International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Index Copernicus Value (2016): 79.57 | Impact Factor (2017): 7.296

The Cost Benefit Analysis Between Conventional Final Shelter with Refuse Derived Fuel Waste Management in Cilacap City

Kun Nasyton[1], Maryunani[2], Nuddin Harahab[3], Budi Prasetyo[4]

[1]University of Brawijaya, Doctoral Program of Environmental Studies, Graduate Program, Veteran Malang 65145, Malang, Indonesia

[2]University of Brawijaya, Department of Economic Development, Faculty of Economic and Business, Veteran Malang 65145, Malang, Indonesia

[3]University of Brawijaya, Department of Fisheries, Faculty of Fisheries, Veteran Malang 65145, Malang, Indonesia

[4]University of Brawijaya, Agricultural Graduate Program, Faculty of Agriculture, Veteran Malang 65145, Malang, Indonesia

Abstract: ***Urban Waste Disposal has become a major concern of the Cilacap Regency Government. Urban waste is currently estimated at 2.25 liters per household / day. Taking into account population growth, the total urban waste that will be generated reaches around 1.15 million m3 / year by 2020. One of the TPA Cilacap, TPA Tritih Lor in Jeruklegi Subdistrict, which is the largest landfill in Cilacap Regency, receives approximately 120 tons of waste per day. This landfill will reach its maximum capacity in 2018 (DLHK, 2017). The problems that arise in the city of Cilacap with the presence of a pile of garbage in the landfill that is not managed properly is getting more and more days because it is directly proportional to population growth and will also impact the decline in environmental quality. Tritih Lor Landfill in Jeruklegi District, which is the largest landfill in Cilacap Regency, receives approximately 120 tons of waste per day. This landfill will reach its maximum capacity in 2018. One of the sustainable long-term methods chosen by the Cilacap District Government is to transform urban waste into Refuse Derived Fuel (RDF), which is a high calorific value separation from processed waste, which can be used as an alternative fuel for cement plants. RDF processing obtained from urban waste will reduce the landfill volume and reduce greenhouse gas (GHG) emissions by avoiding the formation of methane gas in the landfill. In this study, research related to the comparison of the value of investment and operational processing of conventional waste compared to investment and operational processing of waste using RDF. The conclusion of this study including 1) Reducing 80% of garbage into the landfill, 2) Watersheds and groundwater are not contaminated with leachate (leachate is significantly reduced), 3) Scavengers can still operate, with a safer OSH approach, 4) Open employment opportunities in waste processing facilities, 5) Avoid conflicts caused by land acquisition process for new landfill, 6) Contribution Global warming can be avoided or reduced due to CH4 and C gas 2) the result of decomposition of waste does not occur, 7) Extend the life of the existing landfill, 8) The creation of a clean environment and reduced pollution of soil, water and air, with the remaining production in the form of top soil that is beneficial to crop land.***

Keywords: Conventional Landfill, Refuse Derived Fuel (RDF)

1. Introduction

Urban Waste Disposal has become a major concern of the Cilacap Regency Government. Urban waste is currently estimated at 2.25 liters per household / day. Taking into account population growth, the total urban waste that will be generated reaches around 1.15 million m3 / year by 2020. One of the TPA Cilacap, TPA Tritih Lor in Jeruklegi Subdistrict, which is the largest landfill in Cilacap Regency, receives approximately 120 tons of waste per day. This landfill will reach its maximum capacity in 2018 (DLHK, 2017).

The problems that arise in the city of Cilacap with the existence of a pile of garbage in the landfill that is not managed properly is getting more and more days because it is directly proportional to population growth and will also affect the decline in environmental quality because it will produce CO2 emissions from methane gas generated from waste. The existence of uncontrolled scavengers operating in the TPA along with heavy equipment (trucks, excavators and bulldozers) is a separate social problem that requires intensive handling (Baskoro at, al, 2010).

The existing landfill conditions at the present, it is a necessity for the Cilacap District Government to build a new landfill, or to see some alternative methods for managing urban waste. One of the sustainable long-term methods chosen by the Cilacap District Government is to transform urban waste into Refuse Derived Fuel (RDF), which is the separation of high calorific values from processed waste, which can be used as an alternative fuel for cement plants. The processing of RDF obtained from urban waste will reduce the landfill volume and reduce greenhouse gas (GHG) emissions by avoiding the formation of methane gas in the landfill (Techobanoglous et al 1993).

Figure 1: The Location Map of Study Area

2. Methodology

This study was conducted using integrated research method, by adopting and comparing data and analysis from other studies. Data analysis in this study included as much as 120 tons of waste / day in Cilacap city. Total cost required for 15 years:

3. Result

General Description of Tritih Lor Final Disposal Site (Conventional)
The landfill in the composting area, and the area of organic and inorganic waste can cause foul odors (H2S, CH4, NH3 and CO2), the presence of flies, mice as a vector of diseases that can cause various types of diseases such as dysentery basiliartis (shigella shigae), dysentery amobica (Entamoeba histolitica), abdominal typus (Salmonella typl), etc., whereas congenital from mice is pest (Pansterela pestis). This can be a health problem for workers, scavengers who are on the site of activities and local communities.

This impact can occur in all study areas, especially the surrounding communities, garbage workers and scavengers. The impact continues throughout the operation phase and after the landfill operation, so it can be categorized as an important negative impact. For valuation purposes, it is also necessary to know the functions and benefits of natural and environmental resources. The study of the functions and benefits of natural and environmental resources can be divided into extractive use functions (such as taking inorganic waste by scavengers), non-extractive uses (such as hygiene, beauty, and health for the advancement of urban development), environmental services and social / cultural influences. Then, it is necessary to recognize the grouping of functions and benefits of natural and environmental resources into the value of their use.

Reviewing the Cilacap City waste management pattern, from waste generation to landfill, will involve the activities of scavengers in extracting the economic potential contained in waste. The amount of waste taken by the scavenger has economic value, and the al shows the value of the use and extraction of resources directly (extractive use).

General Description of Refused Derived Fuel (RDF) Waste Management

RDF processing of waste as an alternative solid fuel is generally divided into several stages which include crushing process, dryng process, sorting and crushing process and soliditying process. However, before these activities need to be done early sorting.

RDF transportation
RDF products produced from the Cilacap RDF processing unit will be used as an alternative fuel to replace coal from the PT. Holcim Indonesia Tbk. (Cilacap plant). The route for transporting products by land uses an 8-ton truck to the cement factory of PT. Holcim Indonesia Tbk. (Cilacap plant) which is about 5 km away. Transportation is carried out with a packing system that aims to prevent products from being scattered on the road during transportation.

Transportation of residues to landfill
RDF processing will produce residues or residual materials that are not used in the RDF processing process. The residue generated from waste processing capacity of 120 tons per day is estimated at 28 tons per day, consisting of liquid residues (leachate) of 8 tons per day and solid residues of 20 tons per day.

Leachet (leachate) generated from the RDF treatment process is channeled through the leachate distributor installation to the temporary leachate reservoir that has been provided and has been integrated with the leachate treatment plant already in the Jeruklegi landfill. While the solid residues produced will be transported to the Jeruklegi Final Disposal Site (TPA) using an 8 m3 truck.

Calculation of Total Economic Value (TEV) for Conventional Waste Management and RDF
The mass fraction data obtained only shows the type of large group, for example paper type, type of glass, type of recycled plastic and type of metal. Reality in the field, the trade of inorganic waste for this type still has diversity and has different selling prices. To overcome this, it is assumed that the probability of the appearance of each item is considered to have the same opportunity, then the selling price used is the average selling price for each type of waste component.

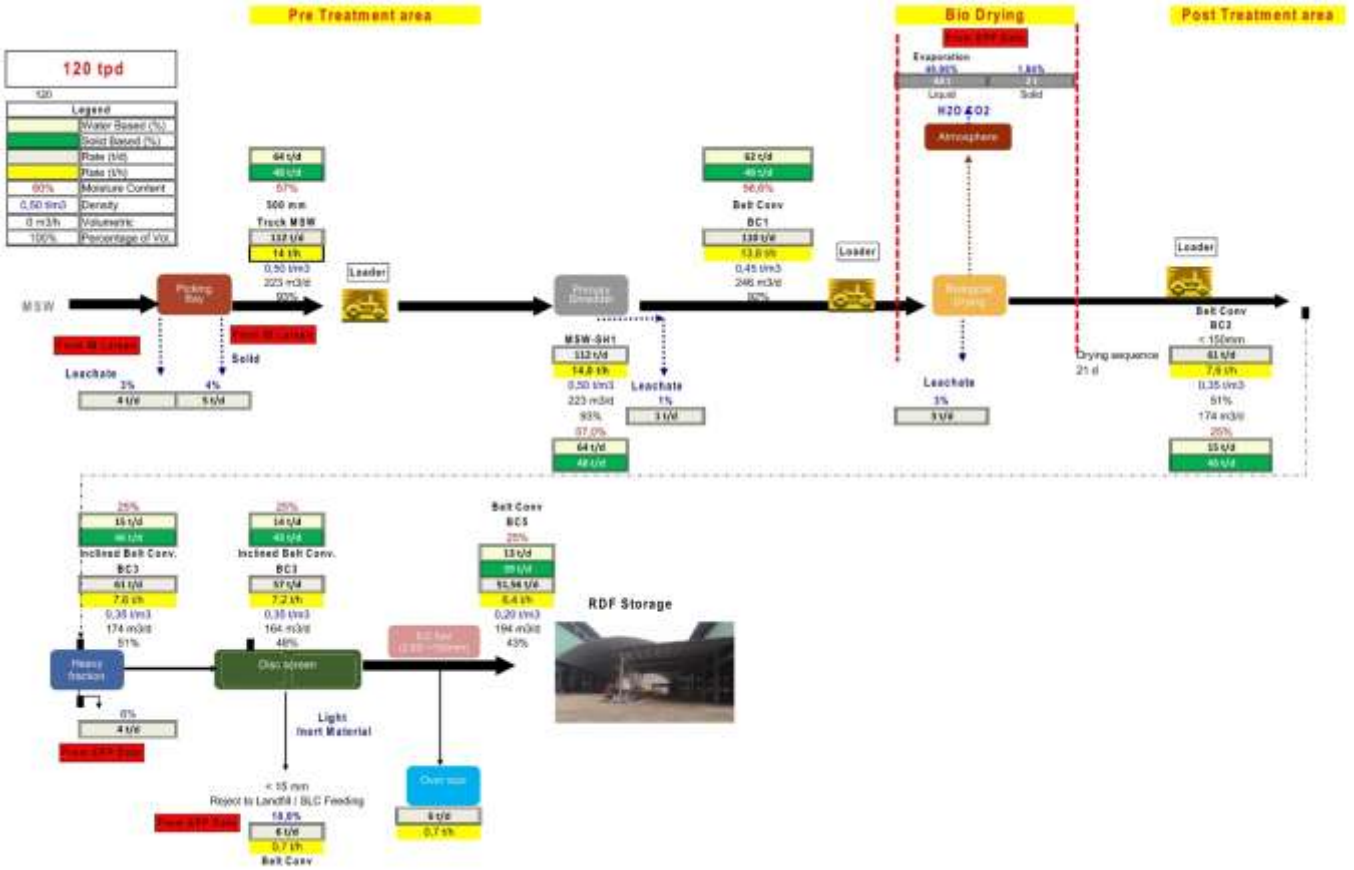

Figure 2: RDF Waste Management System Flow

Table 1: The Mass Fraction of Waste Used By Scavengers

No	Komponen Sampah	Fraksi Massa Sampah (%)
1	Kertas	13,47
2	Gelas/kaca/botol kaca	4,36
3	Plastik daur ulang	18,26
4	Logam/kaleng	1,53
5	Tekstil	1,64
6	Karet	0,33
7	Lain-lain	0,02

Source: Waste Specification Study, 2015

The value of indirect benefits or environmental services caused by waste management is negative and some are positive. Tritih Lor Village will get negative environmental service value, this is caused by the accumulation of waste in the Final Disposal Site. On the contrary, Cilacap City will get positive environmental services, by processing all waste except glass and iron / metal waste into Refused Derive Fuel (RDF) based waste processing, and the results of methane gas sales at Tritih Lor Landfill. In carrying out this valuation, it can be calculated the costs paid by the commercial / non-commercial sector managers, traditional market traders and industry. In addition to residents in settlements calculated from the willingness of financing for the purpose of collecting garbage to the TPS. Cilacap city is divided into 5 sub-districts, 14 sub-districts, 6 villages. Furthermore, from the results of the survey, it can be concluded that there is the ability and willingness of the community towards the pattern of garbage collection to different polling stations. Furthermore, based on the ability of the community, finally the community can be grouped into three groups, namely the community group that lives in the dense / slum area, the people who live in the medium area and the people who live in exclusive areas.

Option Value

The value given in the form of willingness to pay to maintain the existence of natural resources and the environment that will continue to be used in the future. The successful implementation of the Cilacap City waste management will guarantee the smooth flow of waste throughout the City area. In principle, the community is relatively more concerned about the cleanliness of the place of residence and the place to do the activity meaning that the smooth flow of waste throughout the City area is related to the interests of the Cilacap City Government.

It can be emphasized that waste management will encourage the successful achievement of the Cilacap City development goals. Based on this, the cleanliness of Cilacap City is an industrial city, a fishery city, and a service city. In addition, Cilacap City will become a reliable city as a buffer for Central Java. The successful role of Cilacap City development is not only by the cleanliness aspect of the city, but far more complex, which is related to political, social, and economic conditions.

Non-use Value or Passive Value

Bequest value

This positive appreciation from the community will increase the durability of the Solid Waste Service Office or UPT Solid Waste to be able to operate for a longer time. In valuing inheritance values can be done with a willingness to pay or receive compensation (Contingent Valuation

method). The use of RDF as an alternative fuel in the cement industry has several environmental benefits such as:

1) Reducing the use of non-renewable fossil fuels such as coal, and reducing the environmental impacts associated with the extraction of natural materials
2) Contribute to the reduction of greenhouse gas emissions by replacing the use of fossil fuels with other materials that will have to be burned with the appropriate emissions and final residues.
3) Reducing the need for land needed for landfill so as to reduce emissions and also the obligations associated with adequate waste management in the landfill.

Table 2: Cost Parameter

PERIHAL	NILAI	UNIT	KETERANGAN
Berat Sampah Kota (MSW)	120	ton per hari	Ton per hari sampah yang masuk
Capital Expenditure (CAPEX)	82,419,081	Ribuan Rupiah	Biaya Pembangunan Pabrik RDF
Operating Expenditure (OPEX)	4,927,497	Ribuan Rupiah per tahun	Biaya O&M Per Tahun yang dibutuhkan
Lama Proyek	15	tahun	
Tahun Dasar	2018		

Source: Cilacap Government, 2017

Existence value

The absorption of labor in the RDF Processing is the absorption of informal workers and formal labor. Informal workers are a group of scavengers who have been organized in the Tritih Lor Landfill Paguyuban as many as 107 people.

4. Conclusions

The conclusion of this study including 1) Reducing 80% of garbage into the landfill, 2) Watersheds and groundwater are not contaminated with leachate (leachate is significantly reduced), 3) Scavengers can still operate, with a safer OSH approach, 4) Open employment opportunities in waste processing facilities, 5) Avoid conflicts caused by land acquisition process for new landfill, 6) Contribution Global warming can be avoided or reduced due to CH4 and C gas 2) the result of decomposition of waste does not occur, 7) Extend the life of the existing landfill, 8) The creation of a clean environment and reduced pollution of soil, water and air, with the remaining production in the form of top soil that is beneficial to crop land.

5. Suggestion

Hopefully the waste management with RDF method can reduce the social costs accompanied by an increase in social benefits in the long run will reduce the social burden of the Cilacap District Government.

References

[1] Baskoro Lokahita, Enri Damanhuri, *Potensial Of Combustible MSW at Transfer Point in Bandung City as a Refuse Derived Fuel (RDF) Raw material*, National Journal (2010) DC
[2] DLH Kabupaten Cilacap, 2017 "Memorandum Kegiatan Persampahan, 2017".
[3] Erhan Erkut, Avram Karaginnedit, George Perkulidis. *A Multicriteria Facility Location Model for Municipal Solid Waste Management in North Greece*, European Journal of Operational Research, 187 (2008), 1402 – 1421.
[4] J. Malinouskaite, H, Jouhara, D. Czajczyrisca, et,all, *Municipal Solid Waste Management and Waste-to-Energy in The Context of a Circular Economy and Energy Recycling in Europe*, Journal Elsevier 14(2017) 2013 -2044
[5] Kementrian Pekerjaan Umum, 2013. Peraturan Menteri Pekerjaan Umum No. 3 tahun 2013 tentang Penyelenggaraan Prasarana dan sarana Persampahan Dalam Penanganan Sampah Rumah tangga dan Sampah Sejenis Sampah Rumah Tangga
[6] Pemerintah Republik Indonesia, 2008. *Undang-Undang No. 18 tahun 2008 tentang Pengolahan Sampah*, Jakarata
[7] PT Tiga Daun, 2016. "*Technical and Financial Feasibility Study of the Waste Management Cooperation Project in Cilacap Regency".* Danida ESP3
[8] Sandhi Eko Bramono, Ph.D, 2016, *Detailisasi Perhitungan Perbandingan Finansial Tehnologi Lahan Urug dan Teknologi Lahan Urug + Refuse Derived Fuel (RDF) di Kabupaten Cilacap,* Direktorat PLP, Dirjend CK, Kementrian PUPR
[9] SNI 19-3983-1995. *Spesifikasi Timbulan Sampah Untuk Kota Kecil dan Kota Sedang di Indonesia*
[10] Techobanoglous. G. Thiesen H, Vigil S.A (1993), *Integrated Solid Waste management*, International Edition Megraw – Hill, Inc
[11] US.EPA.2001. *Open Burning in Barrels.* U.S. Environmentall Protection Agency : Washington