

## Waste processing building with incineration technology

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**Abstract.** In Indonesia, waste problem is one of major problem of the society in the city as part of their life dynamics. Based on Regional Medium Term Development Plan of South Sulawesi Province in 2013-2018, total volume and waste production from Makassar City, Maros, Gowa, and Takalar Regency estimates the garbage dump level 9,076.949 m<sup>3</sup>/person/day. Additionally, aim of this design is to present a recommendation on waste processing facility design that would accommodate waste processing process activity by incineration technology and supported by supporting activity such as place of education and research on waste, and the administration activity on waste processing facility. Implementation of incineration technology would reduce waste volume up to 90% followed by relative negative impact possibility. The result planning is in form of landscape layout that inspired from the observation analysis of satellite image line pattern of planning site and then created as a building site pattern. Consideration of building orientation conducted by wind analysis process and sun path by auto desk project Vasari software. The footprint designed by separate circulation system between waste management facility interest and the social visiting activity in order to minimize the croos and thus bring convenient to the building user. Building mass designed by inseparable connection series system, from the main building that located in the Northward, then connected to a centre visitor area lengthways, and walked to the waste processing area into the residue area in the Southward area.

**Keywords:** energy, waste processing facility, landscape layout, incineration technology

### 1. Introduction

Waste problem is the part of the dynamics of human life. The waste indeed results from every movement and human activity. Undoubtedly, the garbage will never apart from pollution that currently always disturb the health and society comfort. This definitely will issue about a discussion for the solution of waste phenomenon. Solid waste management is a challenge for the cities authorities in developing countries mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated to its management, the lack of understanding over a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning [1].

According to technical plan, support in Mamminasata Regional landfills stated that, Makassar city as capital city of South Sulawesi Province is one of metropolitan city in Indonesia that has rapidly developed and functioned as a gateway of Eastern Indonesia. Makassar City develops into a major city with back region or interrelated satellite city based on the city development. Based on the result of Metropolitan regional study of Makassar, Mamminasata is regional metropolitan area of Maros, Makassar, Sungguminasa, and Takalar. One of impact in city development is an increasing in waste volume number, required improvement on facility and infrastructure against limited land. As a result,



there is a requirement on good and efficient on waste processing management although the cities in the area of Mamminasata previously have managed their own waste.

Based on Regional Medium Term Development Plan data of South Sulawesi Province 2013-2018, total volume of waste production from Makassar City, The Regency of Maros, Gowa, and Takalar is 4,231.23 m<sup>3</sup>/day and transported garbage amount is 3,735.78 m<sup>3</sup>/day. The standard of metropolitan waste pile is 0.0035 m<sup>3</sup>/person/day which calculated by total population of 2,593,414 people. Afterwards, the estimation of waste pile level is 9,076.949m<sup>3</sup>/person/day. This number definitely required further management in integration and comprehensive waste processing for the scope of Mamminasata cities.

Based on this reality, innovation in city waste management process is required. Waste incineration, introduced originally for volume reduction and hygienic reasons, went through a long and intense development. Together with prevention and recycling measures, waste to energy (WTE) facilities contribute significantly to reaching the goals of waste management. Sophisticated air pollution control (APC) devices ensure that emissions are environmentally safe [2].

One of the solutions is converting the waste into electrical energy or waste to energy. Implementation of incineration technology is by the fuel from the main problem all this time, the waste and turn into strategic option in reducing the waste. The incineration technology also proves to be an efficient solution with a relatively higher efficiency (25%) and lower operational cost (\$1.5–2.5/ton) [3]. Potency in reducing the waste by incineration technology is highly effective and principally produced an output for electrical energy. This incarnation technology substantial help a lot the Indonesian Stated-Owned Company in providing the electric for the society.

Therefore, waste management facility planning with incineration technology (waste to energy) expected would provide an innovation and indicator for the problem of energy. Additionally, waste processing facility plan will offer the best solution in waste management in the area of Mamminasata cities.

## 2. Methods

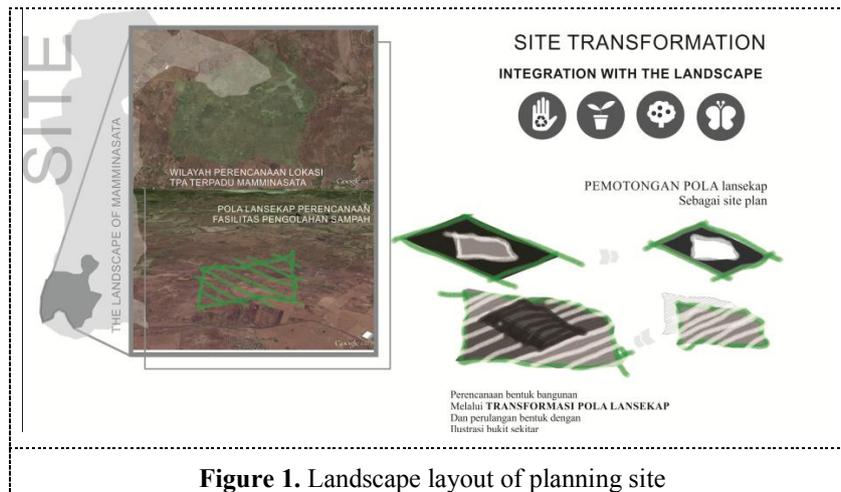
In order to achieve the result of the design approaches to energy saving, the methods applied in designing process are:

- Literature study: In form of data collecting that related on city waste processing, implementation of incineration technology in Mamminasata, and requirement and space standard for waste processing facility
- Observing of the location: Gathering the information on social-economy potency, and physical environment of location that supports on designing achievement.
- Analyzing the design approach: analyzing and simulation of the potency of designed location, application strategy analyzing on form, material, structure, and utility.
- Defining the concept: defining waste processing building concept by implementing the incineration technology that integrated with the environment of design site.
- Design result: Produced the planning of waste processing facility by implementation of incineration technology that will minimize the waste problems and maximize the potency of waste to produce the energy.

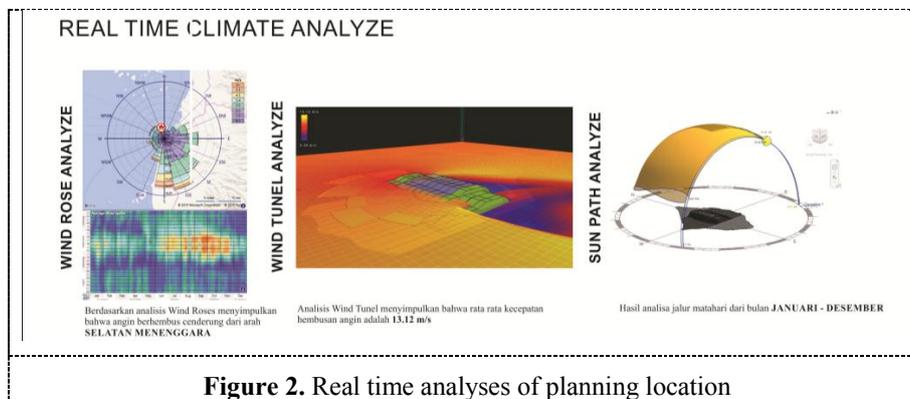
## 3. Discussion

### 3.1. Landscape Layout

Landscape layout inspired from observation analysis of satellite image line pattern in the planning area and then formulated as building site pattern. Considering the building orientation, wind analysis and sun path analyzed by autodesk project Vasari software. Given the challenges to design Net Zero Energy Buildings (NZEBS) the use of Building Performance Simulation (BPS) tools during early design phases has been indispensable [5]. Therefore, based on the consequences for the site form follows the site pattern and then oriented lengthways to the Southern in order to maximize the wind blows direction and sun pathway.



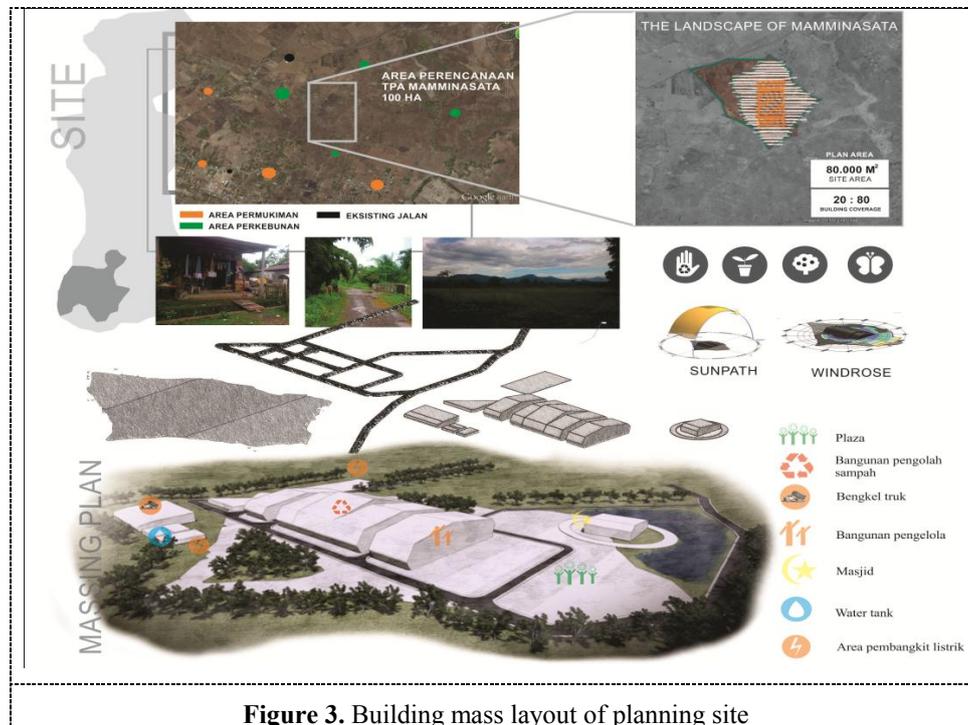
**Figure 1.** Landscape layout of planning site



**Figure 2.** Real time analyses of planning location

### 3.2. Building Mass

Waste processing facility planning based on mass. The design creates integration areas that interconnected based on the function of the building. This facility not only focuses on waste processing system, but also integrates to the education process for the society. Therefore, the facility offers the explanation on waste processing process that would convert into the energy.



### 3.3. Footprint design

Footprint designed by separate circulation system between waste processing facility interest and visitor activity for the society. The design is minimizing the cross that would present convenient to the building user. Circulation system has divided into two parts in the main gate area, between public vehicle and dump truck. The public vehicle will pass the main parking post and the dump truck will through the weight bridge post. The vehicle paths separated with boulevard as circulation marker. The marker for public vehicle will direct to the parking area and the dump truck will direct to the main building of waste processing. In addition, the pedestrian will directed to the pedestrian precinct, offering secure and convenient impression for the building users.

Building mass designed by a series of integrated system, from the main building located in the northward that connected by visitor center area lengthways that follow the waste processing area until the residue area in the southward. Therefore, the visitor will have visual access on was processing process and become an interesting education facility. Green layout design spread into all the area of to create an ecological area. The design will raise a convenient green open space for the building user.

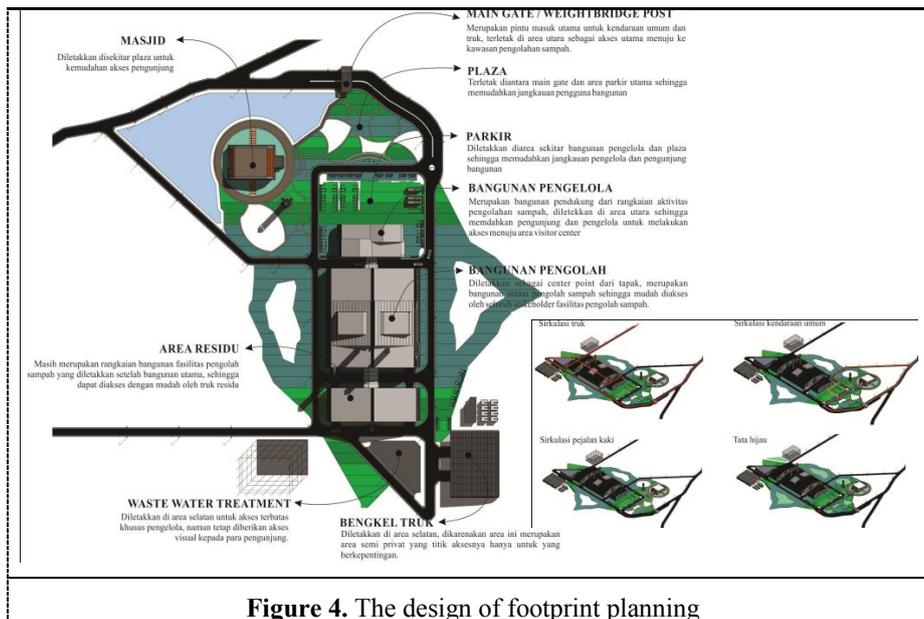


Figure 4. The design of footprint planning

### 3.4. Form

Aim of the building form plan is to create expressive building that appropriate for the function of waste processing building. As a result, the planning would remove a negative image from the society on the waste processing itself. As waste processing facility, the building design creation focus on process of environmental integration. An interesting effort in application process is delivering an interesting education facility, avoiding the filthy and dirty image. Therefore, design application involved to improve the image of waste processing facility.

During the finding of the inspiration, form followed up of landscape pattern application the continued by the combination of geometry transformation into the hill-like form. The hill-like form is an integration of surrounding environment and continued by reforming process. For building display in northern facade area, organic pattern added to create natural expressive impression.

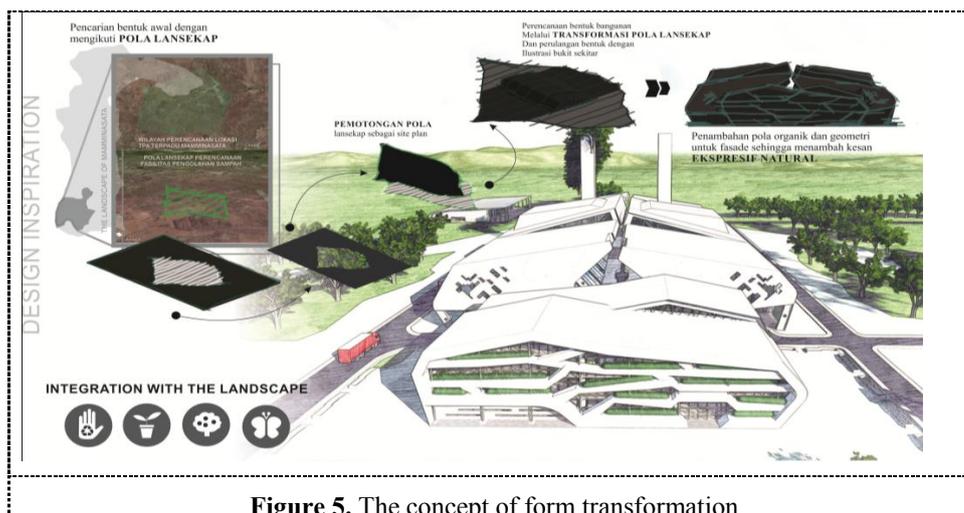


Figure 5. The concept of form transformation

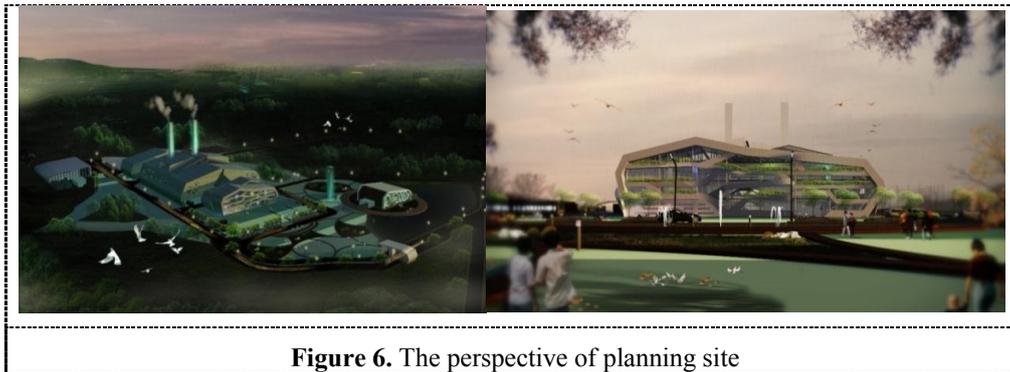


Figure 6. The perspective of planning site

### 3.5. Interior layout

Interior layout consists of the layout of characteristic relation. During the planning process, zoning performed to present restricted area. In the process of planning, four sites zoning applied in this study are public, semi-private, private, and exclusive zone.

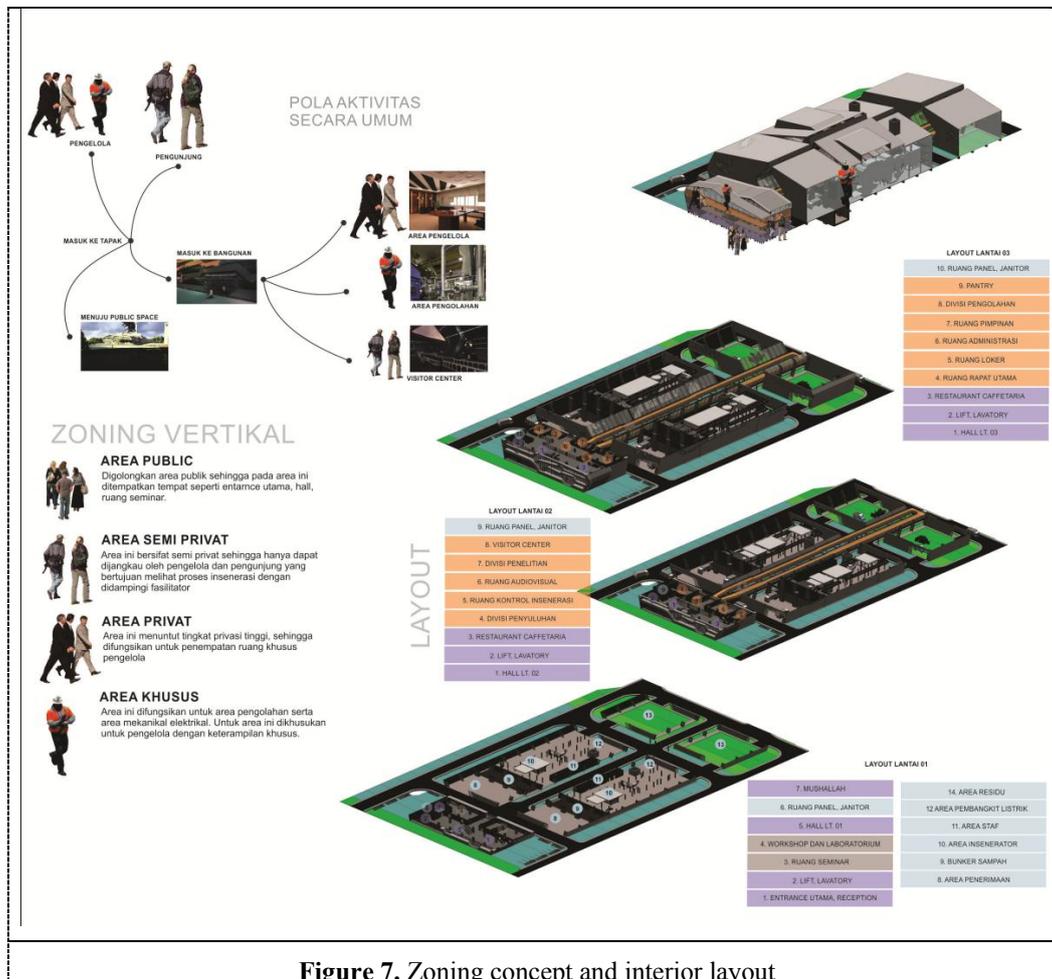


Figure 7. Zoning concept and interior layout

### 3.6. Waste processing concept

Waste production of Mamminasata cities that would be processing is 576 ton and the moisture content is about 60 %. Additionally, reducing moisture content about 50% performed by placing for draining method inside the bunker for 3-5 days. Minimum combustion temperature with incinerator is 850 C. Dioxin will create when the temperature is too low. [6]

Building design planning specification will be able burns the waste is up to 700 ton per day by incineration machine with two units electrical output 10,000 KWh. Incinerator operational operation is 50% of electrical total output.

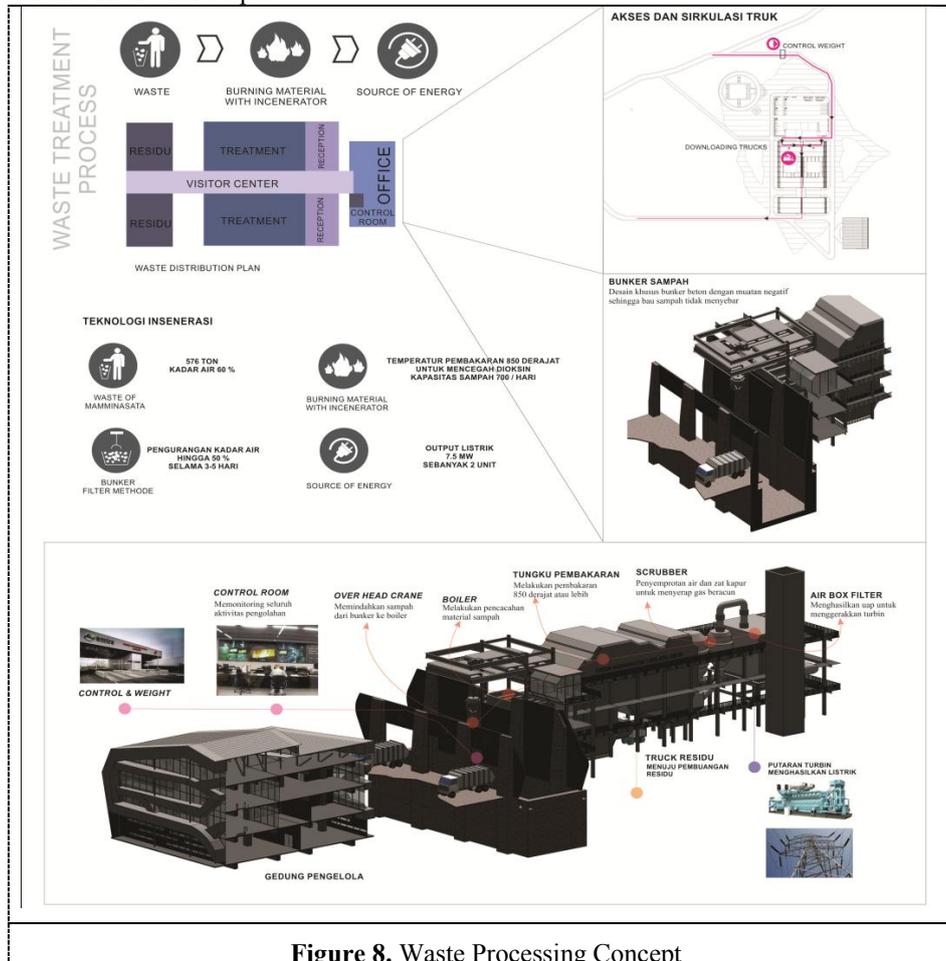


Figure 8. Waste Processing Concept

#### 4. Conclusion

In fact, city waste processing into electrical energy has implemented by European and Asian developed countries. Implementation of incineration technology is by the fuel where the waste is the main problem all this time and turn into strategic option in reducing the waste. Potency in reducing the waste with incineration technology is highly effective. The main point is presenting electrical energy output.

More in depth study is required in the technology to produce alternative energy. For architecture study, target environment design, then in the concept design planning, the application of design concept directed to the energy saving approach and the approach in waste conversion into the energy. As a result, this orientation would combine by the approach of design method that integrated with the environment. Additionally, this combination will support the effort on generating the energy and for the environment itself.

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