

Building Waste Management Innovation Based on Ecofriendly Incineration

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Abstract:- Waste is an unsolved problem that causes flood in Makassar. Based on the data taken by Department of City Parks and Sanitation Makassar the generated waste reached 4.183.41/day in 2016, while only 3.962,63 m³/day or 95.37% was handled. Those numbers need further action in a form of integrated waste management. This research is to give ideas on innovation of building waste management that convert the waste into electricity energy or Waste to Energy by applying incineration technology. With Explorative approach, the aim of the research is to find out form and function of building that is suitable with generated waste problem. The data collection is direct observation, documentation and interviewing related institution. The result of this research covers waste management at Integrated Final Disposal Site, Tamangapa, Makassar designed as a building. The building will generate the waste and will not disturb the surrounding people who live at the area. The building is expressive to change its negative impression of community towards the waste. The design applied is to strengthen the image of waste management building that is innovative, effective and educative. The building is designed to be able to burn the waste up to 700 tons/day using 2 units incineration machine which can produce electricity output 10.000 KWH and the incinerator operational uses 50% of total electricity output.

Keywords:- Flood, Building Inovation, Waste, Incineration, Waste to Energy.

I. INTRODUCTION (HEADING 1)

Makassar, the capital of South Sulawesi, is one of metropolis cities in Indonesia, has been developed rapidly and played its role as the gate for Eastern Indonesia. One of the impacts as developing city is the increasing of waste volume that demands more facilities on limited areas. Based on the circumstances, it required to have a good and efficient waste management.

Waste is an endless problem that increases in terms of number and quality annually. The increase is along with the growth of population in Makassar as well as the growth of other industry sectors. In addition, there is also limitation of facilities and infrastructures, Final Disposal Site, and other facilities are effective and efficient in managing the waste. Based on the data Department of City Parks and Sanitation Makassar, the generated waste reached 4.183.41m³/day in 2016 in Makassar while only

3.962,63m³/per day was handled or only 95,37% of the total generated waste. Those numbers needs to handle especially for managing the waste integration in Makassar as a whole.

Waste is always associated as left over things or worthless waste. Even human always produces waste, yet human himself is mostly avoiding the waste. So far, people manage the waste with open dumping concept, burn, and sanitary land fill which are not good solutions. The main cause of flood is organic waste, plastic or can that is not degradable. These kinds of waste should get special attention for recycling. In this context, a solution for accurate city waste handling requires to minimize the generated waste to reach zero waste. Waste and its management is an urgent problem in Makassar as it can change the ecosystem balance that will damage and pollute the water, soil and air. Therefore, to be able to solve the pollution problem, we need to handle and control the waste. The problem often occurs in managing the city waste is the operational fee that is high as well as a proper place for disposing the waste.

Based on the fact, we need a breakthrough in processing the city waste. One of the solutions is to convert the waste into electricity energy or Waste to Energy system. Waste-to-Energy System (WTE) burns city waste non-B3 to produce electricity or steam, and sterilizing at the same time also reducing the waste volume for landfill. The implementation is by applying incineration technology using the waste as the fuel.

Incineration technology converts solid material (in this context, waste) become gas material (exhaust gas), and solid material hard to burn, that is bottom ash and fly ash. This technology produces heat as the result of incineration process that is useful for converting one material become another different material such as for electricity or hot water. Incineration is a managing waste method by burning the waste over the stove. In some developed countries, incineration technology has applied in big capacity (city scale) (Damanhuri and padmi, 2008).

Incinerator technology in big scale is growing continuously especially when there are many denials concerning air pollution. One of its strengths developing in the newest incinerator technology is the use of energy, so the term incinerator will change to become waste-to-energy thermal converter.

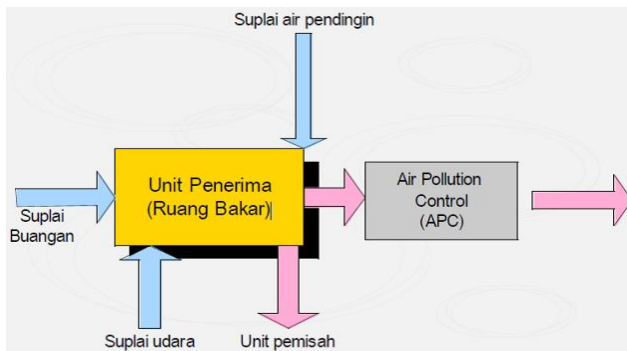


Fig 1:- Incineration Process.

Source: Damanhuri dan Padmi, 2008

Therefore, incineration technology became a strategic alternative in reducing the waste. The potential of waste reducing with incineration technology is very effective and the important thing it can produce electricity. It will be very helpful in reducing the burden of State Electricity Company in providing electricity for community.

For this reason, the planning of incineration technology implementation or waste-to-energy hopefully can become a new breakthrough in solving waste problems and electricity consuming in city. In addition, the design of building should be able to give solution in handling waste in Makassar.

II. METHODOLOGY

The research used qualitative method. Qualitative research methodology based on postpositivism philosophy that is used to investigate natural condition of the research object, where the researcher played a role as the key instrument, the sample taken purposively (Creswell, 2008). The category of this research character is explorative with inductive approach. Explorative research is a method to observe an object deeply. Therefore, this explorative research is finding things that influence something (Groat and Waang, 2002). The approach used in this research is inductive approach. The approach is drawing general conclusion from real facts at the place. Inductive is one ways of thinking in which a general conclusion drawn from various cases individually. The conclusion taken inductively starts by putting the general statements together. In other words, inductive approach is a research that starts or base on data or facts that then connected to the relevant or appropriate theories in order to get a general conclusion.

A. Data Collection Method

The data collection is direct observation, documentation and interview. Direct observation method is getting the data directly to see the physical condition without certain manipulation. The data collection related to city waste management, implementation of incineration technology and standard room needed for waste management facility. Documentation is at the research location, Integrated Final Disposal Site Tamangapa that will become the area of eco-friendly incineration base waste management building in Makassar. The documentations are photos and other form of data that need in analyzing the

data. The interview method is by using purposive sampling method to collect supportive document for completing the observation result.

B. Data Analyzing Method

Data Analyzing Method is design exploration. The method is deciding ideal design implemented at the research location in Final Disposal Site area in Makassar, Tamangapa Sub district. The existing condition of Final Disposal Site Tamangapa is accommodating a lot of generated waste that become more and more in amount. This condition influences the health condition and comfortable of the people who live surrounding the site. Therefore, we need technologies that solve the waste problem. By using this method, we can create ecofriendly incineration base waste management as one of the solutions for waste and electricity problems for community in Makassar.

The steps of conducting the research among others are:

- Literature study, by data collection related to city waste process, the application of incineration technology, also the need and room standard for waste management facility.
- Observation of research location for collecting information about economic potentials and physical environment of research location that can support the success of building innovation design
- Analyzing of design approach is analysis and simulation on research location as well as analysis towards strategy of shape application and building facility.
- Organization the concepts and design exploration on waste management building by applying of incineration technology that integrated with the research environment.
- Design result is a building of waste management by applying incineration technology that is environmentally friendly so it can minimize the waste problem and maximizing waste potential by producing energy.

III. RESULT AND DISCUSSION

Based on the data of Department of City Parks and Sanitation, the generated waste reached 4.183.41m³/day in 2016 in Makassar while only 3.962,63m³ /per day was handled or only 95,37% of the total generated waste. It can be seen that the waste volume input in Final Disposal Site Makassar is big enough. The number is too far from the target of waste reducing that becomes one of the waste management methods, that is 20 % from the total of daily waste output.

The prediction of generated waste either now or in the future is the basis for planning, designing, and reviewing of waste management system that is accurate and efficient. Incineration technology considered able to answer the challenge of waste problem in Makassar. Incineration technology is waste treatment process by burning solid material in very high temperature (>800 degree Celsius) to reduce combustible waste, which cannot be recycled. The target of incineration is to reduce mass and volume of waste

as well as to kill bacteria and virus chemical material toxic, and to ease the process waste organizing. Incineration can reduce the waste volume of domestic solid up to 85-95% and mass reduction up to 70-80%.

The incinerator machine for burning the waste should complete with supervision and control to fulfill particle emission limits to make sure the smoke of burning waste is neutral. In addition, the ash produced of waste burning can be useful for building material, compos mixture or thrown on landfill. Meanwhile, the residue that is not combustible such as metal can be recycled.

A. Site Design

The location of plan building is in Final Disposal Site area in Makassar Sub district Tamangapa. The landscape is inspired from the pattern observation of satellite image line on planning site that later on become the patterns of building site. Next, for consideration of building orientation, analysis of wind and the path of the sun practice by using Vasari

project autodesk software. So that, based on the consideration, the site form is referring to the area pattern that elongated from the north to the south to maximize wind blowing and the path of the sun.

The design of the site is partial circulation system between facilities for waste processing and other activities. It is for minimize the cross of activities to give a comfort for the building user. In main gate area, the circulation system divided into two areas for public transportation and waste trucks.

The building mass designed with integral combination, start from main building in north, then connected with a visitor center area along the waste elongated across the waste process until the residue area in south. To create ecology environment, green site plan implemented across the whole site design. The aim is to form a green open area that is comfortable for the building user.

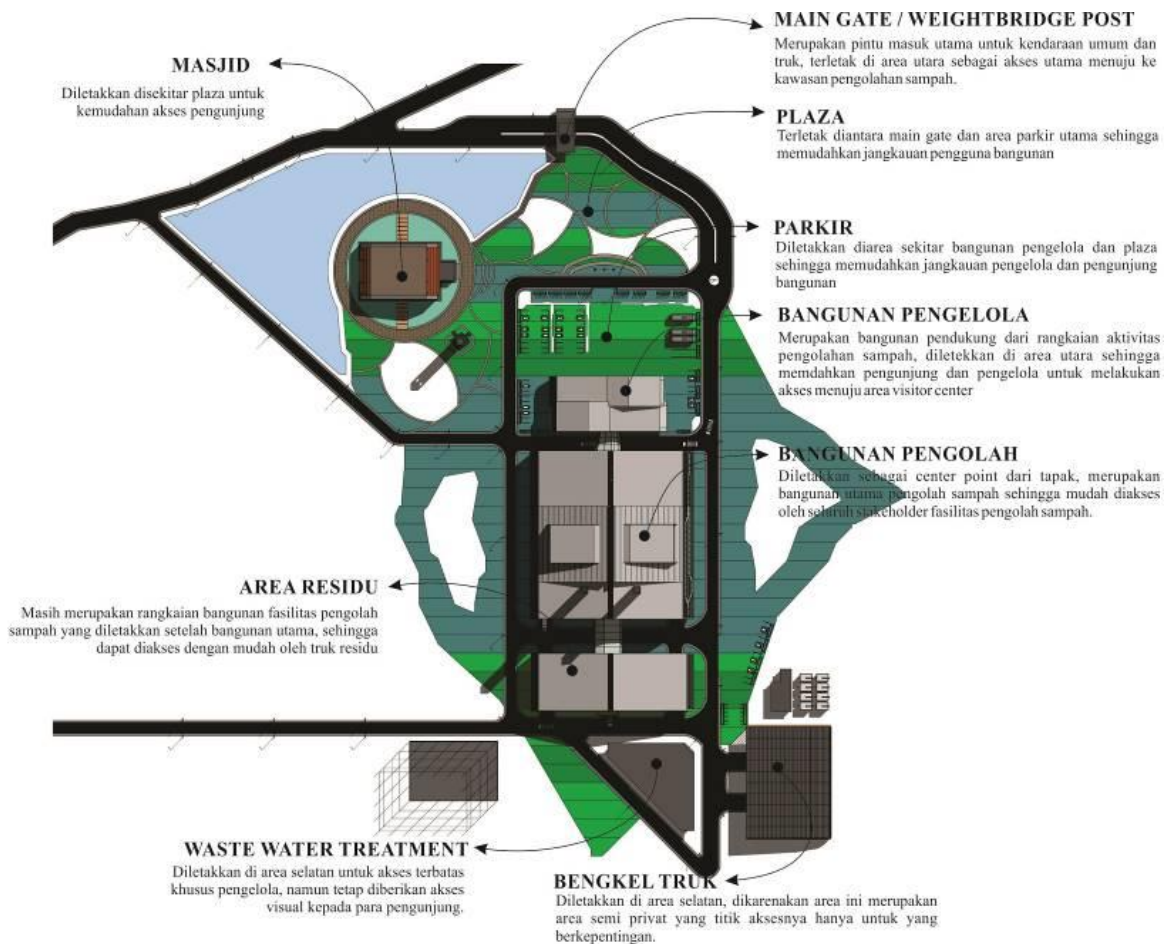


Fig 2:- Site Design of Ecofriendly Incineration Base Waste Process Building. Source: Suradin, 2016

B. Form of Building

The process area of Integrated Final Disposal Site Amangapa designed in a form of building that the generated waste would not disturb the view, creating comfortable and health of people who reside in the area. Building façade is

mostly used glass material that is complete with green area to reduce the sun heat wave.

The form of the building is expressive to change people negative image on waste. As the building of waste process facility, the building form creation is referring to the environment-integrated process far away from slum and

dirty image. That is why the design need an application that strengthens the image of waste process facility building that is innovative, effective and educative.



Fig 3:- Waste Process Building Perspective

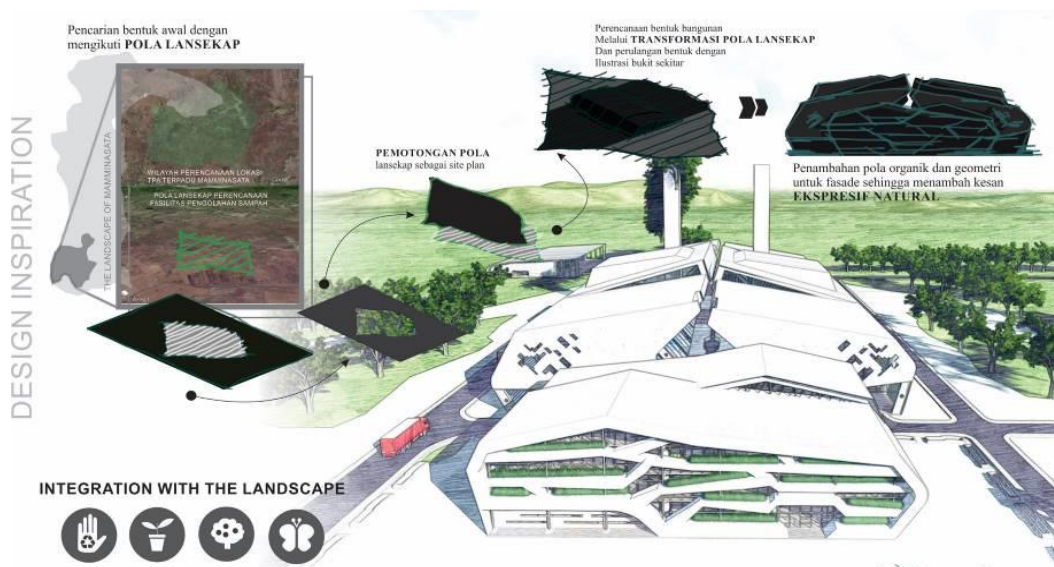


Fig 4:- Transformation of Ecofriendly Incineration Base Waste Process Building

Source: Suradin, 2016

The inspiration of the form comes from combination of landscape pattern application and geometric transformation result in hill like building. The hill like form becomes the basis of recurrence pattern. For building view on north façade, organic pattern used to create natural

expressive image. Massa Building mass is designed with integral combination system, start with the main building in north then connected by center visitor area that is elongated across the area of waste process to the residue area in south.



Fig 5:- Building Mass Organization in Waste Process Site Incineration Base in Integrated Final Disposal Site in Amangapa. Source: Suradin, 2016

C. The Concept of Waste Process

Based on Zubair et.al. (2011), house hold generated waste in Makassar was 2.18 ltr/person/day in volume or 0.28 kg/person with population of 1.796.920 in March 2017 based on report published Population and Civil Registration Agency, so waste production daily was 496

tons. In other words, waste production process is 496 tons with around 60% water content, next the reduction of water content up to 50% done by bunker dewatering system for 3-5 days. The temperature of burning with incinerator unit is 850 degree Celsius. If the temperature is too low, dioxin will not be formed.

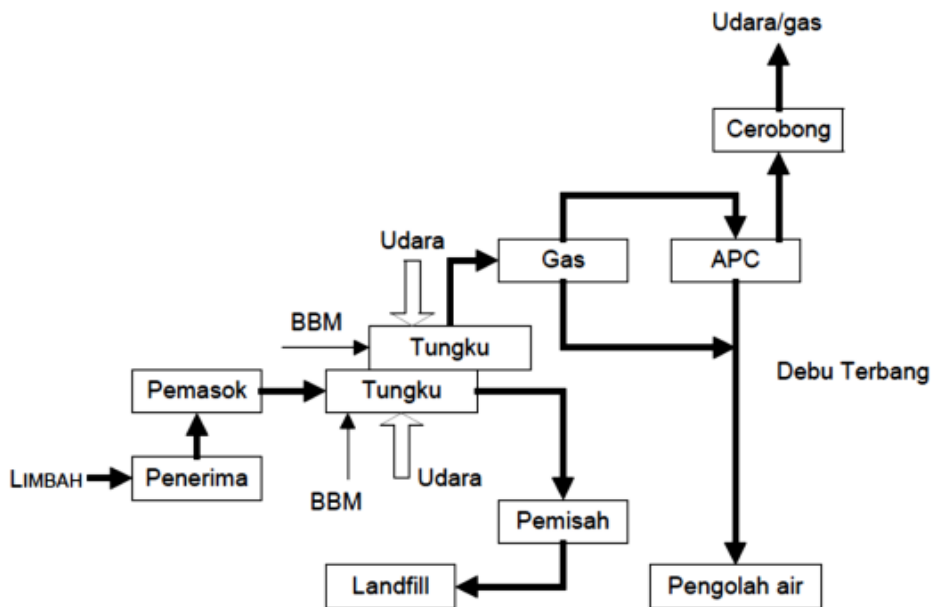


Fig 6:- Units in Incinerator with City Scale Source: Damanhuri and Padmi, 2008.

In incinerator technology there 4 process category, namely

- Pre-treatment process
- Burning Process
- Recovery energy process
- Gas fuel handling process (APC system)

Based on the process mentioned above waste

incineration results in, among others:

- Incinerator Bottom Ash (IBA) is as big as 20-30% of waste mass. IBA is solid residue that is zero harm to be thrown.

➤ Metal (iron or non-iron) as big as 2-5% of waste mass. The metal is gained from the process of sorting out to the waste or IBA

➤ Emission to atmosphere is in amount of 70-75% of waste mass. This emission results in cleaned gas.

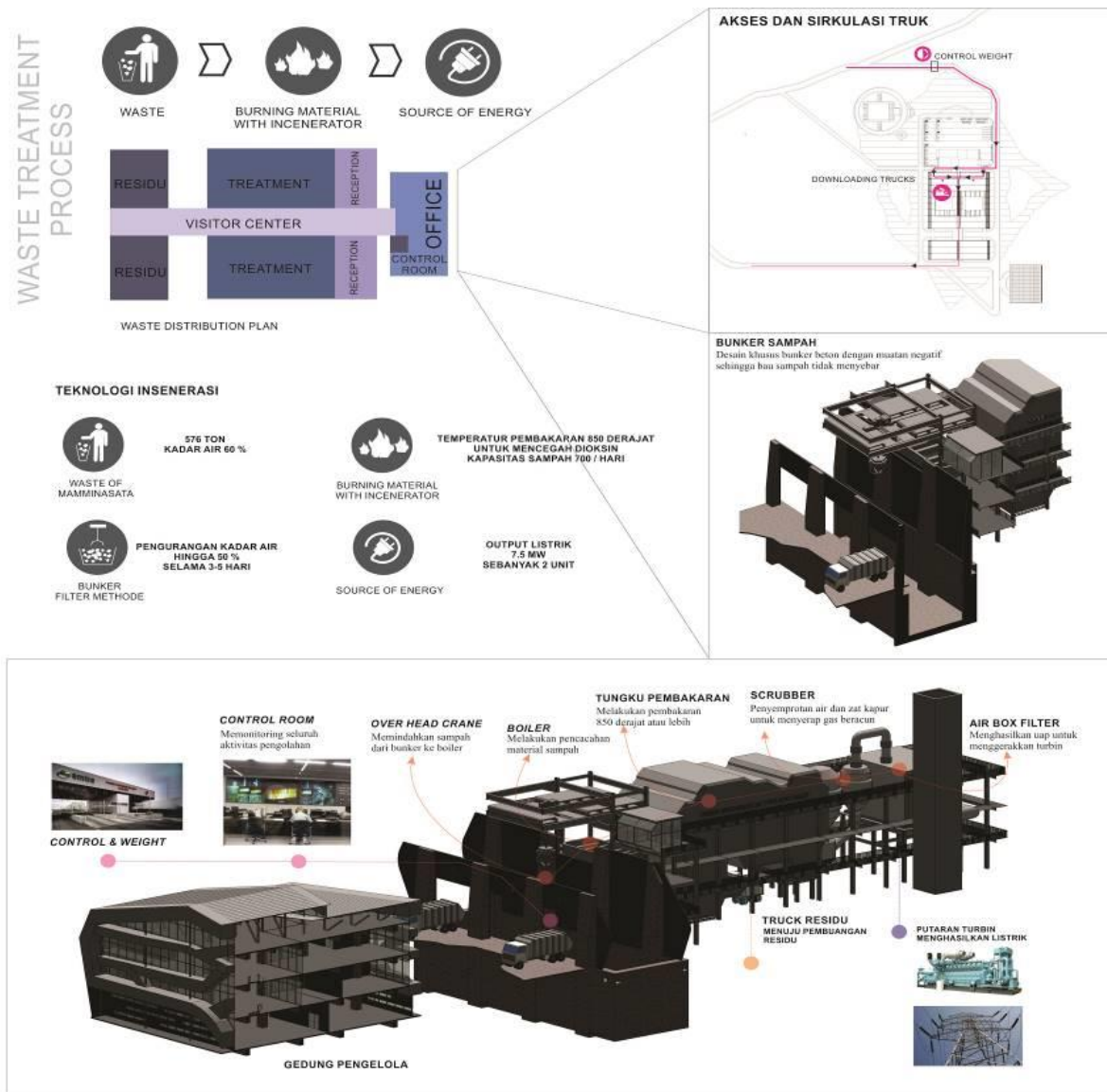


Fig 7:- The Concept of Waste Process with Incineration Technology.
Source: Suradin, 2016

The building specification is designed to be able to burn waste up to 700 tons per day using the incineration machine with electric output of 10,000 KWH from 2 units, for incinerator operational 50% electricity output is needed.

IV. CONCLUSION

Waste process area in Integrated Final Disposal Area Amangapa, Makassar designed in a form of building that generated waste does not disturb people living comfortable in the surrounding. The form of the building is expressive in order to change the negative image on waste. The creation of the building refers to the process of integrated environment far away from slum and dirty image.

So, the design application demands to strengthen image of waste process building which is innovative, effective and educative. In addition, the specification of the building is designed to be able to burn waste up to 700 tons per day, using incineration machine with electricity output 10.000 KWH of 2 machines, and for incinerator operational 50% electricity output is needed.

The implementation of incineration technology used waste fuel is a strategic alternative in reducing generated waste. The potential waste reduction with incineration technology is very effective and especially it can produce electricity output. Other advantages of incineration technology, among others, are reducing 90% of generated waste, energy recovery if it is well managed, air pollution released is low, needs minimal area.

Even though this technology is able to reduce the waste volume until 70%, yet the incinerator is costly in terms of investment, operational and maintenance. The facility of waste burn should use only for gutting/burning unrecyclable waste. The tool need to be completed with supervision and controlling system to fulfill the fulfill emission limits to make sure that the smoke results from the burning is neutral/cleaned gas. The ash from of burning can use for building material, compos mixture material or thrown away on landfill. Meanwhile the waste residue that not burned such as metal can be recycled.

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