



Collaborative Strategies for Waste to Energy Implementation toward Zero Waste and Zero Emission in Indonesia

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Indonesia Pavilion Talk show:
*Towards zero waste and zero emission:
Collaborative strategies for effective
climate action*

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United Nations
Climate Change

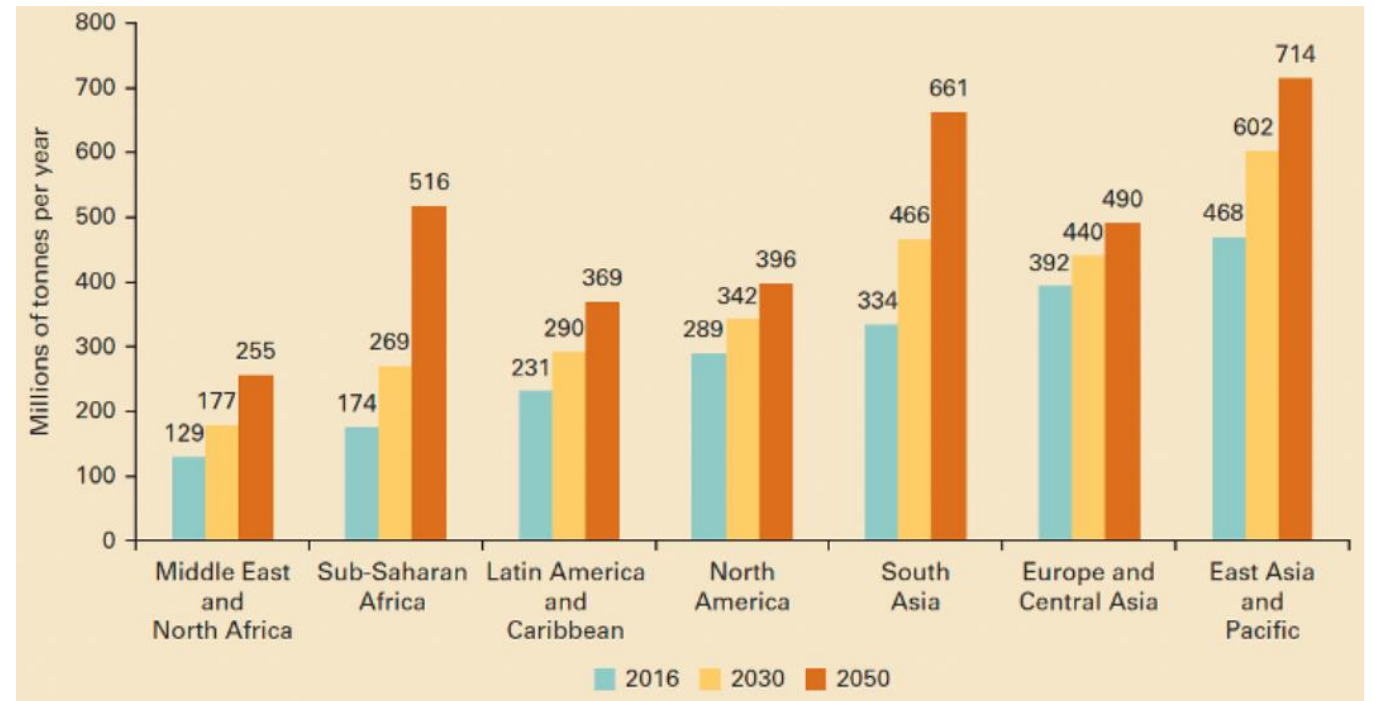


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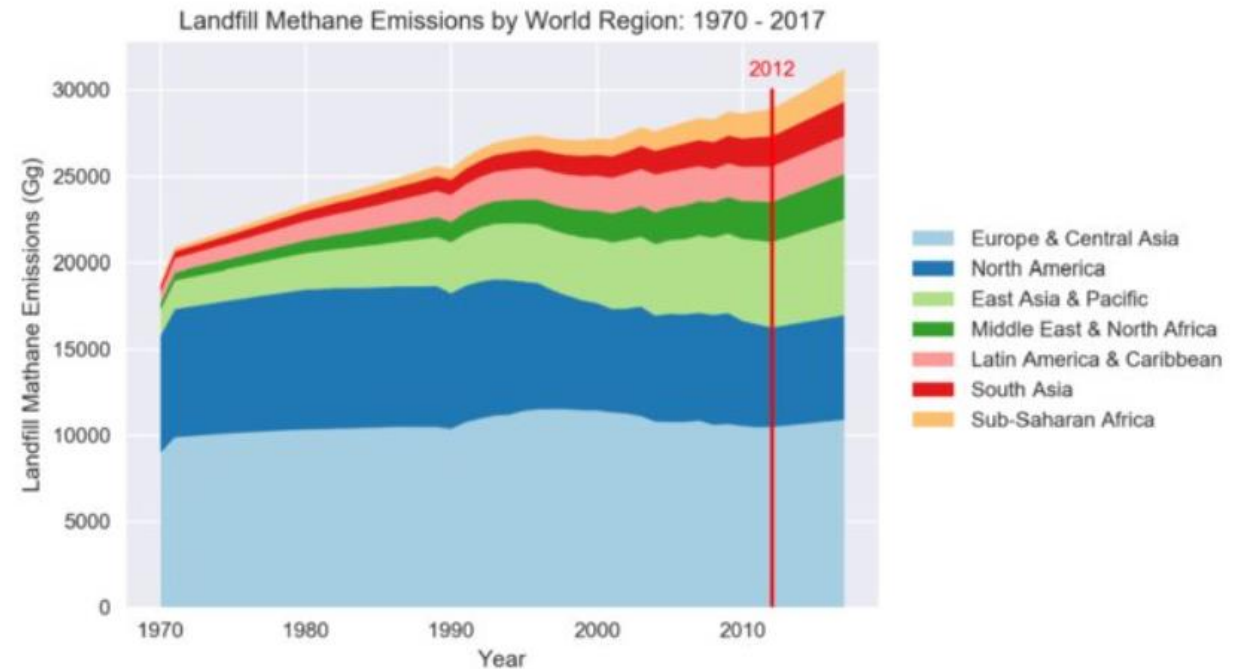
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Solid waste management is a **universal issue** that matters to every single person in the world. And with over **90% of waste** openly dumped or burned in **low-income countries**, it is the poor and most vulnerable who are disproportionately affected.



According to the World Bank, the world generates **2.01 billion tonnes** of municipal solid waste annually, with at least **33%** of that not managed in an environmentally safe manner. By 2050 we will be generating **3.88 billion tonnes** of waste each year, a 73% increase from 2020.

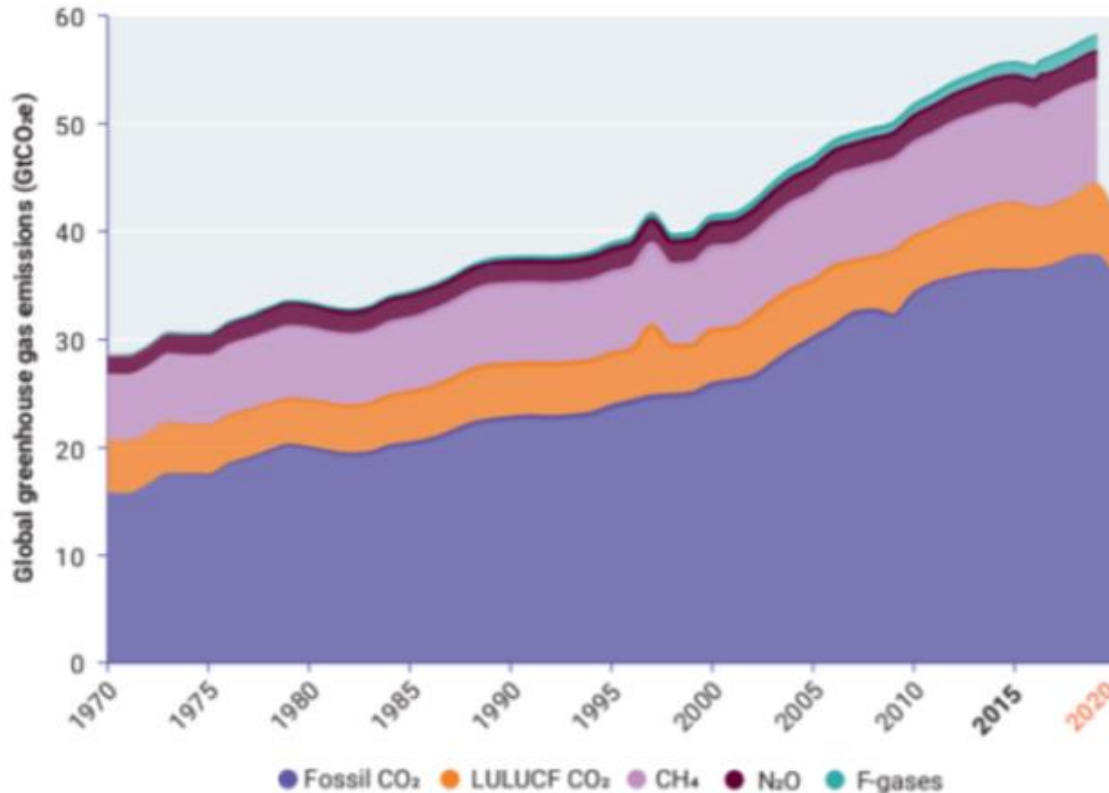
The waste sector is **one of three key methane** emitting sectors — following agriculture and oil and gas. In the short-term, methane is more than **80 times more potent** than carbon dioxide as a climate pollutant and accounts for **“nearly half of the 1 degree Celsius of warming we’ve experienced to date”**.



For every **1,000 tons** (907 metric tons) of food waste landfilled, an estimated **34 metric tons of fugitive methane** emissions (838 mmt CO₂e) are released (USPEA, 2023)

The World Bank estimates that methane emissions from waste are expected to increase by 13 megatons per year over the next decade alone.

Methane is second only to carbon dioxide (CO₂) in driving climate change. Reducing **human-caused methane emissions** is one of the **fastest, most cost-effective** strategies to reduce the rate of warming and contribute to global efforts to limit temperature rise to 1.5°C.



Limiting warming to 1.5°C at the lowest cost

By **2030**

methane emissions need to be reduced in each of the three main emitting sectors:



Reductions relative to 2020 emissions

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Indonesia the **5th largest producer of waste** globally, produces around **64 million tons** of waste annually.

Indonesia is the **second-largest plastic polluter** in the world after China (UNEP). In 2030, municipal waste produced in **367** districts/cities throughout Indonesia is **38,34 million tons/year** with **unmanaged waste** is **38.37%** or **14,71 million tons/year**.

Waste Emergency in Indonesia

Currently there are **ten provinces** whose landfill status has exceeded their storage capacity are Bengkulu, Riau Islands, West Java, Yogyakarta, Banten, Bali, South Kalimantan, East Kalimantan, West Sulawesi and Maluku (PUPR, 2021).

Their an average **excess capacity** of around **62.9 million cubic meters** per year. In fact, the average regional waste storage capacity is only **37.1 million cubic meters** per year.



Waste to Energy (WtE) can play a significant role in creating more **sustainable waste management** systems worldwide.

- By reducing landfill dependency,
- generating renewable energy, and
- promoting resource recovery,



Waste to Energy for solution to toward Zero Waste and Zero Emissions



As of early 2023, there are over **2,700** commercial (WtE) plants operating globally, with a combined disposal capacity of about **530 million tons of waste** per year. Projections suggest that by 2032, there could be more than **3,000 WtE plants** worldwide, capable of handling upwards of **700 million tons** annually.

“Direct” Waste to Energy



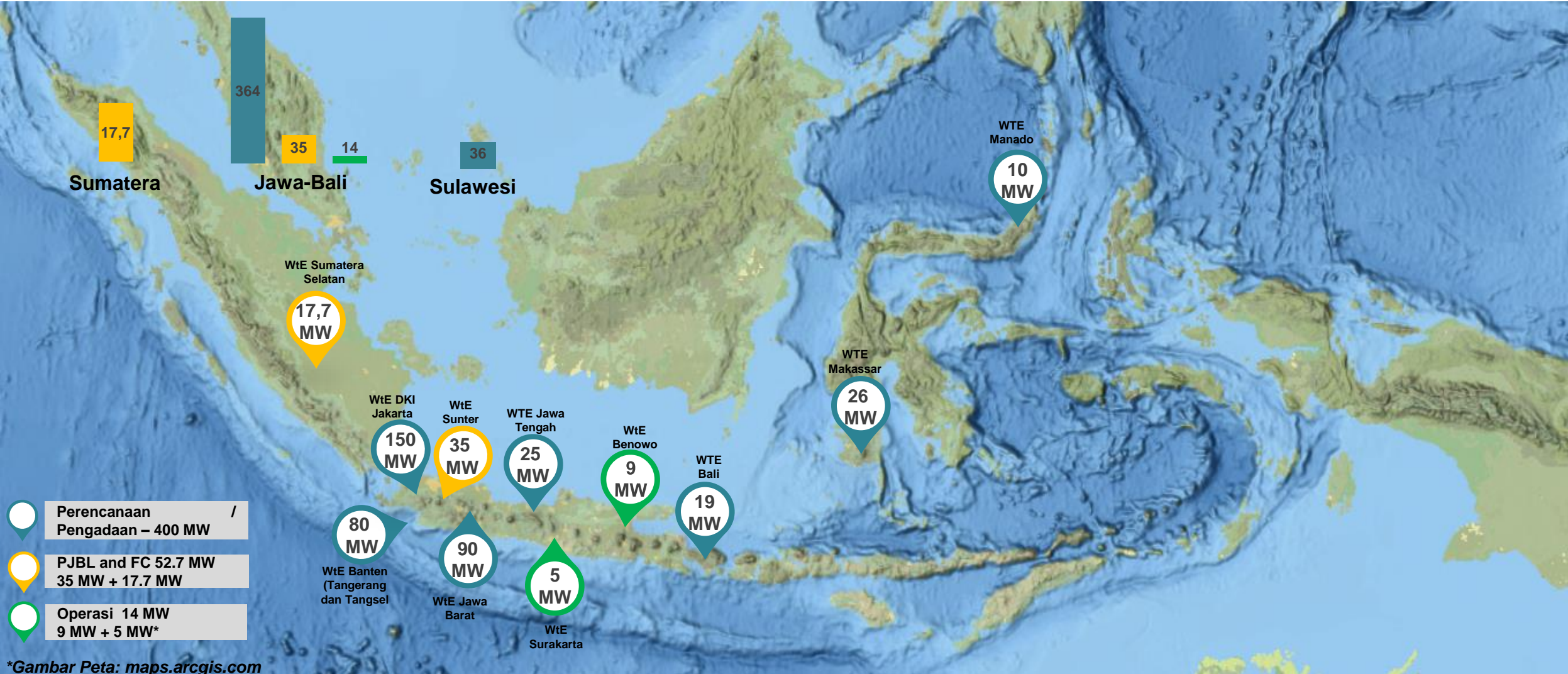
Benowo – Steam Gasification
Producing electricity by Steam Turbine

“Indirect” Waste to Energy



Cilegon - RDF (Refuse Derived Fuel)
Producing electricity by CCFP

Through **Presidential Decree No 35/2018**, Government of Indonesia has utilized **WtE** technology for solving MSW emergency case by asking **PLN** to purchase the **electricity** from WtE with **feed in tariff**. The total capacity of WtE is **452 MW**.



*Gambar Peta: maps.arcgis.com

Nowadays PLN had **PPA** within some Local government to purchase the electricity from the WtE for **20 years** based on **Presidential Decree No 35/2018** within **several technologies**

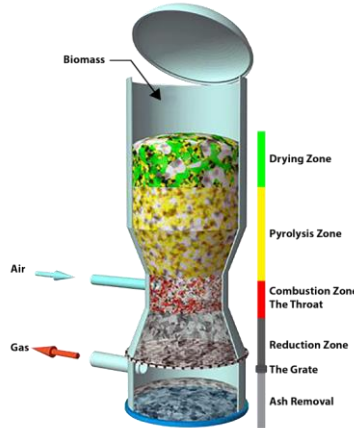


	WtE Benowo	Wte Putri Cempo	WtE Sunter	WtE Palembang
Location	Surabaya, Jawa Timur	Surakarta, Solo	Sunter, Jakarta Utara	Kertapati, Palembang
Capacity	9 MW	5 MW	35 MW	17,7 MW
Tariff	13,35 cUSD/kWh	13,35 cUSD/kWh	11,88 cUSD/kWh	13,35 cUSD/kWh
Waste Utilization	1.000 ton / day	400 ton / day	2.000 ton / day	1.000 ton / day
Technology	Gasifier – Steam Turbine	Gasifier – Gas Engine	Direct Combustion	Direct Combustion
Tipping fee	IDR 400.000/ ton	No Tipping Fee	IDR 600.000/ ton	IDR 400.000/ ton
PPA Signing	PPA 1 July 2016 COD 10 March 2021	PPA 28 Dec 2018 COD 26 January 2024	PPA 16 Oct 2019 COD 2027	PPA 21 Dec 2023 COD 2027

However, the WtE implementation in Indonesia has some challenging issues so that of the **12** designated district/provincial governments, only **4 regional governments had Power Purchase Agreement (PPA) with PLN**



Waste feedstock management



WtE technologies



Cost Budgeting and Structure

For implementation **WtE without tipping fee** for **small waste production**, the “indirect Waste to Energy” technology which is **RDF (Refuse Derived Fuel)** plant has been established at several dump site in Indonesia. The Municipal Waste is converted to be RDF for **fuel co-firing** at the existing coal fire plants around the nation.



Ministry Decree ESDM No. 12/2023 has regulated that the **biomass price (include WtE and RDF)** is **1,2x Coal price** of the existing coal fired power plant. The operational will be started after revision PMK 178/2021 approved



Specification of RDF feedstock for **co-firing fuel** power plant based on **SNI 8966:2021: minimum 80% organic**



Without tipping fee

The recent Co-firing of CCPPs



Location of **52 biomass co-firing** power plant

From **369 potential RDF** plants with the waste production < 500 ton/day, **47 dump site** is located < 30 km from the existing biomass co-firing power plant.



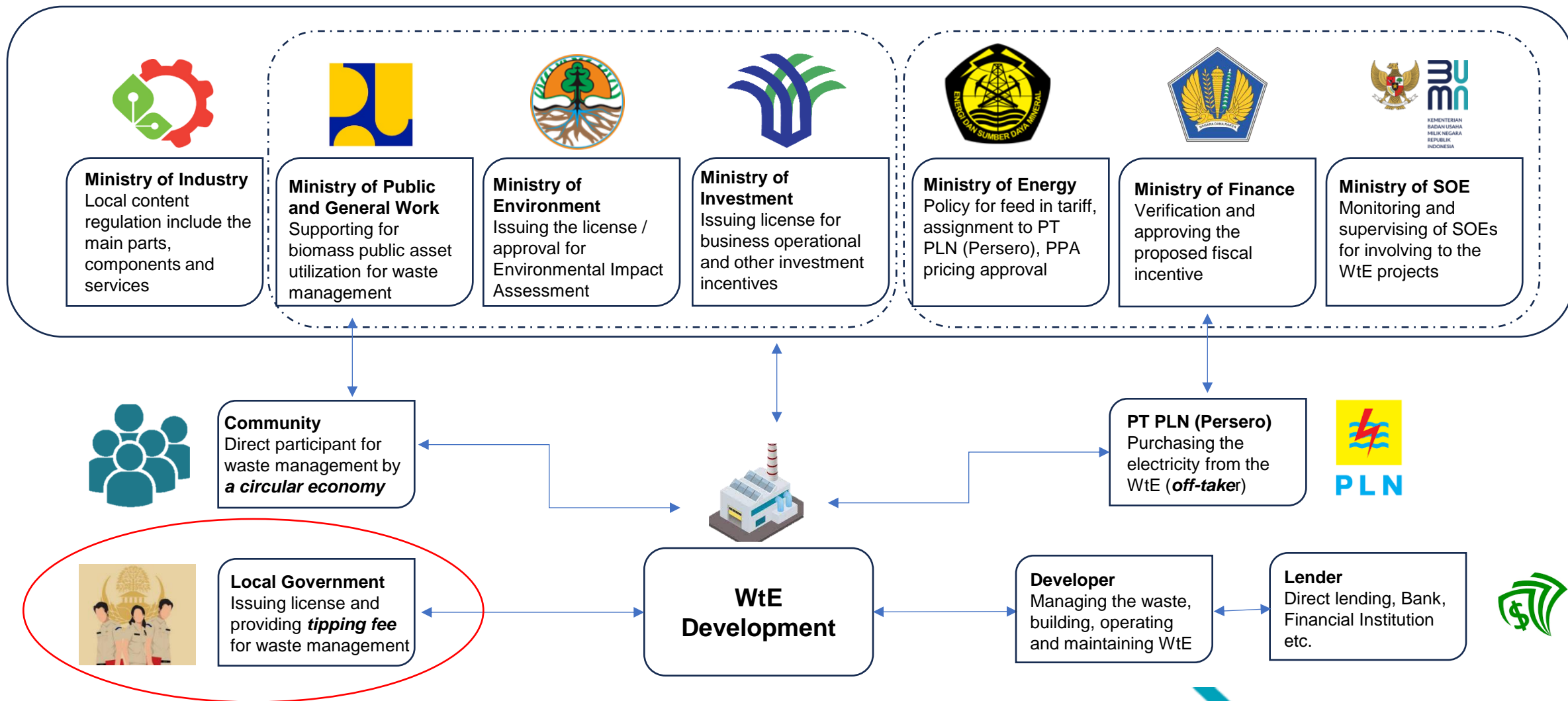
Potential RDF Plant location

Highly Potential RDF Plant
47 sites

Total waste capacity
2,4 M ton /year

Nama PLTU	Kebutuhan 1% Biomassa sampah (Ton/tahun) /Unit	Nama Fasilitas TPA	Kabupaten	Jarak TPA Ke PLTU [Km]	Potensi Sampah yg Dikelola (Ton/tahun)
PLTU ADIPALA	27.489 TPA Cilacap	Kab. Cilacap	Kab. Cilacap	11	33.633,58
PLTU LONTAR	13.781 TPA Jatiwaringin	Kab. Tangerang	Kab. Tangerang	10	343.741,67
PLTU LONTAR	13.781 TPA Dengung	Kab. Lebak	Kab. Lebak	19	25.093,75
PLTU LONTAR EXTENSION	13.781 TPA Jatiwaringin	Kab. Tangerang	Kab. Tangerang	10	343.741,67
PLTU LONTAR EXTENSION	13.781 TPA Dengung	Kab. Lebak	Kab. Lebak	19	25.093,75
PLTU PACITAN	14.904 TPA Srabah	Kab. Trenggalek	Kab. Trenggalek	28	51.100,00
PLTU PAITON (PJB)	18.875 TPA Seboroh Krejengan	Kab. Probolinggo	Kab. Probolinggo	21	21.051,60
PLTU PAITON-9	30.871 TPA Seboroh Krejengan	Kab. Probolinggo	Kab. Probolinggo	20	21.051,60
PLTU PELABUHAN RATU	16.979 TPA Cimenteng	Kab. Sukabumi	Kab. Sukabumi	27	143.080,00
PLTU PELABUHAN RATU	16.979 TPA Kadaleman	Kab. Sukabumi	Kab. Sukabumi	30	13.505,00
PLTU REMBANG	14.985 TPA LANDOH	Kab. Rembang	Kab. Rembang	18	11.822,35
PLTU SURALAYA 8	29.779 TPA Cilowong	Kota Serang	Kota Serang	29	100.878,70
PLTU SURALAYA unit 1-4	18.811 TPA Cilowong	Kota Serang	Kota Serang	28	100.878,70
PLTU SURALAYA unit 5-7	24.783 TPA Cilowong	Kota Serang	Kota Serang	28	100.878,70
PLTU TANJUNG JATI B Unit 1-2	30.037 TPA KRASAK	Kab. Jepara	Kab. Jepara	9	3.686,50
PLTU TANJUNG JATI B Unit 1-2	30.037 TPA Bandengan Jepara	Kab. Jepara	Kab. Jepara	16	19.418,00
PLTU TANJUNG JATI B Unit 1-2	30.037 TPA Gemulung Jepara	Kab. Jepara	Kab. Jepara	29	2.336,00
PLTU TANJUNG JATI B Unit 3-4	30.037 TPA KRASAK	Kab. Jepara	Kab. Jepara	9	3.686,50
PLTU TANJUNG JATI B Unit 3-4	30.037 TPA Bandengan Jepara	Kab. Jepara	Kab. Jepara	16	19.418,00
PLTU TANJUNG JATI B Unit 3-4	30.037 TPA Gemulung Jepara	Kab. Jepara	Kab. Jepara	29	2.336,00
PLTU Tj AWAR AWAR	17.510 TPA Gunung Panggung	Kab. Tuban	Kab. Tuban	15	0,00
PLTU BENGKAYANG (PLTU 3 KALBAR)	3.076 TPA WONOSARI	Kota Singkawang	Kota Singkawang	19	13.798,21
PLTU BERAU	644 TPA Bujangga	Kab. Berau	Kab. Berau	9	15.983,35
PLTU PULANG PISAU	2.400 TPA HANDEL PALINGET	Kab. Kapuas	Kab. Kapuas	30	5.580,85
PLTU SANGGAU	328 TPA Sungai Kosak	Kab. Sanggau	Kab. Sanggau	14	13.510,47
PLTU TELUK BALIKPAPAN	5.154 TPA Bulumunung	Kab. Penajam Paser Utara	Kab. Penajam Paser Utara	10	8.092,05
PLTU TELUK BALIKPAPAN	5.154 UPTD TPA Sampah Manggar	Kota Balikpapan	Kota Balikpapan	18	128.239,11
PLTU SOFIFI	322 TPA RUMBUNE	Kota Tidore Kepulauan	Kota Tidore Kepulauan	20	8.190,60
PLTU TIDORE	353 TPA RUMBUNE	Kota Tidore Kepulauan	Kota Tidore Kepulauan	1	8.190,60
PLTU TIDORE	353 TPA BUKU DERU-DERU	Kota Ternate	Kota Ternate	14	18.231,75
PLTU LOMBOK FTP 2	2.414 TPA Ijobalit	Kab. Lombok Timur	Kab. Lombok Timur	27	49.989,31
PLTU BARRU	1.771 TPA Padangloang	Kab. Barru	Kab. Barru	15	12.656,38
PLTU BANGKA BARU (Air Anyir)	2.334 TPA Parit Enam	Kota Pangkal Pinang	Kota Pangkal Pinang	7	12.410,00
PLTU BANGKA BARU (Air Anyir)	2.334 TPA KENANGA	Kab. Bangka	Kab. Bangka	18	26.097,50
PLTU BUKIT ASAM	3.361 TPA Bukit Kancil	Kab. Muara Enim	Kab. Muara Enim	5	34.277,15
PLTU BUKIT ASAM	3.361 TPA Sukarami	Kab. Lahat	Kab. Lahat	29	40.285,05
PLTU LABUHAN ANGIN	7.227 TPA Sibolga	Kota Sibolga	Kota Sibolga	8	15.038,00
PLTU OMBILIN	4.568 TPA Sampah Kayu Gadang	Kota Sawahlunto	Kota Sawahlunto	6	5.068,03
PLTU OMBILIN	4.568 TPA Sampah Regional Solok	Kota Solok	Kota Solok	22	16.162,20
PLTU OMBILIN	4.568 TPA Bukik Sangkiang	Kab. Tanah Datar	Kab. Tanah Datar	24	15.523,45
PLTU PANGKALAN SUSU	10.463 TPA tangkahan durian	Kab. Langkat	Kab. Langkat	15	7.300,00
PLTU TANJUNG BALAI KARIMUN	330 TPA Sememal	Kab. Karimun	Kab. Karimun	10	46.902,50
PLTU TARAHAH	4.567 TPA Bakung	Kota Bandar Lampung	Kota Bandar Lampung	14	9.636,00
PLTU TARAHAH BARU (SEBALANG)	5.886 TPA Bakung	Kota Bandar Lampung	Kota Bandar Lampung	22	9.636,00
PLTU TELUK SIRIH	5.429 UPT TPA SAMPAH	Kota Padang	Kota Padang	27	163.885,00
PLTU TENAYAN	7.050 TPA- 2 Muara Fajar	Kota Pekanbaru	Kota Pekanbaru	13	282.739,95
PLTU TENAYAN	7.050 TPA Tualang	Kab. Siak	Kab. Siak	17	14.581,75

PLN, as off-taker, can not do alone. To implement WtE successfully in Indonesia we need **Strategic Collaboration**. However, the most determinant party is the **Local Government**.



Conclusion

1. Solid waste management is a universal issue and one of three key methane emitting sectors — following agriculture and oil and gas.
2. Reducing human-caused methane emissions is one of the fastest, most cost-effective strategies to reduce the rate of warming and contribute to limit temperature rise to 1.5°C global.
3. Some low-income countries include Indonesia already had waste emergency case
4. Waste to Energy (**WtE**) can play a significant role to achieve zero waste and zero emission worldwide.
 - By reducing landfill dependency,
 - generating renewable energy, and
 - promoting resource recovery
5. Government of Indonesia has utilized WtE technology for solving MSW emergency by:
 - Direct WtE for large scale waste utilization
 - Indirect WtE using RDF for co firing fuel for the existing power plants
6. However, the WtE implementation in Indonesia has some challenging issues. Strategic Collaboration is needed for implementing WtE successfully in this region.



PLN

THANK YOU

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