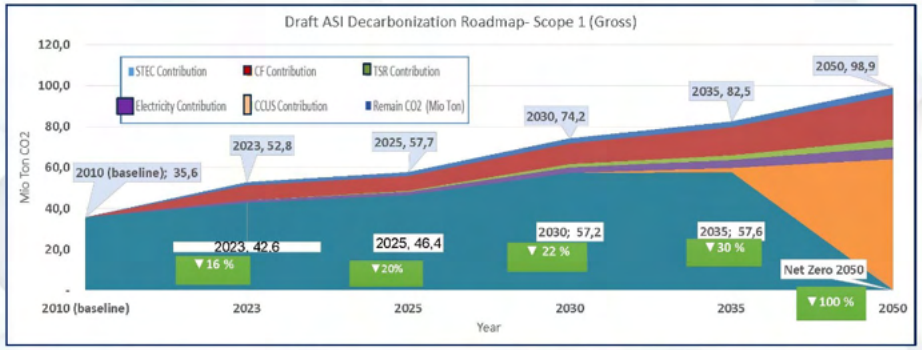
Parameter	2010 (baseline)	2025	2030	2035	2050
Produksi Semen (Ton)	43.200.000	70.000.000	90.000.000	100.000.000	120.000.000
Scope 1					
Reduction Clinker to cement ratio (%)	81	69	68	65	60
Fuel Switching (Alternative Fuel) - % TSR	3	11	23	28	40
Spesifik thermal energy - MJ/ton Cli	3725	3354	3358	3358	3358
Scope 2					



Initiatives contribution up to 2050	
STEC Contribution (%)	3,4
CF Contribution (%)	22,1
TSR Contribution (%)	8,7
Electric Scope 2 (%)	5,9
CCUs (%)	60,0
Total	100,0

- Decarbonization action till 2030 aim to reduce CO_2 emission by 19.3 mio tonnes (26% reduction from BAU), and directly affecting **reduce Greenhouse Gas emission (which causing climate change)**
- In the other hand, it gives growth **opportunity for Technology Manufacturer** and **challenge for Cement Producer** (due to additional cost)
- Therefore supports from regulator are required in accelerating the action as well (**such as : incentive, carbon pricing mechanism**)
- For CCUS we are expecting the full scale reliable technology and economically feasible and support from government

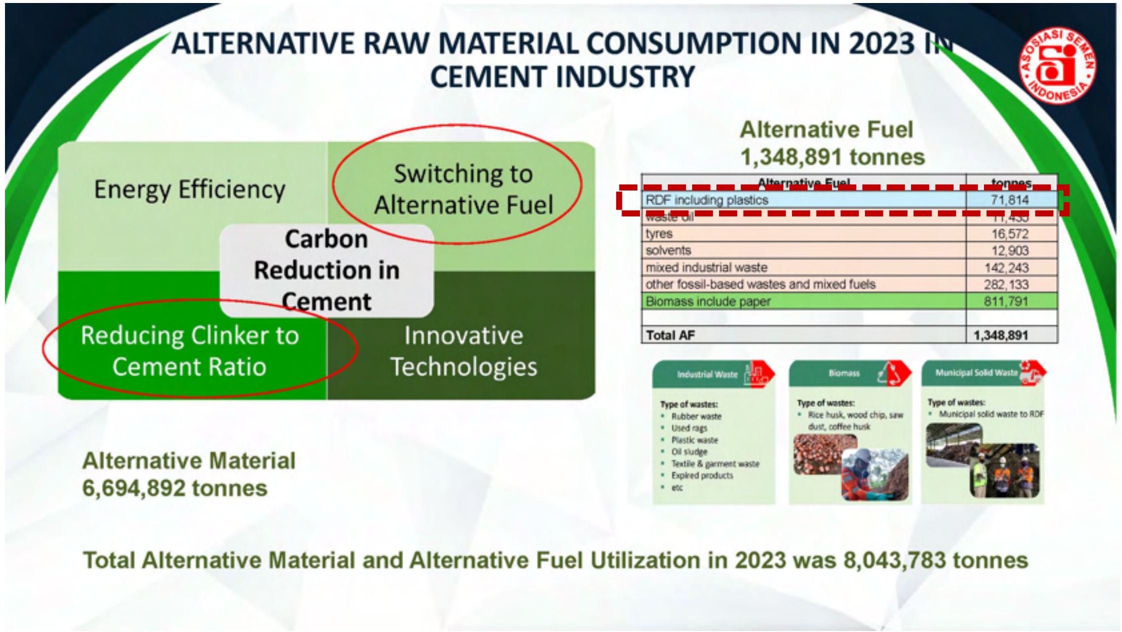
DECARBONIZATION ROAD MAP – SCOPE 1 AND SCOPE 2 (GROSS)



Initiatives Contribution in 2050	
STEC (%)	3,4
CF (%)	22,1
TSR (%)	4,0
Electricity (Scope 2)	5,9
CCUS -TBD Need to be Aligned with Gov (%)	64,6
Total (%)	100,0

Parameter	2010 (baseline)	2023 (Actual)	2025	2030	2035	2050
Produksi Semen ekuivalen (Ton)	43.200.000	64.000.000	70.000.000	90.000.000	100.000.000	120.000.000
Reduction Clinker to cement ratio (%)	81	68,5	69,0	68,0	65	60
Produksi Clinker	34.992.000	43.846.400	48.300.000	61.200.000	65.000.000	71.820.000
TSR Biomass	2	3,1	4,0	8	10	15
TSR Alternatif fosil fuel	1	6	7,0	15	18	25
TSR Traditional Fosil Fuel	97	90,9	89,0	77	72	60
Spesifik thermal energy - MJ/ton Cli	3725	3395	3355	3358	3358	3358
Scope 2						
Specific Electrical Energy Consumption (Kwh/ton Cem)	110	98	95	91	90	89

Progress of utilization of RDF in Cement Industries



1. **Total RDF Utilization by Cement Industries in 2023: 71,814 tonnes**
2. **In 2050, it is expected the RDF utilization can achieve 4 million tonnes per year (equal to 12-13 million tonnes of fresh waste) (ASI, 2024)**

RDF utilization by Cement Sector will also contribute around 20% to achieve Zero Emission Zero Waste Program of Ministry of Environment (MOE) in 2050

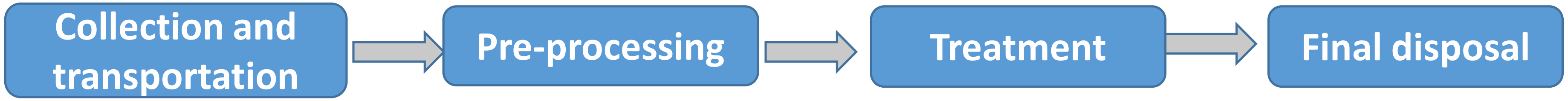
IGES/CCAC's Emission Quantification Tool (EQT):
Calculation of SLCP Emissions based on Life Cycle and IWM Approach

Available here, please download!

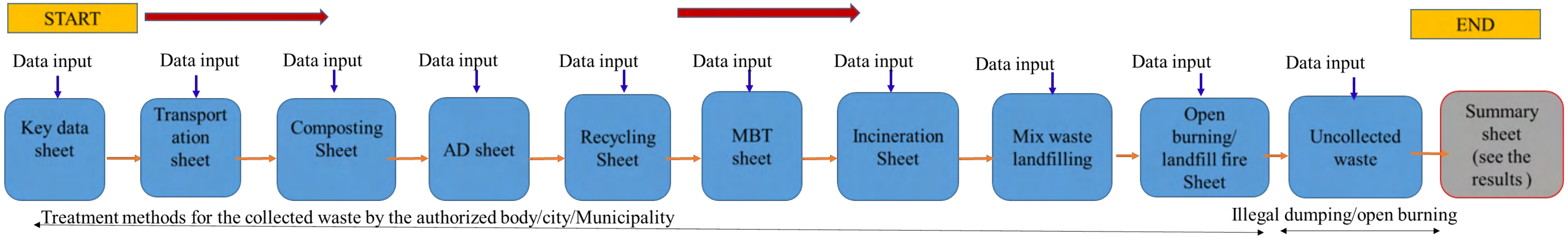
https://www.ccet.jp/publications/emission-quantification-tool-eqt-estimation-ghgsslcps-solid-waste-sector

Features of the Emission Quantification tool

- This tool is simple and step by step guidance has been provided to users in all the sheets on how to enter the data and obtain the results
- Special skill is not required and ability to work with excel would be sufficient
- Each and every sheet has designed a way that users can easily move among the sheets , enter the data and obtain the results on their preferred waste treatment options
- The tool accounts both SLCPs and other GHGs from waste management considering the entire life cycle



- Both emissions and savings potentials is accounted across the life cycle

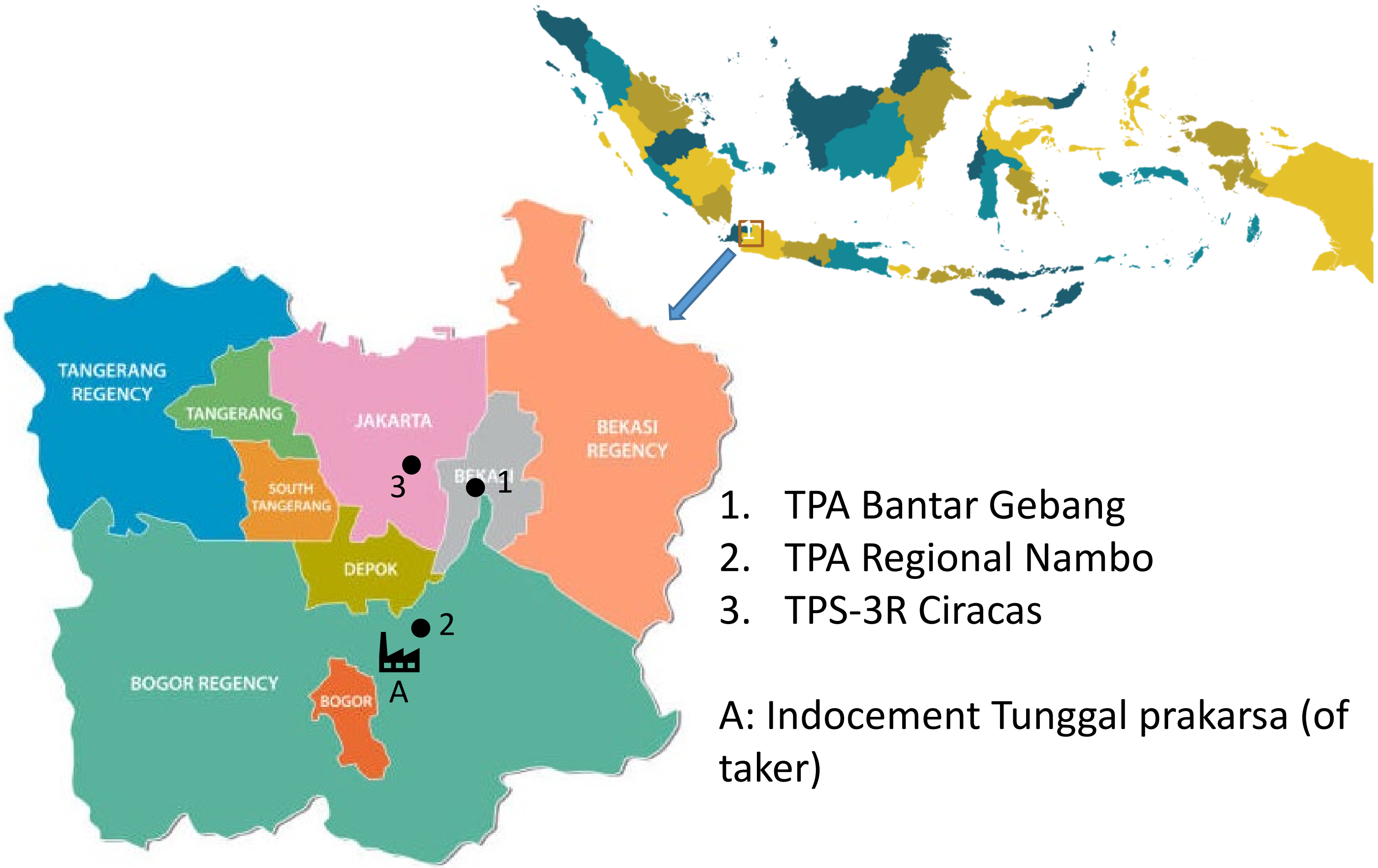


3 Priorities Case Studies
Project Profile

- Bantar Gebang a Centralized Facility at Final Disposal Site for Municipal Solid Waste of Jakarta City. Running capacity about 700 ton/day (designed capacity 2000 ton/day)

- TPA Regional Nambo – a centralized medium size facility of West Java province which served to treat waste from 4 different municipalities. The running capacity is 50 ton/day (from the design capacity of Phase 1: 400 ton/day). Final aims to be able to treat 2000 ton/day and

- TPS3R Ciracas – Decentralized RDF facilities near sources (community) with small design Capacity. Running capacity 10 ton/day (Design 20-50 ton/day)



1. TPA Bantar Gebang
2. TPA Regional Nambo
3. TPS-3R Ciracas

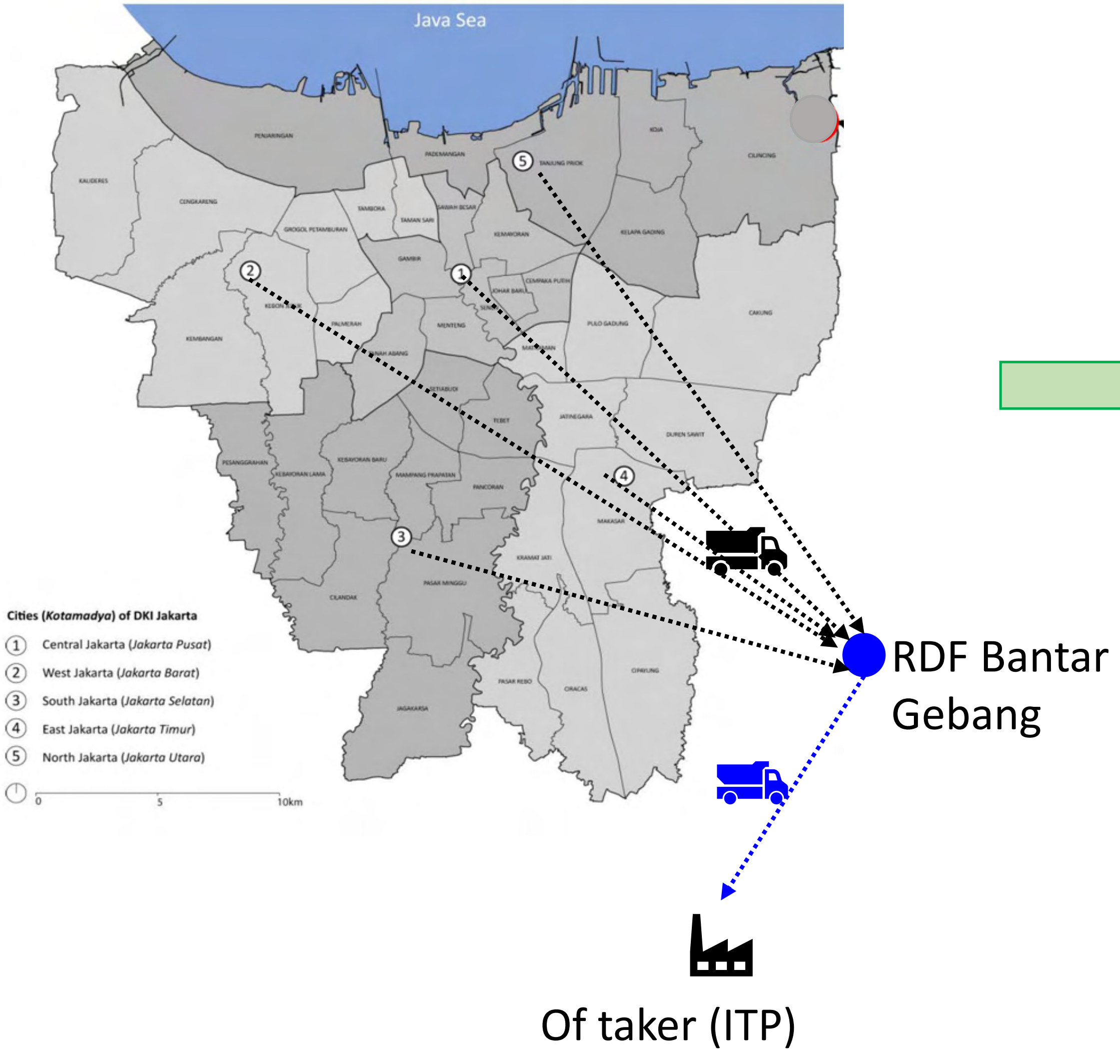
A: Indocement Tunggal prakarsa (of taker)

RDF Facilities

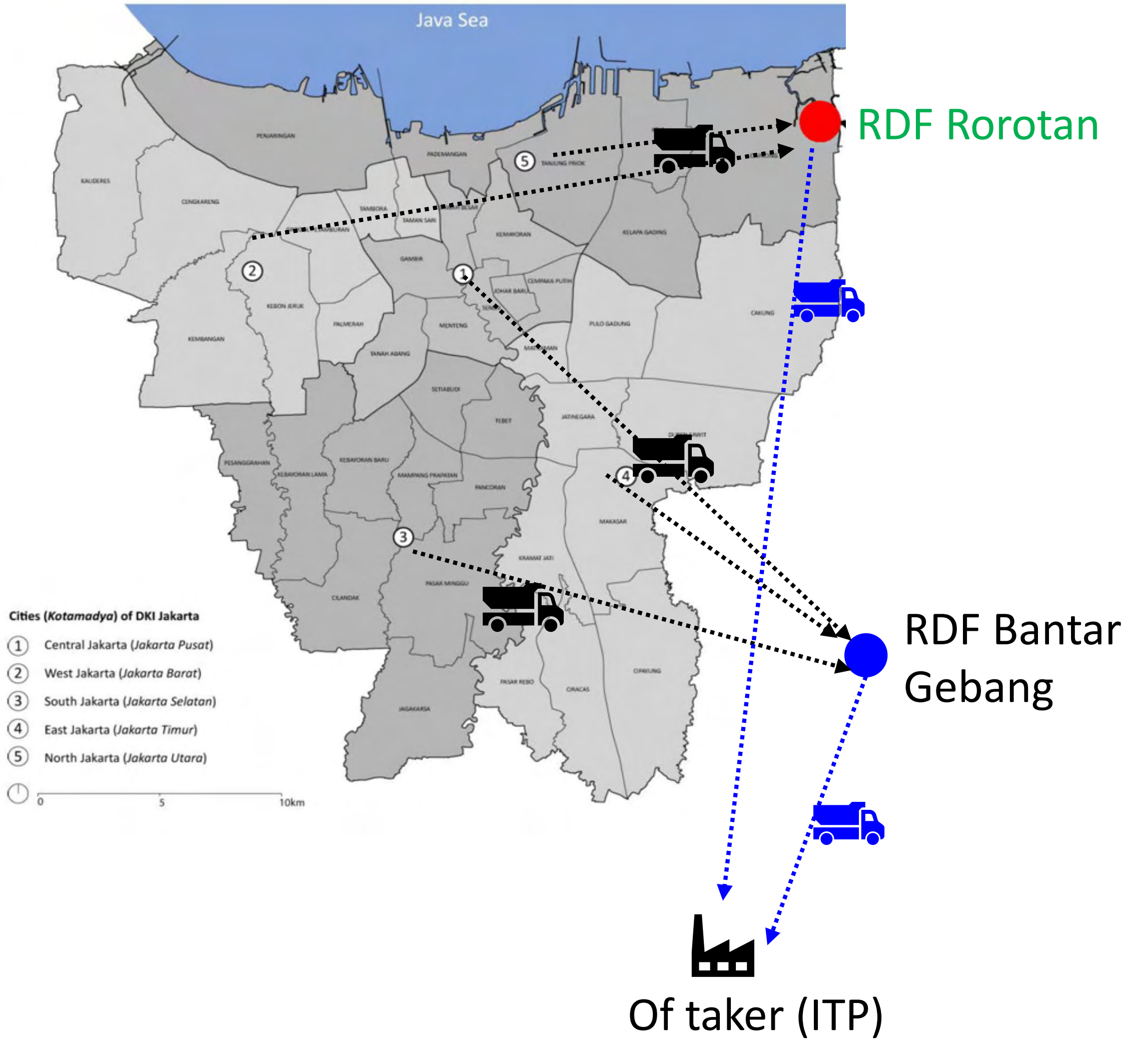
- Jakarta (Bantargebang) → Centralized large facility. Of taker are Indocement Tunggal Perkasa (ITP) (Heidelberg Group – Germany) & Solusi Bangun Indonesia (Semen Indonesia Group/SIG, Holcim Group)
- TPA Regional Nambo (Bogor Regency) → Centralized medium size RDF facility to serve and receive municipal solid waste from 4 different municipalities (Bogor City; Bogor Regency; Depok City and South Tangerang City)
- TPS3R Ciracas(East Jakarta) → Small RDF production unit within Jakarta city. Transfer the product to Bantar Gebang for storage and transportation to of taker

Case Study 1: RDF Bantar Gebang (Since 2023)

As of now (2024)



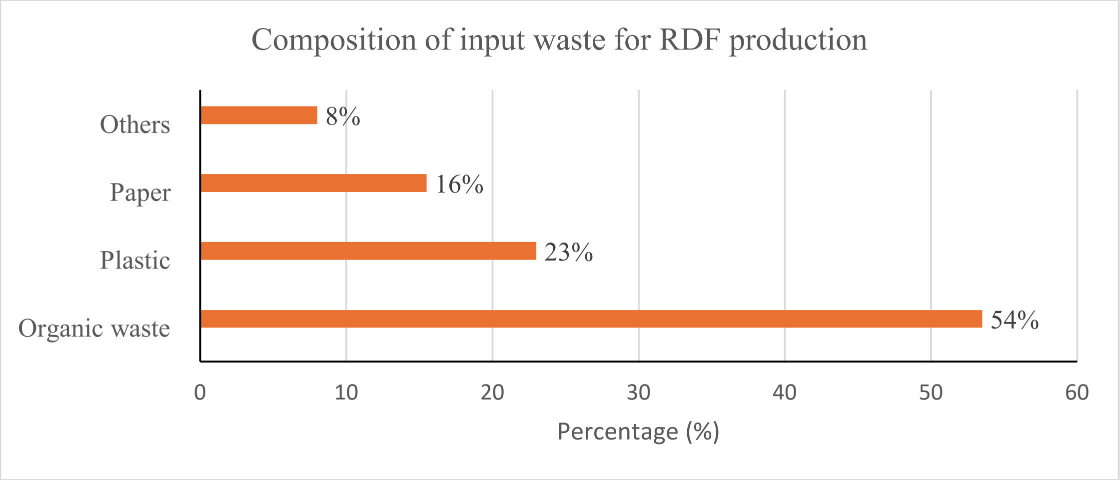
Next near future (Mid 2025 onward)



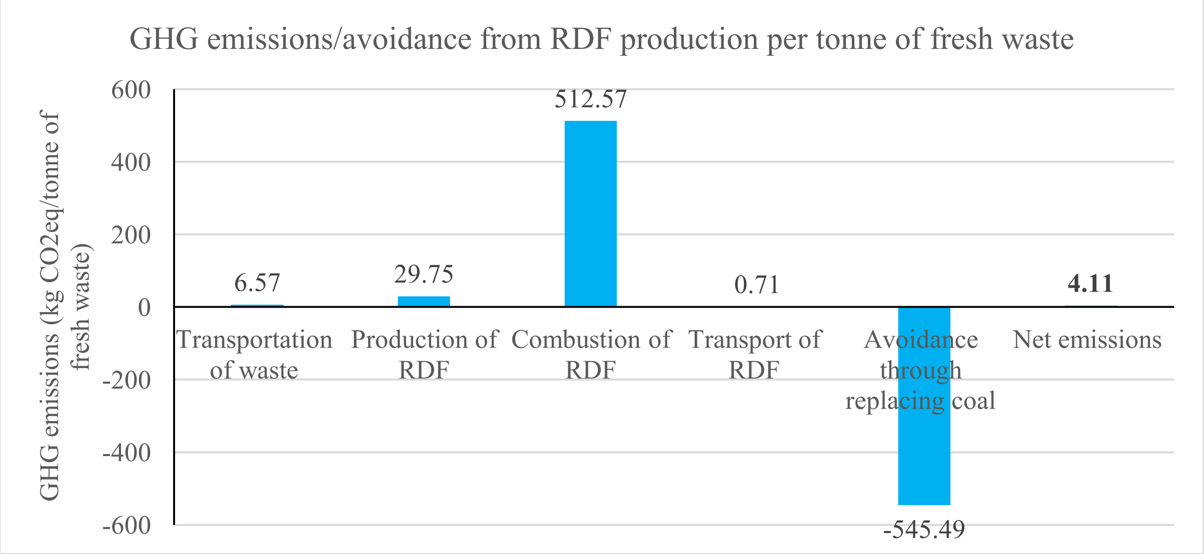
Jakarta: (1) Bantar Gebang since 2023

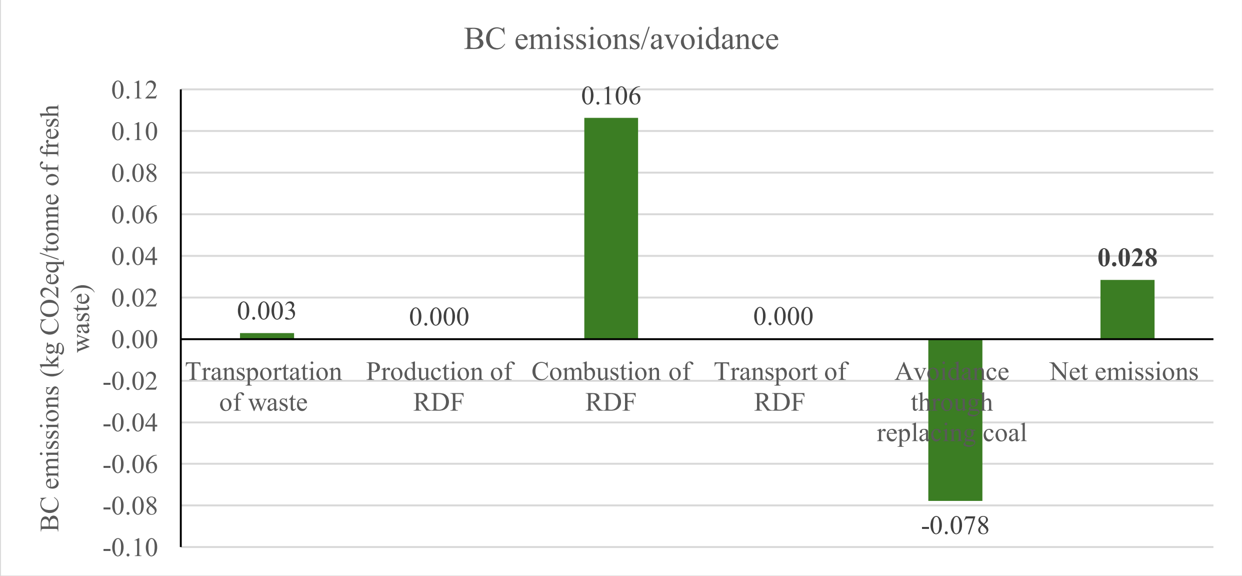
Two types:

- Mining Landfill (1000 ton/day)
- Fresh Waste (1000 ton/day)

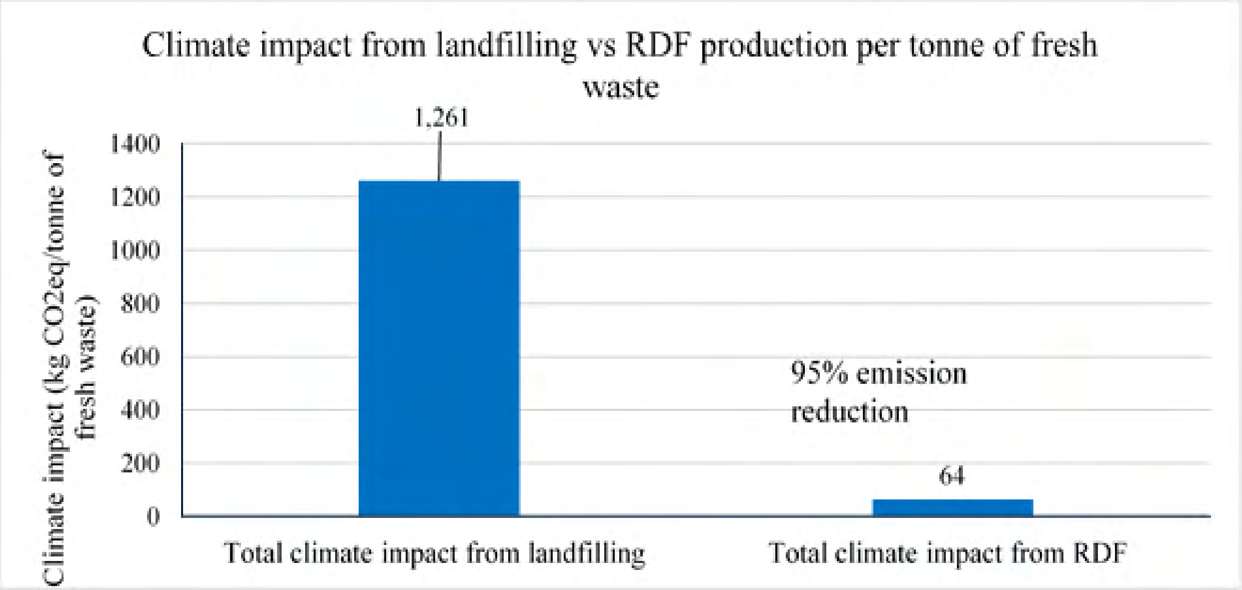


Co-benefits Analysis using EQT Tool





Type of emissions	Description	Amount of emissions/tonne of fresh waste input (kg/tonne of fresh waste)
BC emissions	BC emissions	0.11
	BC avoidance through energy recovery	0.08
	Net emissions	**0.03**
CO_2 emissions	CO_2 emissions	538.66
	CO_2 avoidance through energy recovery	543.13
	Net emissions	**-4.47**
CH_4 emissions	CH_4 emissions	0.001
	CH_4 avoidance	0.006
	Net CH_4 emissions	**-0.005**
N_2O emissions	N_2O emissions	0.02
	N_2O avoidance through energy recovery	0.01
	Net N_2O emissions	**0.01**
Net BC emissions		**0.03**
Net GHG emissions		**-2.46**



(2) TPA Regional Nambo (Since Mid 2024)

Source of Waste

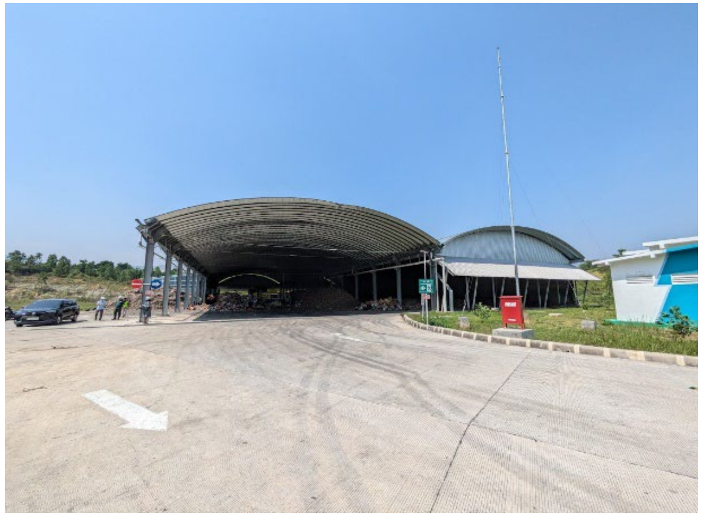
1. Bogor Regency (20 ton/day) (15 km)
2. Bogor City (10 ton/day) (7-10 km)
3. Depok City (10 ton/day) (7-10 km)
4. South Tangerang City (10 ton/day) – 30 km

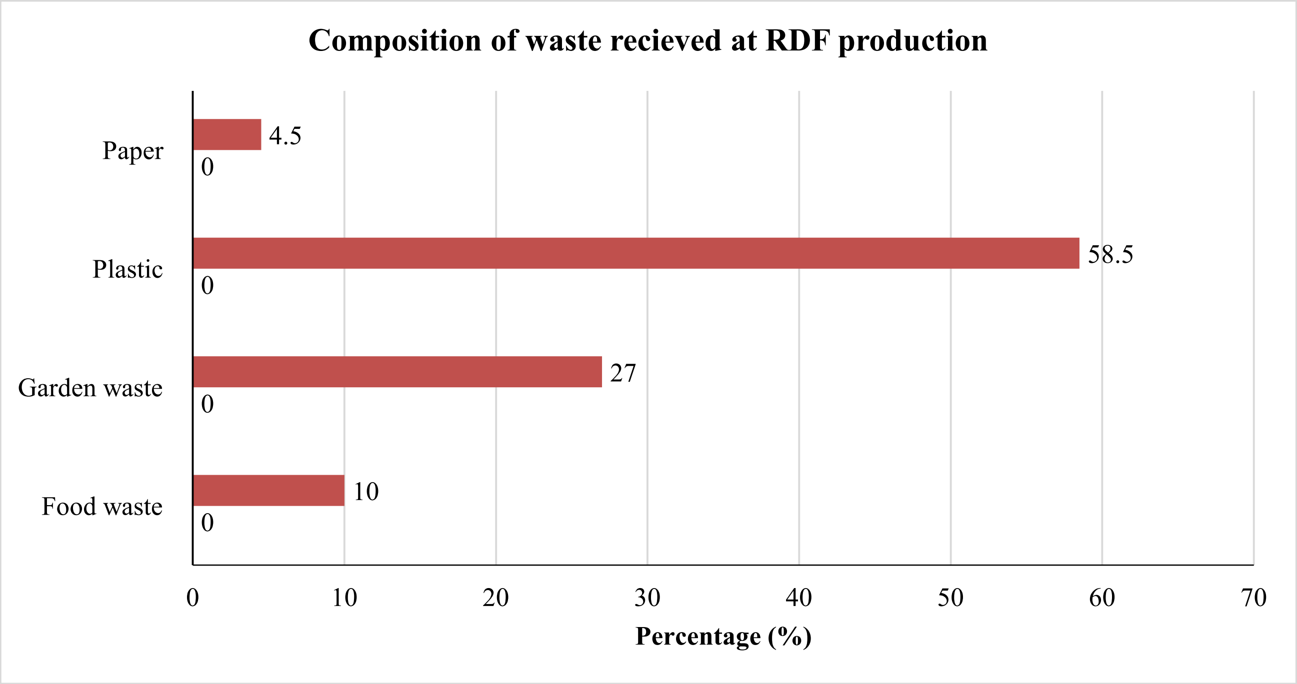
: TPA Regional Nambo (50 ton/day)

: Indocement Tunggal prakarsa (of taker)

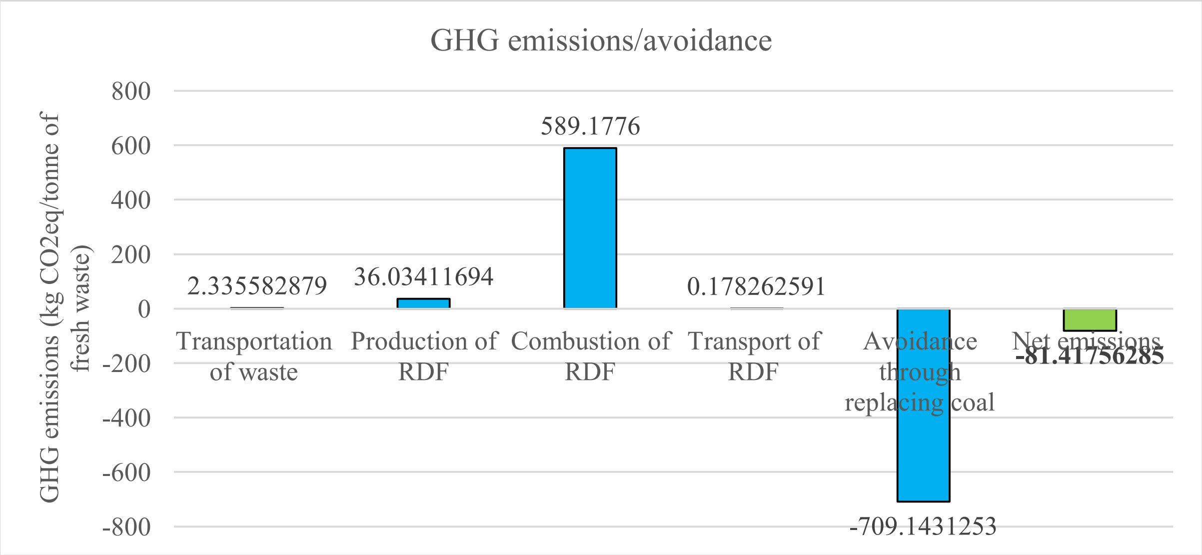
: Transportation of Fresh Municipal Waste

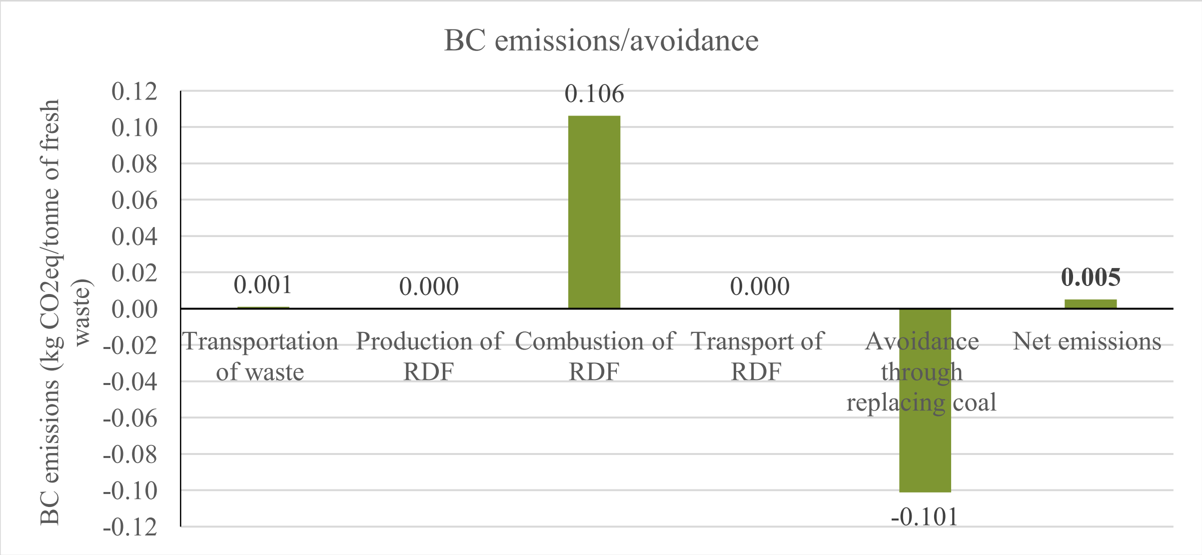
: Transportation of RDF



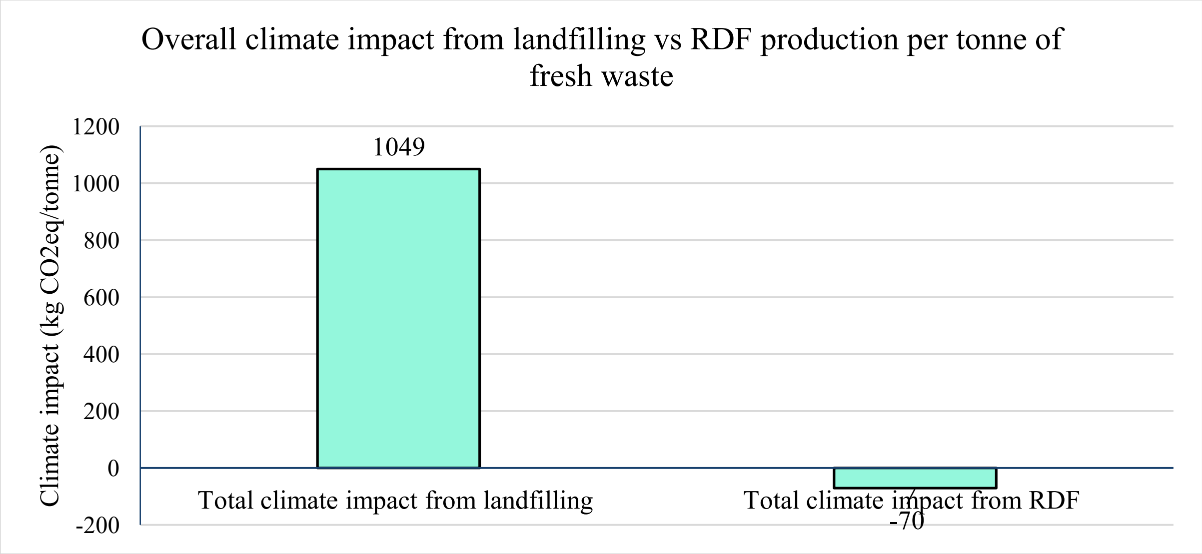

Composition of waste recieved at RDF production
Paper
4.5
0
Plastic
58.5
0
Garden waste
27
0
Food waste
10
0
0
10
20
30
40
50
60
70
Percentage (%)

Co-benefits Analysis using EQT Tool

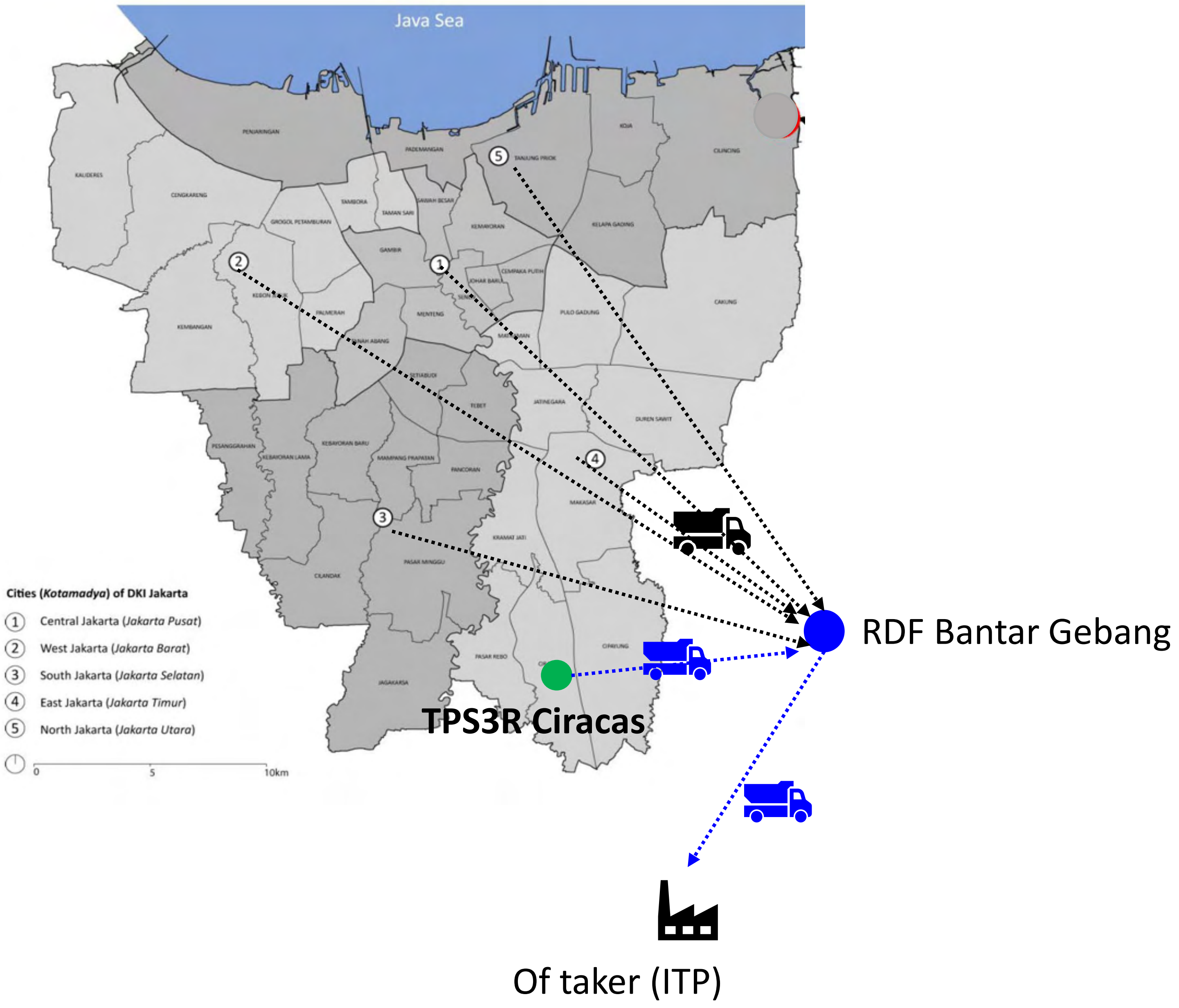




Type of emissions	Description	Amount of emissions/tonne of fresh waste input (kg/tonne of fresh waste)
BC emissions	BC emissions	0.11
	BC avoidance through energy recovery	0.10
	Net emissions	0.01
CO_2 emissions	CO2 emissions	623.35
	CO2 avoidance through energy recovery	706.07
	Net emissions	-82.72
CH_4 emissions	CH4 emissions	0.001
	CH4 avoidance	0.006
	Net CH4 emissions	-0.005
N_2O emissions	N2O emissions	0.02
	N2O avoidance through energy recovery	0.01
	Net N2O emissions	0.01
Net BC emissions		**0.01**
Net GHG emissions		**-81.42**



Case Study 3: TPS3R Ciracas (Since Early 2024)



Jakarta: (3) TPS3R Ciracas - 2024

- A small facility to receive waste from neighbourhood community
- Fresh Waste (20-50 ton/day) (no landfill at the facility)
- Residue from TPS3R will be sent over to TPA Bantar Gebang
- RDF product although possible to be transported directly to the of taker, however, at this moment it was transported to RDF Bantar Gebang
- Reference:

East Jakarta : 25-50 ton/day https://m.beritajakarta.id/potret/album/15820/melihat-pengolahan-sampah-di-tps-3r-ciracas4.


Jakarta
Sadar
Sampah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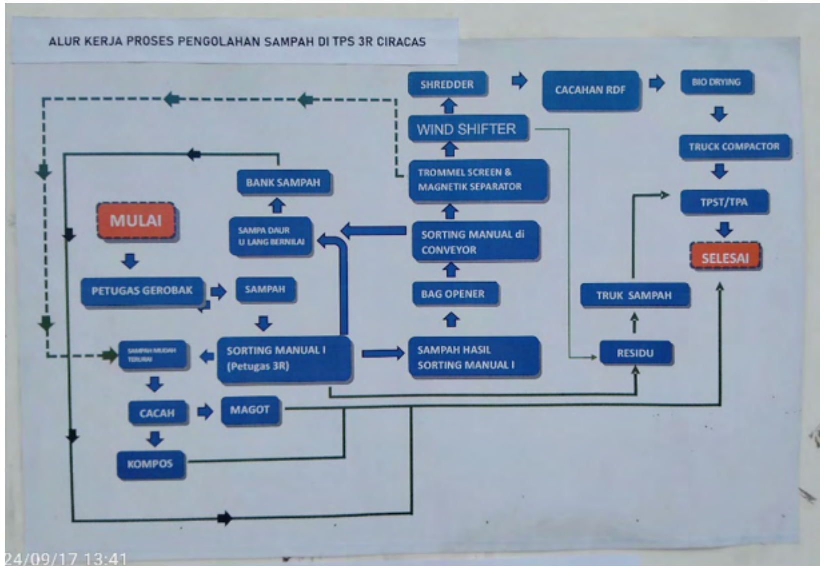
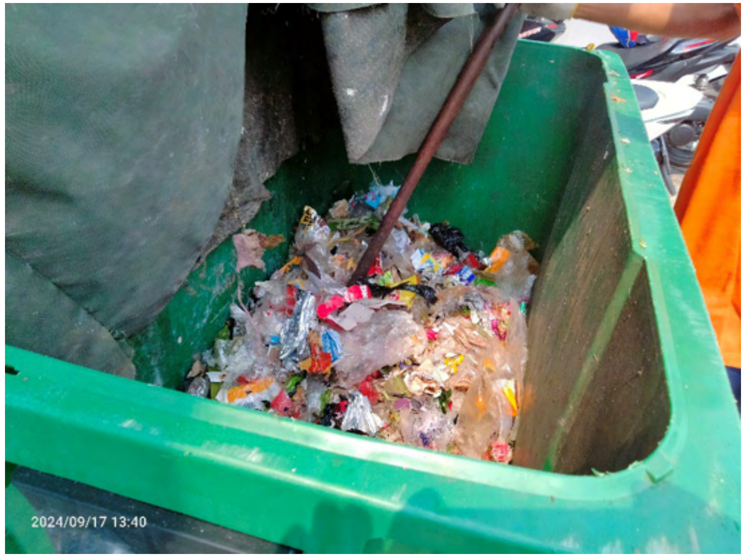
2024/09/17 13:37


ALUR KERJA PROSES PENGOLAHAN SAMPAH DI TPS 3R CIRACAS
SHREDDER
CACAHAN RDF
BIO DRYING
WIND SHIFTER
TRUCK COMPACTOR
BANK SAMPAH
TROMMEL SCREEN & MAGNETIK SEPARATOR
TPST/TPA
MULAI
SAMPA DAUR U LANG BERNILAI
SORTING MANUAL di CONVEYOR
SELESAI
PETUGAS GEROBAK
SAMPAH
BAG OPENER
TRUK SAMPAH
SORTING MANUAL I (Petugas 3R)
SAMPAH HASIL SORTING MANUAL I
RESIDU
CACAH
MAGOT
KOMPOS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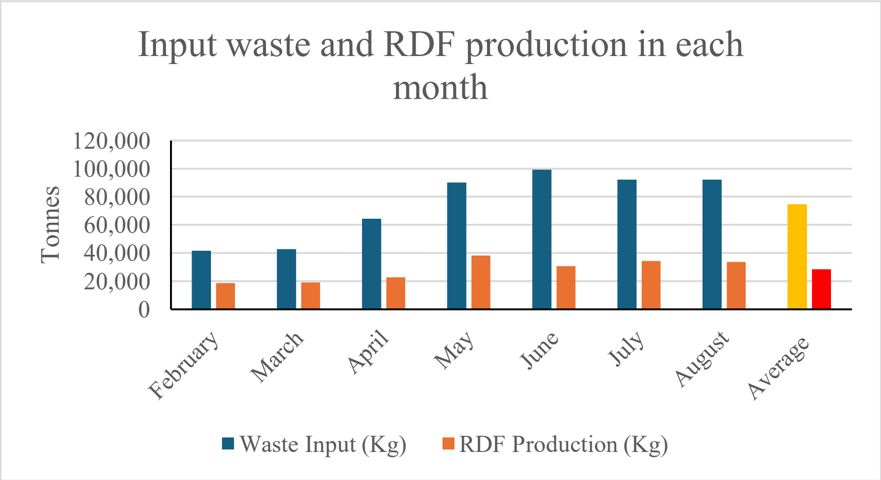
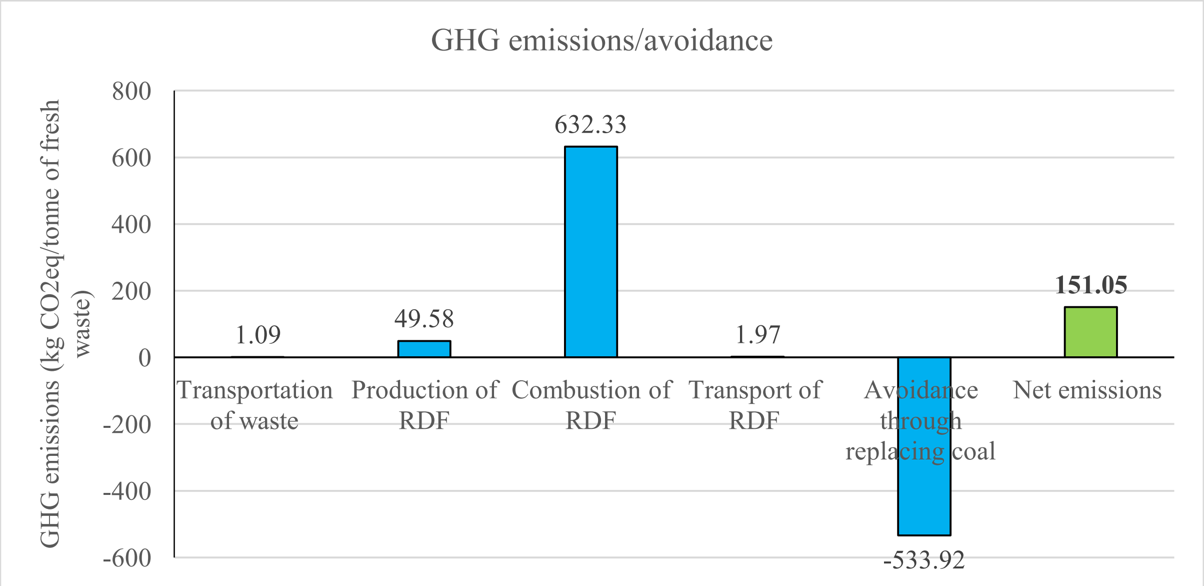
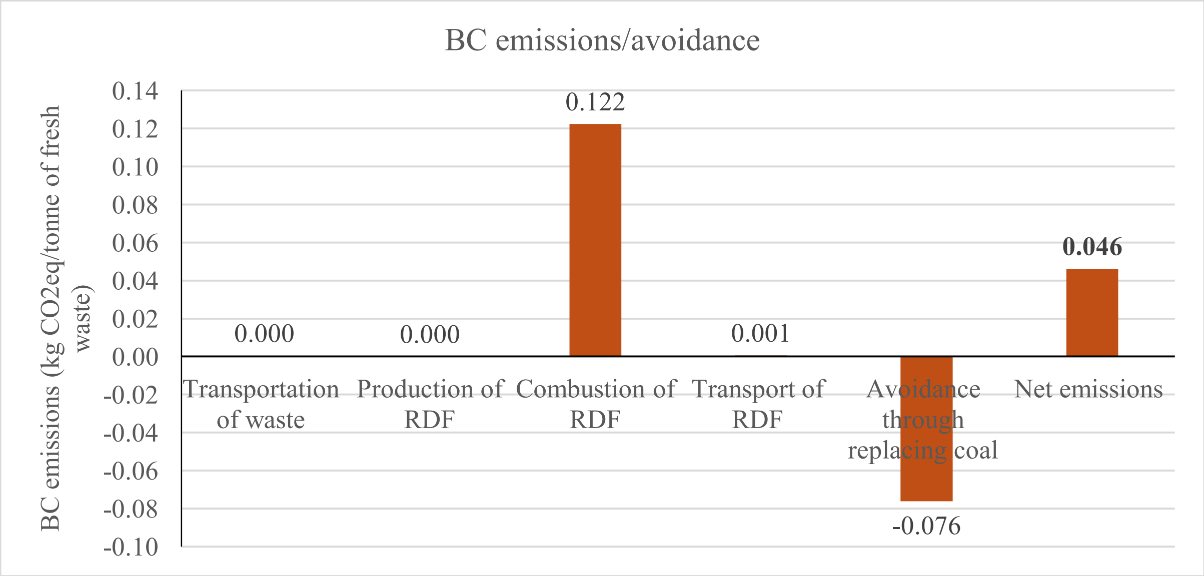
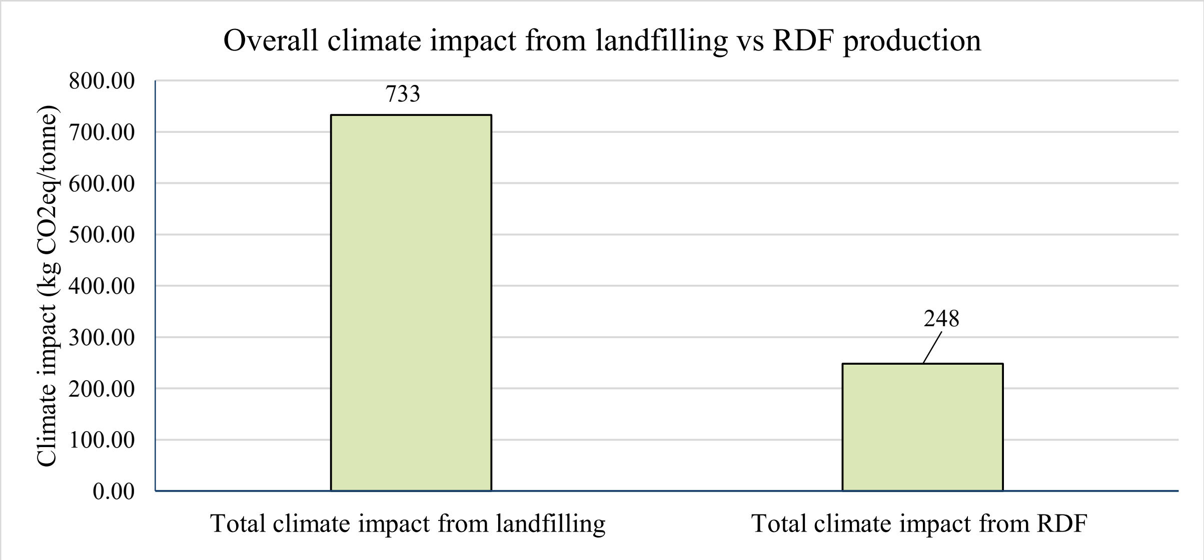

Input waste and RDF production in each month
Tonnes
120,000
100,000
80,000
60,000
40,000
20,000
0
February
March
April
May
June
July
August
Average
Waste Input (Kg)
RDF Production (Kg)

Co-benefits Analysis using EQT Tool



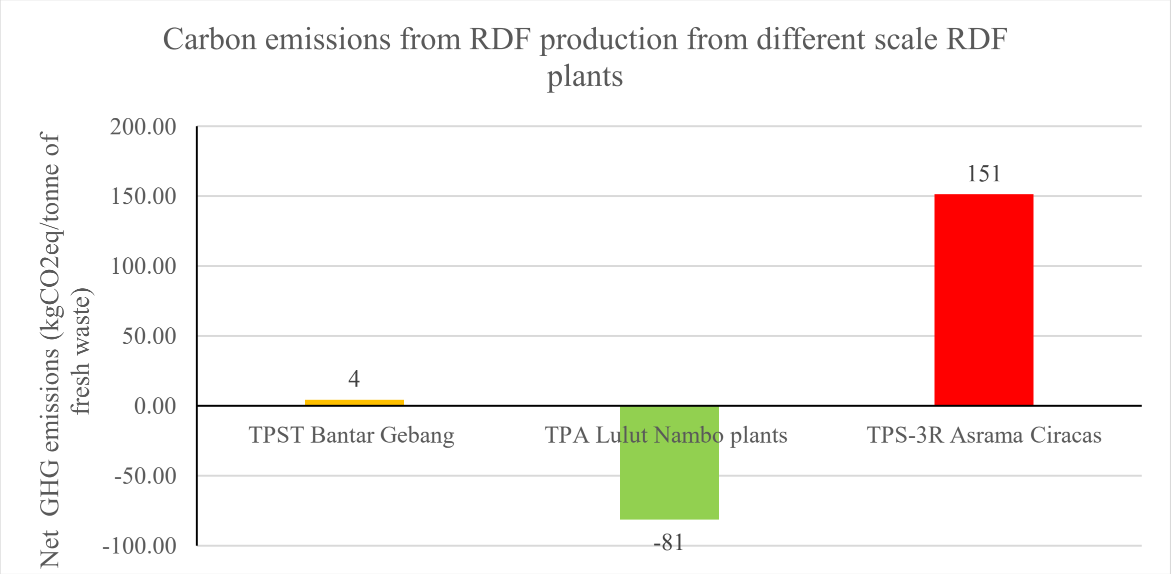


Type of emissions	Description	Amount of emissions/tonne of fresh waste input (kg/tonne of fresh waste)
BC emissions	BC emissions	0.12
	BC avoidance through energy recovery	0.08
	Net emissions	0.05
CO_2 emissions	CO2 emissions	679.93
	CO2 avoidance through energy recovery	531.61
	Net emissions	148.32
CH_4 emissions	CH4 emissions	0.001
	CH4 avoidance	0.006
	Net CH4 emissions	-0.005
N_2O emissions	N2O emissions	0.02
	N2O avoidance through energy recovery	0.01
	Net N2O emissions	0.01
Net BC emissions		**0.05**
Net GHG emissions		**151.05**



Summary of 3 Cases Study

Description	Unit	Bantar Gebang	TPA Lulut Nambo	TPS-3R Ciracas
Type of plants	Type	Centralized	Centralized	Decentralized
Designed capacity for fresh waste	Ton/day	1000 (Large)	50 (Medium)	10 (Small)
Calorific value of RDF produced	Kcal/tonne of RDF	4000	5200	3400
Net GHG emissions (fresh waste)	kg CO_2 eq/ton	4.11	-81.42	151.05
Net BC emissions (fresh waste)	kg BC/ton	0.03	0.005	0.046
GHG mitigation compared to landfilling	Percentage (%)	95%	107%	66%
Job Creation	No of Workers/Persons	300	46	10



Thank you

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