Applied Research in Science and Technology 5(1): 86–96 2025

Contents lists available at openscie.com
E-ISSN: 2776-7205
Applied Research in Science and Technology
DOI: 10.33292/areste.v5i1.72
Journal homepage: https://areste.org/index.php/oai

Waste Power Plant as an Innovative Solution to Overcome Air Pollution in Bantargebang Integrated Waste Management Facility

Ihsanuddin Fadillah[1], Katarina Apriani[1], Intan Suroya Hazlin[1], Syabrina Samsu Raudathul Mawadah[1], Suyen E. M. Siringoringo[1], M. Ridho Ulya[1], Muhammad Hakiem Sedo Putra[2]

[1]Department of Environmental Engineering, University of Lampung, Lampung, Indonesia

[2]Department of Integrated Water Management Engineering, Institute Technology of Sumatera, Lampung, Indonesia

*Correspondence E-mail: m.ridhoulya@eng.unila.ac.id

ARTICLE INFO

Article History:
Received 08 May 2025
Revised 13 June 2025
Accepted 23 June 2025
Published 26 June 2025

Keywords:
Air Pollution Control,
Bantargebang,
Thermal Incineration,
Waste Power Plant.

ABSTRACT

Background: The dominance of domestic waste in Bantargebang Integrated Waste Management Facility (IWMF), makes the characteristics of the waste can be categorized as combustible waste, with the type of waste mostly plastic and non-plastic. Waste dumped in Bantargebang creates new problems related to environmental pollution. The Merah Putih Waste Power Plant (Pembangkit Listrik Tenaga Sampah = PLTSa) is an important thing in efforts to control air pollution and waste management, where the quantity of waste production is relatively large and needs to be handled immediately.
Aims: This study aims to analyze the benefits of the Waste Power Plant in reducing air pollution at the Bantargebang IWMF.
Methods: The research uses a descriptive approach to systematically describe, analyze, and explain phenomena. In addition, quantitative analysis is applied to process and interpret data in the form of numbers. Data collection methods include air pollution data analysis, where air quality monitoring data was collected at 2019 before the PLTSa began operating and 2024 after the PLTSa began operating.
Result: Based on the data obtained, the air quality in 2019 before the PLTSa operated and after the PLTSa operated in 2024, the concentration of PM2.5 decreased to 33.8 µg/m³, SO2 decreased to 2.1 µg/m³, CO decreased to 1.437 µg/m³, NO_2 decreased to 0.5 µg/m³. Furthermore, it can be seen that after the PLTSa Merah Putih Bantargebang began operating in mid-2019, it showed benefits in 2024, where most air pollutants decreased compared to 2019, such as PM2.5, SO_2, CO, and NO_2. This decrease reflects the success of the emission control system from the waste combustion process applied to the PLTSa.

To cite this article: Fadillah, I., Apriani, K., Hazlin, I. S., Mawadah, S. S. R., Siringoringo, S. E. M., Ulya, M. R., Putra, M. H. S. (2025). Waste power plant as an innovative solution to overcome air pollution in Bantargebang. *Applied Research in Science and Technology*, 5(1), 86–96.

1. Introduction

Bantargebang, Bekasi, is one of the largest landfills in Indonesia. The volume of waste from Jakarta to IWMF Bantar Gebang averages around 7,000 to 8,000 tons per day which is served by 1,200 garbage trucks, of which 60% is domestic or household waste (Sukwika & Noviana, 2020). The dominance of domestic waste in Bantargebang makes the waste characteristics categorized as combustible waste, with the type of waste mostly plastic and some non-plastic. As a result, the large amount of waste dumped into Bantargebang creates new problems related to pollution in the environment. The most significant environmental pollution problem in Bantargebang is closely related to air pollution in the Bantargebang area, and air pollution is a major concern due to methane gas emissions produced from the decomposition process of non-organic and organic materials originating from various places, especially households and trade centers such as markets (Nazaruddin, 2022).

The Merah Putih Waste Power Plant (PLTSa) is an important thing in efforts to control air pollution and waste management because the quantity of waste production is relatively large, with waste characteristics that have diverse compositions and irregular waste collection in the community according to the characteristics of the waste and is not supported by adequate waste transportation facilities, making PLTSa with thermal incineration technology an alternative way to convert waste into electrical energy and reduce waste decomposition. The selection of technology in the Merah Putih PLTSa is also important to consider according to field needs, and the decision to use thermal incineration technology with a reciprocating grate system, which is capable of burning waste at temperatures above 850°C, is the right decision because the advantages of this technology can convert the mass and volume of waste up to 90% smaller than the original mass and volume, the energy produced can also help operate thermal incineration technology so that operational costs for energy needs are cheaper, this technology also applies an air pollution control system with an Electrostatic Precipitator (ESP) and gas scrubber to ensure that exhaust gases meet environmental standards (Fuadi *et al.,* 2022).

According to Listiyani *et al.* (2023), following the study of waste management problems carried out, the combustion process with thermal incineration using a reciprocating grate system is capable of processing as much as 100 tons of waste per day, with the advantage of reducing not only the mass and volume of waste but also the output produced in the form of electrical energy of up to 700 KW/hour of electricity per day, sufficient to meet local electricity needs. The Merah Putih PLTSa in Bantargebang, through thermal incineration technology with a reciprocating grate system, can be an example of how technology-based solutions can be applied to overcome air pollution while supporting the transition to clean energy; with its success, this PLTSa has the potential to be replicated in other big cities in Indonesia, as a real step in managing waste sustainably and creating economic and environmental benefits (Suranto, 2019; Larasati & Puspaningtyas, 2020). This research needs to be done to enrich information to control air pollution and waste processing because the quantity of waste production is increasing if not handled. Therefore, this study aims to analyze the role of the Waste Power Plant (PLTSa) in reducing air pollution at the Bantargebang IWMF.

2. Methods

The method used to clarify the study stages can be seen in the reference framework presented in the form of a flowchart in Figure 1. The research approach uses a descriptive approach to describe, analyze, and explain phenomena systematically. In addition, quantitative analysis is applied in the processing and interpretation of data in the form of numbers. Secondary data collection: this study relies on the analysis of official documents, including project reports, feasibility studies, and PLTSa operational data, which include information on waste processing capacity, air quality sensors, electrical energy generated, and emissions generated. In addition, a literature review from previous studies was

also conducted to understand thermal incineration technology, PLTSa operational, financial analysis, and its application in waste management in urban areas.

Data collection methods include air pollution data analysis, where air quality monitoring data was collected between 2019 and 2024 after PLTSa began operating. Data sources are obtained from emission measuring devices and reports published by related agencies such as the Environmental Service. This analysis aims to evaluate the efficiency of PLTSa in reducing pollution. Finally, data validation and triangulation are carried out by comparing information from various sources, including official documents and environmental data, to ensure the accuracy and consistency of the research results. With this method, research is expected to produce more valid findings. It can be used as a basis for decision-making related to waste management and the operational efficiency of PLTSa.

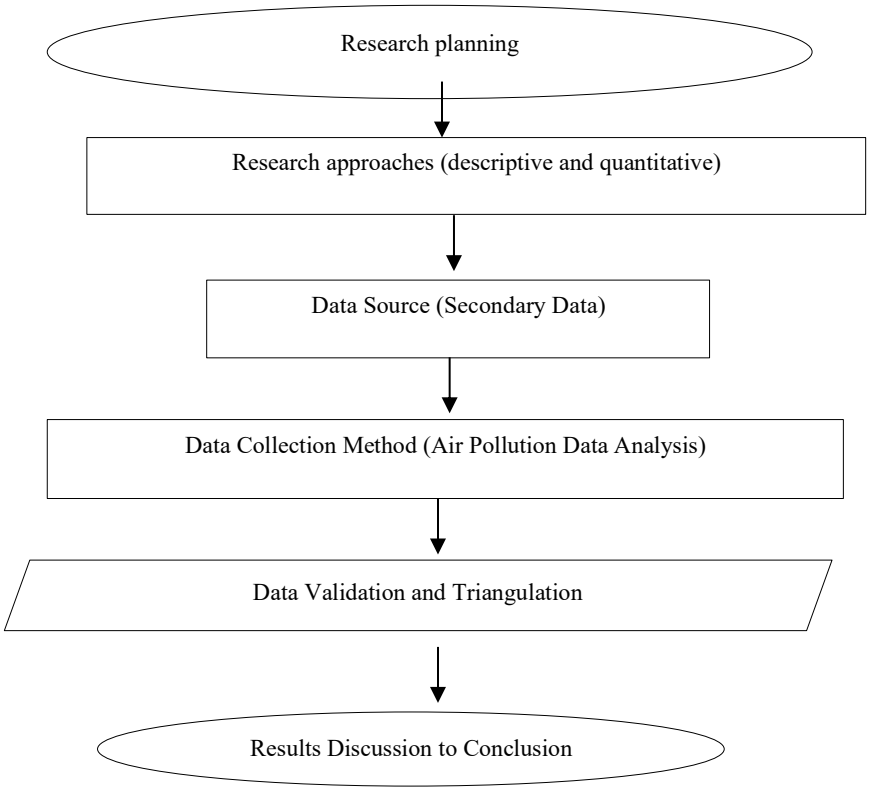

Figure 1. Research method framework

3. Results and Discussion

3.1 Air Pollution at Bantargebang IWMF

Various activities at Bantar Gebang IWMF cause air pollution at IWMF Bantargebang. Activities such as the back and forth of vehicles carrying garbage are one of the causes of particulate matter pollution, and waste decomposition activities are one of the factors that cause gas pollutants. The volume of waste from Jakarta to IWMF Bantargebang averages around 7,000 to 8,000 tons per day, which is served by 1,200 garbage trucks, of which 60% is domestic or household waste, with the large volume of waste produced every day, waste processing using the open dumping and sanitary landfill systems by burying waste using red soil, then covering it using geomembrane is not an effective solution for waste management at Bantargebang IWMF (Sukwika & Noviana, 2020).

3.2 Composition of Waste Types at Bantargebang IWMF

The composition of the largest type of waste is dominated by wet food waste, followed by various types of waste with their characteristics. The following is Figure 2 of the composition of types of waste in IWMF Bantargebang.

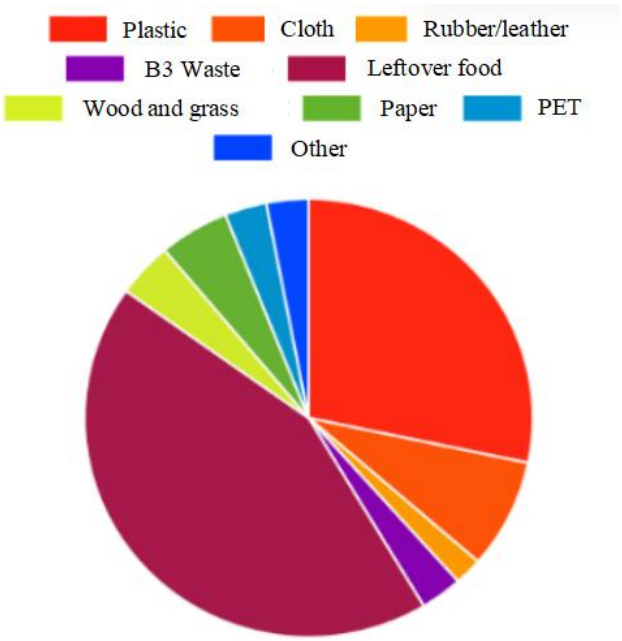

Figure 2. Composition of waste from Bantargebang IWMF
Source: https://upstdlh.id/IWMF/data

There are at least 9 categories of waste types, where the largest waste is food waste reaching 43%, then plastic waste 28%, cloth 8%, paper 5%, wood and grass 4%, B3 3%, rubber and leather 2%, PET 3% and others 3%. The composition of various types of waste with types of waste that are mixed makes it difficult to process waste. One of the efforts made to manage waste is landfill mining with an approach used to increase the capacity of the Bantargebang IWMF in expanding its operational area. This method involves mining inactive landfill zones with waste that has undergone a decomposition process. The aim is to enable the reuse of the land, thereby extending the service life of the Bantargebang IWMF and optimizing its function for the benefit of the environment. According to Rifa'i & Ardiatma (2022), the waste that has been excavated and filtered with a rotary screen separates material measuring below and above 10 mm, obtaining material in the form of soil or compost in relatively large quantities. The following is the composition of compost at the Bantargebang IWMF.

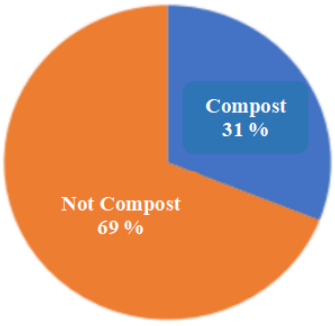

Figure 3. Composition of Bantargebang IWMF compost (Rifa'i & Ardiatma, 2022).

There is still a lot of recycling potential for other types of waste at the Bantargebang IWMF, and the following is data on the composition of waste at the Bantargebang IWMF.

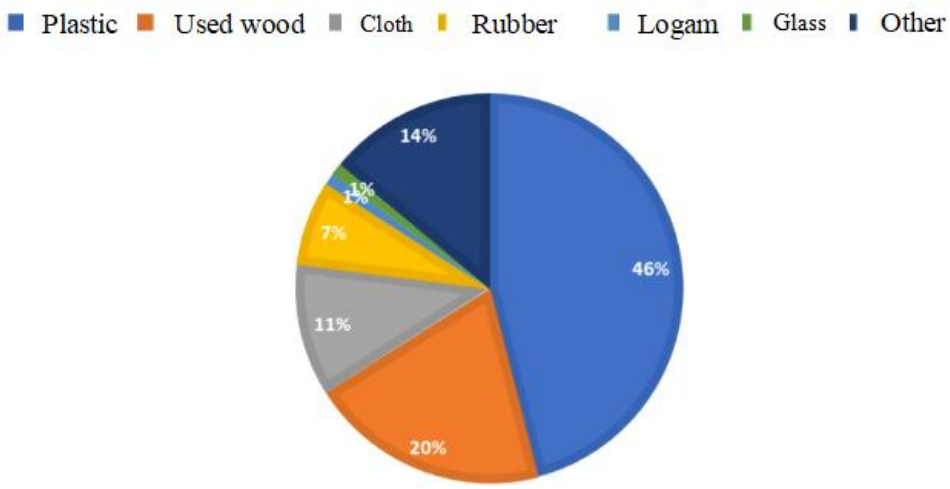

Figure 4. Composition of waste at Bantargebang IWMF (Rifa'i & Ardiatma, 2022).

The Bantargebang IWMF excavation waste has the potential to be processed to be converted into an energy source or RDF (refuse-derived fuels), because it has a fairly high calorific value. The waste material used has the characteristic of being combustible. The following is data on the composition of waste at the Bantargebang IWMF.

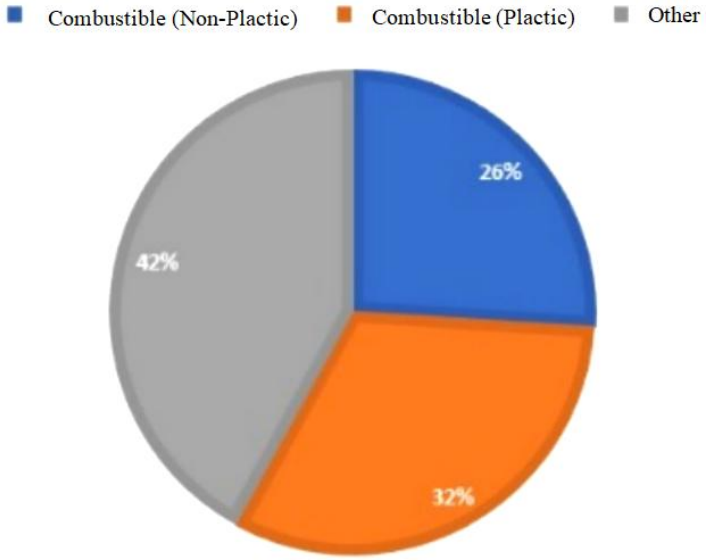

Figure 5. Composition of waste at Bantargebang IWMF (Rifa'i & Ardiatma, 2022).

3.3 Waste Power Plant (PLTSa)

The efforts to prevent air pollution carried out by the DKI Jakarta government are the Waste Power Plant (PLTSa), which was established in 2019 and operated by PT Jakarta Propertindo (Jakpro), a company owned by PT Jakarta Propertindo (Jakpro). The implementation stages carried out to implement PLTSa start from project planning, where PLTSa uses thermal process technology to destroy waste quickly and is environmentally friendly. Based on data sourced from the Integrated

Waste Management Unit of the DKI Jakarta Provincial Environmental Service, PLTSa operates 24 hours a day and 250-300 days a year with a waste processing capacity of 100 tons per day and produces 700 kW of electricity (data of PLTSa, 2019). The PLTSa aims to reduce the volume of waste entering the landfill, produce electrical energy that can be used to operate the internal PLTSa unit and reduce air pollutant emissions. The PLTSa was completed in December 2018 and inaugurated on March 23, 2019, collaborating with PT Holcim Indonesia Tbk for research on the use of waste as an alternative fuel.

According to PTL-BPPT, the technology used by PLTSa in the process of processing waste into electrical energy includes manufacturing technology, including (boiler, furnace, waste bunker, water treatment plant, and wastewater treatment plant). Incineration technology that has been adjusted to the capacity of waste at IWMF Bantargebang and in Indonesia has wet and mixed characteristics. The equipment used has specifications including a bunker equipped with a platform and crane, a boiler that produces superheated steam with a temperature of 390 ° C and a pressure of 40 Bar, a furnace designed to burn waste at a temperature of ± 850 ° C so that dioxin formation is minimized, reciprocating grate, total condensing type turbine, and Air Pollution Control (APC) equipped with a Water Treatment Plant (WTP) and Waste Water Treatment Plant (WWTP) (Qodriyatun, 2021).

Thermal processing is the conversion of solid waste into a gas, liquid, or solid phase converted by the presence of heat energy released. According to Rachim (2017), the following are the objectives of thermal solid waste processing: Reducing total organic compounds, destroying organic contaminants, obtaining concentrates from inorganic contaminants, reducing the mass and volume of solid waste, recovering energy content from solid waste, maintaining raw materials and resources. From an environmental engineering perspective, the use of thermal incineration at the Merah Putih PLTSa is a significant solution to reduce waste volume while minimizing the risk of pollution. Reciprocating Grate technology allows waste to be burned at temperatures above 850°C, which is effective in reducing waste volume; the burned waste leaves an ash residue of 20-30%, which is easier to manage and reuse, for example, for building materials or paving (Suranto, 2019).

PLTSa itself has several thermal (heat) usage bases in its energy conversion process. The use of this thermal technology is based on its fast, significant, and environmentally friendly nature in destroying tons of waste. The Thermochemical process carried out by PLTSa changes wastes with mixed and wet characteristics into fuel in solid or liquid form. Thermochemical technology has been applied in PLTSa Bantargebang using the Incineration method, which is a thermochemical method that produces steam to drive an electric generator. Hot steam from exhaust gas from burning waste is used to convert water in the boiler into steam. This steam is used to rotate the turbine, which produces renewable energy in the form of electricity. The main tools used by PLTSa to convert waste into electricity are divided into four, namely a bunker made of concrete, a combustion chamber consisting of a reciprocating grate boiler system that is capable of burning waste at temperatures above 950 ° C with the aim of reducing exhaust gas residues that pollute the environment, a pollution control system, and also a steam turbine unit for generating electricity.

Optimization that can be done to reduce pollutant gases produced and processed using Air Pollution Control (APC) system equipment on PLTSa is equipped with activated carbon injection to control dioxin and furan emissions, with the amount of dioxin and furan emissions produced in accordance with the quality standards regulated by the Regulation of the Minister of Environment and Forestry (Regulation of the Minister of Environment and Forestry No. P.15/MENLHK/SETJEN/KUM.1/4/2019). This system also reduces exposure to carcinogenic substances that can have a negative impact on health (WHO, 2021). The working system of carbon injection works by utilizing its pores with a diameter of 1.7-3 nm. This size allows activated carbon to absorb dioxin molecules that are 1.37 nm long, 0.738 nm wide, and 0.35 nm thick. With these characteristics, activated carbon can effectively capture and reduce the presence of dioxin in a system.

3.4 Types of Waste Raw Materials that Potentially Produce Dioxin and Furan Emissions

The characteristics of combustible waste with a relatively high calorific value are used to produce large amounts of energy and convert the mass and volume of waste. The waste burned based on the composition of the type of waste at the Bantargebang IWMF: 32% is combustible plastic waste, 26% is not combustible plastic waste, and 42% is other combustible waste. According to Priyadi *et al.* (2023) waste consisting of synthetic chemicals such as styrofoam, plastic, and rubber can produce toxic gases that are harmful to health and reduce air quality. When plastic is burned, toxic dioxin compounds can form and have a negative impact on the environment and humans. Dioxin formation can occur at various temperature levels, from low-temperature combustion to the use of incinerators with a temperature range of 400–600°C, where this condition is the optimal point for the formation of these toxic compounds. In addition, due to the diverse composition of waste, unstable combustion also has the potential to produce other hazardous substances, such as dioxins and furans, which can further worsen air pollution.

3.5 Bantargebang Emission Data 2019 and 2024

Based on the analysis of literature studies, it shows that the construction of waste-to-energy power plants is able to reduce the amount of environmental pollution, especially air pollution, in the Bantargebang area. The following is Table 1 of the GHG Emission and Absorption Profile of DKI Jakarta Province.

Table 1. DKI Jakarta Environmental Service Report Data 2023

Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	Gg CO2e													
1. Energy	18.881	19.630	21.180	24.082	22.721	25.619	25.841	26.550	28.425	27.735	22.854	24.968	26.777	27.330
1.A. Fuel combustion activity	18.768	19.516	21.066	23.969	22.608	25.505	25.727	26.437	28.312	27.622	22.741	24.855	26.686	26.892
1.A.1 Energy industry: Power generation	8.044	7.785	6.843	7.521	8.010	7.737	7.227	6.673	7.938	8.744	7.301	8.530	7.217	7.443
1.A.2 Manufacturing Industry	2.330	2.326	2.256	2.755	1.935	2.083	2.648	3.465	3.417	2.064	2.081	2.219	2.443	1.992
1.A.3 Transportation	7.258	8.201	10.722	12.453	11.424	14.102	14.293	14.671	15.325	15.364	11.903	12.642	15.543	15.992
1.A.4 Others (Commercial and Residential)	1.130	1.198	1.239	1.233	1.233	1.577	1.553	1.622	1.625	1.442	1.450	1.459	1.477	1.458
1A5 Others	6	6	6	6	6	6	6	6	7	7	6	6	6	6
1.B. Fugitive emissions	113	113	113	113	113	113	113	113	113	113	113	113	91	438
2. IPPU	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3. AFOLU	31	34	33	31	(2)	(5)	(6)	(8)	(7)	89	(24)	(14)	(32)	(35)
3.A Animal farm	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3.B Land	28	32	30	29	(4)	(6)	(7)	(9)	(8)	88	(25)	(15)	(33)	(36)
3.C Aggregate sources and non CO2	2	1	2	1	1	1	1	1	1	1	1	1	0	0

emissions														
4. Waste	1.873	1.837	1.746	1.845	1.915	2.000	2.083	2.199	2.284	2.305	2.396	2.450	2.478	2.369
4.A Solid waste management at landfills	941	892	791	886	941	1.010	1.090	1.167	1.231	1.249	1.336	1.363	1.379	1.296
4.B Biological management of solid waste	-	1,1	1,1	1,1	1,1	1,0	1,0	0,0	0,1	0,1	0,1	0,2	0,2	0,4
4.C Incineration and open burning	-	-	-	-	-	-	-	1	1	-	0	1	1	0
4.D Liquid waste processing	932	944	954	958	973	989	993	1.031	1.051	1.057	1.060	1.086	1.099	1.072
Total direct GHG emissions	20.785	21.500	22.958	25.958	24.635	27.614	27.918	28.741	30.702	30.130	25.226	27.404	29.223	29.664
Indirect GHG emissions	19.733	21.787	24.988	29.028	26.927	29.065	30.982	28.378	29.309	30.907	29.015	29.301	31.145	33.420
Grand total GHG emissions (direct + indirect)	40.518	43.288	47.947	54.986	51.562	56.680	58.900	57.120	60.011	61.037	54.242	56.705	60.368	63.084

Based on the above data obtained from the DKI Jakarta Environmental Service Report 2023, it has emissions and absorption of GHG of DKI Jakarta Province from solid waste management of TPA. This data shows a decrease in the level of emissions released into the environment each year. This has a good impact on the utilization of waste into energy, which is an innovative solution for overcoming air pollution in Bantargebang. Table 2 below shows a comparison of pollutant concentrations in 2019 and 2024

Table 2. Comparison of pollutant oncentrations in 2019 and 2024

Parameter	Air Quality 2019	Air Quality 2024	National Ambient Air Quality Standards (max)	Air Qiality (WHO)
	Concentration ((µg/m³)			
PM 2.5	48	33.8	55	15
PM 10	35	57.2	75	45
O_3	28	109.8	150	100
SO_2	15	2.1	75	40
CO	4	1.437	4000	4
NO_2	3	0.5	75	25

Based on the data that has been presented, it shows that the air quality in 2019 before the PLTSa operated and after the PLTSa operated in 2024, the air condition is in the unhealthy category for sensitive groups. However, the changes that occurred in 2024 were seen in the concentration of PM2.5 decreasing to 33.8 µg/m³, PM10 increasing to 57.2 µg/m³, O_3 increasing to 109.8 µg/m, SO_2 decreasing to 2.1 µg/m³, CO decreasing to 1.437 µg/m³, NO_2 decreasing to 0.5 µg/m³. Based on the data presented, it can be seen that after the Bantargebang PLTSa operated in 2024, most air pollutants have decreased compared to 2019, such as $PM_{2.5}$, SO_2, CO, and NO_2. This decrease reflects the success of the emission control system from the waste incineration process applied to the PLTSa, with exceptions for PM_{10} and ozone (O_3) concentrations, which actually increased. This increase shows that

although controlled combustion technology is able to reduce primary pollutants, other factors trigger the increase in these two types of pollutants.

The increase in PM_{10} (larger particulates) generally does not come from combustion but from physical and mechanical activities in the environment around the PLTSa. Intensive PLTSa operations involve truck traffic, heavy equipment movement, solid material processing, and dry waste transportation, all of which have the potential to produce coarse dust. If the road area is not paved or not sprayed regularly, this dust will be more easily lifted into the air, especially during the dry season. Therefore, even though combustion emissions are controlled, PM_{10} increases as a result of increased logistics activities and lack of non-combustion dust control. Meanwhile, the increase in tropospheric ozone (O_3) is more complex because ozone is not a pollutant that is directly released but is formed in the atmosphere through photochemical reactions between NO_x (such as NO_2) and volatile organic compounds (VOCs) with the help of sunlight. When NO_2 concentrations decrease, as will happen in 2024, this process can actually increase ozone concentrations due to the reduction in ozone destruction reactions by NO. In addition, VOCs that are still available from the waste decomposition process or vehicle activity can also be raw materials for ozone formation. In other words, a decrease in nitrogen gas pollutants does not always mean a decrease in ozone. In fact, under certain conditions, especially when the weather is sunny, and VOCs remain high, ozone can increase. Overall, these data show that although PLTSa has a positive impact on controlling combustion pollutants, such as $PM_{2.5}$, SO_2, CO, and NO_2, comprehensive control of physical and chemical activities in the surrounding environment is still needed. Controlling street dust and reducing VOC emissions is important to overcome the spike in PM_{10} and O_3 so that air quality around the Bantargebang IWMF can continue to improve overall.

Below is Table 3 of the air quality standards according to the Regulation of the Minister of Environment and Forestry (LHK) No. P.15/MENLHK/SETJEN/KUM.1/4/2019:

Table 3. Air Quality Standards of No. P.15/MENLHK/SETJEN/KUM.1/4/2019

No	Parameter	Quality standards ($\mu g/m^3$)	Information
1	Particulates (PM_{10})	30	Maxim Concentration
2	Sulfur Dioxide (SO_2)	50	Normal condition, O_2 reference is 11%
3	Nitrogen Oxide (NO_x)	100	The result of combustion
4	Carbon monoxide (CO)	100	-
5	Hydrochloric Acid (HCl)	10	Results of burning waste
6	Hydrofluoric Acid (HF)	1	Dangerous heavy metals
7	Dioxins and Furans	0.0001	Dangerous heavy metals

Based on the air quality standard table data, it was found that the Bantargebang air concentration is still in a safe status according to the quality standard, classified below it; only PM10 is above the set quality standard and is at an unhealthy concentration for sensitive groups. The implementation of PLTSa has gone through an AMDAL (*Environmental Impact Assessment*) process that considers:

Positive Impacts: Reduction in greenhouse gas emissions, reduction in waste piles, and improvement in air quality. Before the PLTSa was operational, air pollution in the Bantargebang IWMF was mainly caused by vehicle activity and waste decomposition that produces methane gas. Since the implementation of PLTSa, the concentration of several air pollutants, such as $PM_{2.5}$, SO_2, CO, and NO_2, has decreased.

Negative Impacts: Residual emissions from combustion (such as fly ash) and risks to workers if waste management is not carried out properly.

Overall, the air quality around the Bantargebang IWMF after the construction of the TPSA showed significant improvements. Although challenges in managing air pollution still exist, more environmentally friendly waste management at the TPSA has succeeded in reducing greenhouse gas emissions, odors, and other air pollution. This positive impact depends on the effectiveness of continuous management.

4. Conclusions

The positive impact of the presence of the Merah Putih PLTSa, the concentration of air pollution has decreased pollutants, although PM_{10} is still increasing. Based on the data that has been discussed, it can be concluded that the air quality in 2019 before the PLTSa operates and after the PLTSa operates in 2024, is seen in the concentration of $PM_{2.5}$ decreased to 33.8 µg/m³, PM_{10} increased to 57.2 µg/m³, O_3 increased to 109.8 µg/m³, SO_2 decreased to 2.1 µg/m³, CO decreased to 1.437 µg/m³, NO_2 decreased by 0.5 µg/m³. Based on the results and discussion, it can be seen that after the Bantargebang PLTSa began operating in 2024, most air pollutants decreased compared to 2019, such as $PM_{2.5}$, SO_2, CO, and NO_2. This decrease reflects the success of the emission control system from the waste incineration process applied to the PLTSa, with exceptions for PM_{10} and ozone (O_3) concentrations, which increased. This increase shows that although controlled combustion technology can reduce primary pollutants, other factors trigger the increase in these two types of pollutants.

5. Authors Note

The authors declare that there is no conflict of interest regarding the publication of this article. The authors also confirm that this manuscript is an original work, has not been published elsewhere, and is free from any form of plagiarism.

7. References

AccuWeather. (2019). Kualitas Udara: Bantargebang. Retrieved from https://www.accuweather.com/id/id/bantargebang/202567/air-quality-index/202567?form=MG0AV3

Forestry, I. M. (2024, December 18). Air quality near Bantargebang, Bekasi. IQAir. https://www.iqair.com/indonesia/west-java/bekasi/bantar-gebang

Fuadi, M. F., Firmansyah, Y. W., & R, M. F. (2022). Sebaran kadar partikulat debu total dan faktor risiko pekerja dengan kejadian ISPA di industri pembakaran batu kapur Kecamatan Margasari Kabupaten Tegal. *Sanitasi: Jurnal Kesehatan Lingkungan*, 15(1). https://doi.org/10.29238/sanitasi.v15i1.1430

Infopublik. (2019, March 26). PLTSa Merah Putih Bantargebang bisa sebagai contoh secara nasional. https://www.infopublik.id

Larasati, N., & Puspaningtyas, A. (2020). Manajemen Tempat Pengelolaan Sampah Terpadu Bantar Gebang dengan Konsep Collaborative Governance. CHANNEL: Jurnal Komunikasi, 8(1), 69-78.

Listiyani, Q., Khasanah, W. N., & Purwanti, P. (2023). *Kajian permasalahan pengelolaan sampah di IWMF Bantargebang Kota Bekasi (Studi Kasus PLTSa Merah Putih)*. Prosiding Seminar Nasional Sains, p. 76.

Nazaruddin, N. (2022). Monitoring and calculation of the air pollution standard index (APSI) of Bandung Regency. *IOP Conference Series: Earth and Environmental Science*, 1017, 012005.

Pembangkit Listrik Tenaga Sampah (PLTSa). (2017, December 20). UPSTDHL. https://upstdlh.id/IWMF/pltsa?form=MG0AV

Pembangkit Listrik Tenaga Sampah (PLTSa). (2019). UPSTDHL. Retrieved from https://upstdlh.id/IWMF/pltsa

Priyadi, S., Soelistijono, R., Azies, A. F., Haryuni, & Wiyono. (2023). Inovasi pengelolaan sampah rumah tangga dengan teknologi zero waste berorientasi pada good management-garbage practices. *Ganesha: Jurnal Pengabdian Masyarakat*, 3(1), 23-30.

Qodriyatun, S. N. (2021). Pembangkit Listrik Tenaga Sampah: Antara permasalahan lingkungan dan percepatan pembangunan energi terbarukan. *Aspirasi: Jurnal Masalah-Masalah Sosial*, 12(1), 63-84.

Rachim, T. A. (2017). *Life cycle assessment (LCA) pengolahan sampah secara termal (Studi kasus: TPA Benowo, Kota Surabaya)* [Undergraduate thesis]. Institute Sepuluh November.

Rifa'i, I., & Ardiatma, D. (2022). *Potensi sampah landfill mining di IWMF Bantargebang sebagai bahan baku alternatif refused derived fuel (RDF)*. Prosiding SAINTEK: Sains dan Teknologi, 1(1), 542–543.

Sukwika, T., & Noviana, L. (2020). Status Keberlanjutan Pengelolaan Sampah Terpadu di IWMF-Bantargebang, Bekasi: Menggunakan Rapfish dengan R Statistik. Jurnal Ilmu Lingkungan, 18(1), 107-118. https://doi.org/10.14710/jil.18.1.107-118.

Suranto, G. (2019, 24 Februari). "Pemprov DKI Jakarta ajak seluruh pihak wujudkan Jakarta bebas sampah". Infopublik. id. Diakses dari https://www.infopublik.id/sosial-budaya/329137/pemprov-dki-ajak-seluruh-pihak-wujudkanJakarta-bebas-sampah.

UPSTDHL. (2025). Komposisi Sampah IWMF Bantargebang. Retrieved from https://upstdlh.id/IWMF/data

World Health Organization. (2021). *WHO global air quality guidelines: Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide*. World Health Organization. https://apps.who.int/iris/handle/10665/345329