Implementation of 3R in Waste Management PT. PJB UP Gresik

Erna Triastutik, Risa P. Camelia, Mirza K. Salmah, Idrus Pamungkas, Naindar Afdanny, Totok R. Biyanto

Abstract— ***Jawa-Bali Power Generation Company (PT. PJB) is a subsidiary of State Electricity Company (PT. PLN) which is engaged in generation of electric power. PT. PJB has 5 corporate culture in the company, one is care to environment sustainability. This culture should be implemented in every unit in PT. PJB UP Gresik). In order to implement corporate culture, PT. PJB UP Gresik had performed an implementation of non-hazardous and non-toxic waste management in the activities of Reduce, Reuse, and Recycle (3R). The non-hazardous and non-toxic waste i.e. dry leaf, inorganic non-metal waste, metal waste and organic non-leaf waste. This paper describes the utilization of dried leaves for compost, inorganic non-metal waste for CSR Program, minimalize utilization of organic non-leaf waste and metal waste for recycle in PT. PJB UP Gresik. PT. PJB UP Gresik successfully performed management of waste utilization based on 3R activities. The benefit of these activities are useful for PT. PJB UP Gresik itself, communities, country and planet sustainability. It benefit could be as financial or healthy and comfort that can improve people and plant productivity.***

Index Terms— **Waste management, non-hazardous and non-toxic waste, Environment awareness.**

I. Introduction

One of green practice is waste management. However, in every industrial processes, by product or waste cannot be avoided but it can be mitigated or reduced to minimize the environmental impact [1]. Therefore, PT. PJB UP Gresik has a program of environmental conservation that the aim of the program is to maintain the environmental conditions around PT. PJB UP Gresik.

One of the environmental conservation program perform by PT. PJB UP Gresik is waste management that consists of categorizing the waste into 4 types i.e. dry leaf (organic), inorganic of non-metal waste (plastics), metal waste and organic non-leaf waste (papers) [2].

The utilization of categorized waste as follows [3]:

- Dry leaf for compost.
- Inorganic of non-metal waste for handicraft that it is performed in Corporate Social Responsibility (CSR) Program of PT. PJB UP Gresik.
- Metal waste is sold for reuse.
- Organic non-leaf waste i.e. used paper or paperboard are minimize using Paperless System.

In addition, to reduce paper waste, PT. PJB UP Gresik also perform the Paperless Log sheet System Program. This program replace log sheet paper into Android System Base. Android System Base will record all the information of equipment in power plant and serve as database for many purposes [4].

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1. PT. PJB UP GRESIK, Gresik, Indonesia)
2. Engineering Physics Department, Institut Teknologi Sepuluh Nopember (ITS), Indonesia
Email: trb@ep.its.ac.id

II. Procedure for Paper Submission

A. Flowchart of waste management

The explanation about the procedure of waste management in PT. PJB UP Gresik is shown in Figure 1.

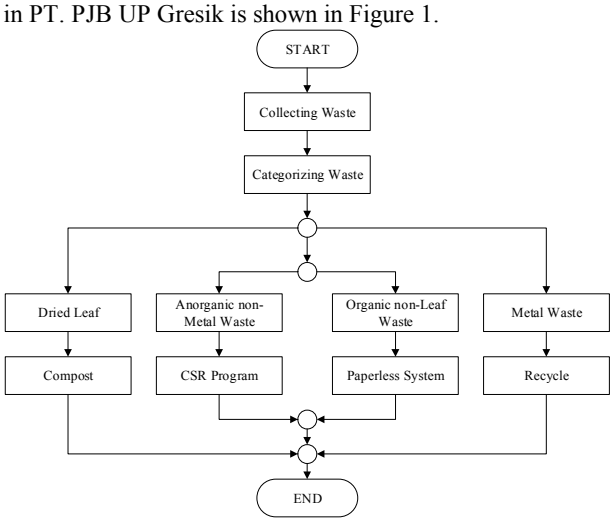

Figure 1. Flowchart of waste management procedure

Waste in PT. PJB UP Gresik was categorized into 4 types and it collected and sent to each further processing as shown in Figure 1. Dry leaves including grass are cut into small size dimension, decomposing and pack in plastic bag for self-usage and sale it into the local market [5].

Inorganic non-metal waste i.e. plastic bottles, jerry cans, plastic containers are allocated for CSR program PT. PJB UP Gresik. Type of CSR program that perform is mentoring program for communities around PT. PJB UP Gresik. The purpose of this CSR programs is develop the new communities skills in utilizing waste became handicraft and sell it in craft gallery [6].

Above activities are performed to reuse and recycle waste in all activities call “Reduce, Reuse and Recycle (3R)”. The remaining program is the reducing of consumable material such as paper for form, report, etc. In the Paperless program, the waste management aims is to remove five sheets paper consumption per day per person that required for operation and maintenance of the plant. The paperless innovation is utilization of Android phone or Tablet application to record operator plant activities. From this program, PT. PJB UP Gresik can save cost of purchasing paper and maintain clean and green environment.

It can concluded that the spirit of implementation of Reduce, Reuse and Recycle (3R) program [7] in PT. PJB UP

Gresik, the waste can be reduce from the early, recycle for degradable product and reuse it for new product. All of that are very useful for PT. PJB UP Gresik itself, communities, country and planet sustainability.

III. Implementation of Waste Management in PT. PJB UP Gresik

A. Layout of waste bin container in PT. PJB UP Gresik

In collecting the waste, the location and the number of waste bins should put in the consideration. It depend on the people activities concentration and the number of the people. It was designed by waste management as shown in Figure 2. The detail of location name are tabulated in Nomenclature

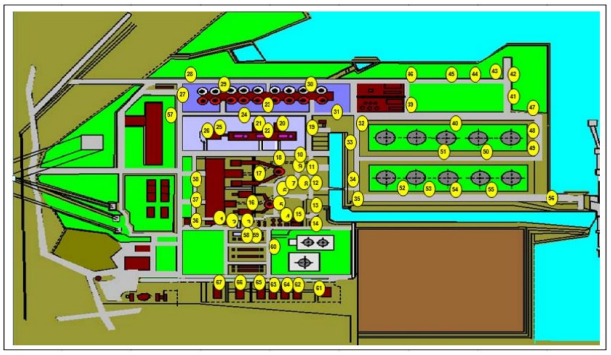

Figure 2. Map of location of waste container in PT. PJB UP Gresik

Nomenclature

1	Service Building
2	Warehouse
3	Steam Power Plant (PLTU) 1-2
4	Steam Power Plant (PLTU) 1-2
5	Steam Power Plant (PLTU) 1-2
6	Steam Power Plant (PLTU) 1-2
7	Steam Power Plant (PLTU) 1-2
8	Steam Power Plant (PLTU) 1-2
9	Steam Power Plant (PLTU) 3-4
10	Steam Power Plant (PLTU) 3-4
11	CWP 3-4
12	CWP 3-4
13	WWTP PLTU
14	WWTP PLTU
15	WTP PLTU
16	PLTU 1-2
17	PLTU 3-4
18	PLTU 3-4
19	Combine Cycle Gas and Steam Power Plant (PLTGU) Block 3
20	(PLTGU) Block 3
21	(PLTGU) Block 2
22	(PLTGU) Block 2
23	(PLTGU) Block 2
24	(PLTGU) Block 1
25	PLTGU Service Building
26	PLTGU Service Building
27	Rendal - Har / Main Substation
28	PLTGU Block 1
29	PLTGU Block 1
30	PLTGU Block 2
31	PLTGU Block 2
32	ROST
33	ROST
34	ROST
35	Intake
36	Pond
37	Transformer PLTU 1-2
38	Transformer PLTU 3-4
39	Golf Yard
40	Golf Yard
41	Golf Yard
42	Golf Yard
43	Golf Yard
44	Golf Yard
45	Golf Yard
46	Golf Yard
47	ROST
48	ROST
49	ROST
50	ROST
51	ROST
52	Intake
53	Intake
54	Intake
55	Intake
56	Jetty
57	Rendal - Har / Main Substation
58	Workshop Gas Power Plant (PLTG)
59	Workshop Gas Power Plant (PLTG)
60	PLTG
61	Hazardous and Toxic Warehouse
62	Warehouse 6
63	Warehouse 5
64	Warehouse 4
65	Warehouse 3
66	Warehouse 2
67	Warehouse 1

B. Waste balance and waste utilization in PT. PJB UP Gresik

Table 1. Waste utilization during 2011-2015

Location	Volume of Waste (Ton)									
	Year of 2011	Utilization (%)	Year of 2012	Utilization (%)	Year of 2013	Utilization (%)	Year of 2014	Utilization (%)	Year of 2015	Utilization (%)
Zone 1 (Service Building, PLTU, Knowledge Building, Soccer Field, Production Area of PLTU)										
Dry Leaf	5.12	0	7.39	71.18	10.72	81.9	12.52	100	7.21	100
Organic non-leaf Waste	68.75	0	55.3	1.92	50.45	13.88	63.4	16.45	35.24	14.84
Metal Waste	82.13	37.09	23.47	43.46	43.85	77.17	210.12	95.49	20.14	78
Inorganic non-metal Waste	10.46	0	55.81	0	50.02	4.66	39.23	14.68	55.56	4.64
Zone 2 (CCB PLTGU, Rendal Building, Production Area of PLTGU)										
Dry Leaf	12.85	0	16.46	66.34	18.14	86.93	23.2	100	11.72	100
Organic non-leaf Waste	82.87	0	73.04	5.82	74.55	13.31	79.35	17.05	38.36	29.58
Metal Waste	6.99	98.28	28.94	75.5	70.6	31.73	4.04	60.15	26.3	80.88
Inorganic non-metal Waste	38.79	0	40.77	0	40.12	8.47	49.32	4.44	37.93	1.21
Zone 3 (Golf Field, Jetty, Area of Oil Tank)										
Dry Leaf	14.79	0	16.9	74.26	20.59	100	20.25	100	15.07	100
Organic non-leaf Waste	193.82	0	174.82	4.14	182.99	7.02	208.07	7.49	23.29	29.58
Metal Waste	34.27	59.99	79.06	44.47	37.49	63.94	4.26	54.23	16.11	80.88
Inorganic non-metal Waste	388.08	0	350.61	0	389.11	0.41	421.52	0.91	193.36	1.21
Zone 4 (Warehouse Area, Production Area of PLTG, Desalination Area of PLTU)										
Dry Leaf	21.94	0	25.68	59.46	29.7	60.4	30.47	100	13.3	100
Organic non-leaf Waste	80.91	0	28.38	24	33.19	31.36	20.09	75.71	17.74	38.61
Metal Waste	33.23	66.51	29.1	28.31	62.35	37.29	49.11	11.69	7.95	58.36
Inorganic non-metal Waste	106.99	0	128.98	0	69.34	4.5	66.43	5.04	48.69	4.79

Waste management in PT. PJB UP Gresik was divide the area become 4 zones, based on building purposes. Refer to Table 1, it can be seen that there is an increasing in the utilization of waste in PT. PJB UP Gresik. It will affect to increase of fund for preservation of plants and maintenance of infrastructure in PT. PJB UP Gresik.

The largest percentage benefit of waste utilization in PT. PJB UP Gresik is on the utilization of dry leaves to produce a compost as a fertilizer. Another benefit is improve the comfort and healthy of the people in PT. PJB UP Gresik and communities.

In another hand the smallest percentage of benefit 3R is utilization of inorganic non-metal waste i.e. plastic, it also shown that the culture of PT. PJB UP Gresik's people have been developed in term of awareness in green practice. Moreover, the application of paperless system can be proven that the green spirit was influenced in the life of the people and PT. PJB UP Gresik management.

IV. Waste Management Program Activities

A. Composting Program

Composting program that motivated by PT. PJB UP Gresik was began in the middle of 2012. The program is the effect of forestation in the PT. PJB UP Gresik area. The dry leaves of each trees represent as waste. It a potential benefit if the waste can be processed became a compost. In order to catch this opportunity, waste management PT. PJB UP Gresik performed composting by build a unit composting process in the plant area. The unit use material of dry leaves and grass, decompose it and pack it in plastic bag. It shown in Figure 3.

Figure 3. Utilization of dry leaf to produce compost

B. CSR Program

Figure 4. Activity of CSR Program in local communities around PT. PJB UP Gresik

CSR program is a form of concern of PT PJB UP Gresik to the local community. CSR programs has a purpose to guide and mentor a local community who lived around PT. PJB UP

Gresik in order to have new knowledge and skills regarding the utilization of inorganic non-metal waste, so the local community can had additional income from handcraft products. The product of handcraft are in the form of jar, vase, plastic carpets, and box of wipes. A portion of the funds obtained from craft selling is used as operational costs for "Intan Permata" Preschools.

C. Paperless System

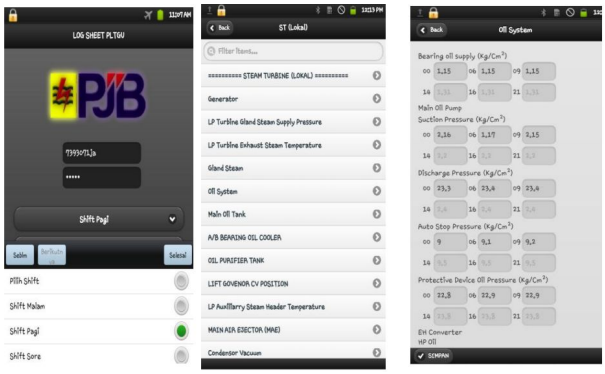

Figure 5. Screenshot of e-logsheet system.

Innovation is done using android technology to replace the paper in the process of data logger and recording of equipment condition in the plant. The operator can identify the tag number of equipment and compare it with database, recording and analyzing the equipment condition. The digital data have some benefit in further analyzing, planning and redesign of related equipment. It benefit will reduce time consuming, human error and improve easy ability of all department in PT. PJB UP Gresik.

D. Waste Recycle

Aging, fatigue, corrosion, erosion, and deformation have been the main cause of equipment repair and replacing. Repair and replacing is a part of maintenance activities that produce a waste from material that consumed, and replace. Degraded material can be used for other purposes, such as tube boilers, fire pipe, aluminum plate, ball pipe, fan casing, steel wire. The utilization of used material depend on industrial or communities demands. These activities provide side incomes that can be used to perform plant maintenance.

V. Conclusion

PT. PJB UP Gresik successfully performed management of waste utilization based on 3R activities. The benefit of these activities are useful for PT. PJB UP Gresik itself, communities, country and planet sustainability. It benefit may as financial or healthy and comfort that can improve people and plant productivity.

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References

[1] Omer, Abdeen Mustafa. "Energy, environment and sustainable development." Renewable and sustainable energy reviews 12.9 (2008): 2265-2300.R. Caves, Multinational Enterprise and Economic Analysis, Cambridge University Press, Cambridge, 1982. (book style)

[2] Prüss, Annette, Eric Giroult, and Philip Rushbrook. "Safe management of wastes from health-care activities." World Health Organization, 1999.

[3] Burke, Lee, and Jeanne M. Logsdon. "How corporate social responsibility pays off." Long range planning 29.4 (1996): 495-502.

[4] I Wayan Santiyasa, et al. "E-Logsheet, Pemanfaatan Teknologi Smartphone / Tablet untuk Menggantikan Manual Logsheet." PT. PJB UP Gresik. 2015.

[5] Inckel, Madeleine, Tim Tersmette, and Tom Veldkamp. "The preparation and use of compost." (2002).

[6] Chi, Ngo Kim, and Pham Quoc Long. "Solid waste management associated with the development of 3R initiatives: case study in major urban areas of Vietnam." Journal of Material Cycles and Waste Management 13.1 (2011): 25-33.

[7] Anastas, Paul T., and John C. Warner. "Principles of green chemistry." Green chemistry: Theory and practice (1998):29-56.

Author

Erna Triastutik, Risa P. Camelia, Mirza K. Salmah, **Salmah**, **Idrus Pamungkas**
PT. PJB UP Gresik, Gresik, East Java, Indonesia.

Totok R. Biyanto, Naindar Afdanny,
Process Design, Control and Optimization Laboratory, Department of Engineering Physics, Institut Teknologi Sepuluh Nopember (ITS), Surabaya. (E-mail: trb@ep.its.ac.id).