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3R Implementation in Waste Management at PT. PJB UP Muara Tawar

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Abstract: *The waste problem are also an important issue for PT. PJB UP Muara Tawar power plant. The waste can contaminate the rain and river water, then flow to the sea. As we know, the power plant condenser utilize sea water as cooling fulid. The sea water will flow through pump and filter. The waste contamined in water sea has posibility to clog the intake of filter. As point of view from management of PT. PJB UP Muara Tawar, the sea water pollution due to solid waste can affect the operation and maintenance of power plant, meanwhile, it can impact to the society health awareness. Hence, this program is very important to the company and society and it is in line with Sustainable Development Goals (SDGs) i.e. "clean water and proper sanitation". This program was initiated by PT. PJB UP Muara Tawar and it is perfomed by employment with the main objective improve clean environmental and society healthy. Waste reduction is done by reduce the use of objects that can generate waste, waste disposal according to type, and advanced processing of waste such as composting. This program have been succesfull implemented. From this program the amount of solid waste are reduced. Organic waste are reduced by 0.8 ton in 2013, 511 ton in 2014, 401 ton in 2015 and 271 ton in 2016. Inorganic waste are reduced 19 ton in 2013, 529 ton in 2014, 418 ton in 2015 and 279 ton in 2016.*

Keywords: *inorganic waste, health, non-hazardous, non-toxic, organic waste*

I. Introduction

Solid waste/garbage problems in Bekasi District are still an unresolved problem. The waste increase over the time due to increase in population and human activities [1]. Waste processing requires some facilities [2]. However, the capacity of processing facilities less than waste volume. In order to overcome this matter, some people in Segarajaya Village area, especially at Kampung Mandalajaya, Kampung Paljaya, and Kampung Kaliadem burn the waste. This solution increase air pollution [3].

The waste problems also an important issue for PT. PJB UP Muara Tawar power plant due to contamination in rain and river then flow to the sea. As we know, the power plant condenser utilize sea water as cooling fluid. The sea water will flow through pump and filter, and the waste contained in sea water has possibility to clog the intake of filter.

As point of view from management of PT. PJB UP Muara Tawar, the sea water pollution due to solid waste can affect the operation and maintenance of power plant, meanwhile, it can impact to the society health awareness. Hence, this program is very important to the company and society and it is in line with Sustainable Development Goals (SDGs) i.e. "clean water and proper sanitation"[4]. This program was initiated by PT. PJB UP Muara Tawar and it is performed by employment with the main objective to improve clean environmental and society healthy [5]. Waste reduction was carried out by reducing the goods that can produce waste, waste classification, and advanced processing of waste such as composting. By this program, it is expected that non-hazardous and non-toxic solid waste can be reduced.

II. Theory

Waste management can be carried out through reuse, reducing, and recycle (3R) the waste. Reuse is utilization of waste for the same or other functions while reduce is the effort of reducing waste by decreasing goods consumption, and recycle is reprocessing the waste for other purposes [6].

Sources of waste can vary from households, markets, stalls, offices, public buildings, and industries. Based on their chemical composition, the waste is divided into organic waste and inorganic waste. Research on solid waste in Indonesia shows that 80% waste is organic waste, and it is estimated that 78% of the waste can be reused [7].

Waste management is all the plans and actions to reuse, reduce and recycle the waste before final disposal [8]. This includes collection, transport, treatment and disposal of waste as well as monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management including guidance on recycling etc.

III. Method

The integrated waste processing program requires several resources, including human worker as garbage collector and administrator. Another resource is the facilities for garbage collection, sorting, washing and pressing, such as carts, trash cans, scales, etc. The program is performed by the following stages:

1. Waste disposal according to its type. By this stages it easier to select the waste that it can be processed or not. Fig. 1. shows garbage bins with 4 type of waste i.e. paper waste, battery, metal, and other waste.

Figure 1. Garbage Bins by Type of Garbage

2. Processed waste is plastic and paper waste. Unprocessed waste will be collected and sent to the landfills by district government.
3. Plastic waste will be washed in the tub to remove dirt and put into the washing machine for further cleaning process.
4. Paper waste are collected to change with new paper. By this program it is expected that paper waste will be reduced. Fig. 2. shows the collected waste paper in Muara Tawar office room.

Figure 2. Water Reuse in Muara Tawar Office

5. Organic waste are processed to make a compos. There are composting facility in Muara Tawar. Figure 3 shows the composting facility in Muara Tawar.

Figure 3. Composting Facilities in Muara Tawar

IV. Discussion

In implementation of the program, it show that non-hazardous and nontoxic waste can be reduced. The practice of waste reduction by reducing the use of paper shows a good result. Table 1. shows inorganic and organic waste before implementation of waste processing in 2013-2016 period. It shows the use of paper is reduced per year.

Table 1. Inorganic and Organic Waste before Implementation of Program

No	Type	Source	Waste to Landfill			
			2013	2014	2015	2016
A	Inorganic		Ton	ton	ton	Ton
1	Sea Waste	Water Intake	1540	2107	2016	1281
2	Paper	Office	1.463	1.382	1.371	0.726
3	Plastic	Office, Canteen	0.819	0.999	0.837	0.44
4	Metal	workshop	0.108	0.114	0.124	0.079
Total Inorganic			1542.39	2109.495	2018.332	1282.244
B	Organic					
1	Leaf	Park	17.522	18.14	17.458	8.865
2	Wood	Park, Civil Workshop	0.061	0.052	0.058	0.039
3	Leftover	Canteen	0.068	0.067	0.068	0.033
Total Organic			27.655	26.7	27.184	13.828
Total			1570.045	2136.196	2045.516	1296.072

Figure 4. Paper Waste Reduction and Utilization Graphic

Reduce and utilization of waste from implementation of this program is shown in Table 2 and Table 3. Table 2. shows the waste reduction has been increase per year. It is shown that reduction of waste program successfully implemented. From 2013 to 2014, the waste reduction is increase 0.009 ton of waste per year. From 2014 to 2015, the waste reduction is increase 0.007 ton of waste per year.

Table 2. Reduce of Waste

No	Type	Source	Reduction			
			2013	2014	2015	2016
A	Inorganic		ton	ton	ton	Ton
1	Sea Waste	Water Intake	0	0	0	0
2	Paper	Office	0.016	0.017	0.015	0.009
3	Plastic	Office, Canteen	0.141	0.148	0.157	0.077
4	Metal	workshop	0	0	0	0
Total Inorganic			0.156	0.165	0.172	0.087
B	Organic					
1	Leaf	Park	0	0	0	0
2	Wood	Park, Civil Workshop	0	0	0	0
3	Leftover	Canteen	0	0	0	0
Total Organic			0	0	0	0
Total			0.156	0.165	0.172	0.087

Table 3. shows the utilization of waste have great impact to reduce the waste before it send to landfill. Utilization of sea waste from water intake reach 510 ton in 2014 period. It was great impact to reduce waste.

Table 3. Utilization of Waste

No	Type	Source	Utilization			
			2013	2014	2015	2016
A	Inorganic		Ton	ton	ton	Ton
1	Sea Waste	Water Intake	0	510	400	270
2	Paper	Office	0.743	0.722	0.701	0.5
3	Plastic	Office, Canteen	0	0	0	0
4	Metal	workshop	0.066	0.075	0.08	0.032
Total Inorganic			0.809	510.97	400.781	270.532
B	Organic					
1	Leaf	Park	17.522	18.14	17.458	8.865
2	Wood	Park, Civil Workshop	0.061	0.052	0.058	0.039
3	Leftover	Canteen	0.068	0.067	0.068	0.033
Total Organic			17.651	18.259	17.584	8.937
Total			18.46	529.056	418.365	279.469

Table 4. shows the final waste sent to landfills. It is shows that the waste are reduced by implementation of this program. In 2013, before utilization and reduction of waste, total of waste sent to landfill are 1570 ton. After implementation of program, the total waste sent to landfill are reduced to 1551 ton. In 2014, before utilization and reduction of waste, total of waste sent to landfill are 2136 ton. After implementation of program, the total waste sent to landfill are reduced to 1607 ton. In 2015, before utilization and reduction of waste program, total of waste sent to landfill are 2045 ton. After implementation of program, the total waste sent to landfill are reduced to 1627 ton. Therefore, implementation of this program are successful.

Table 4. Final Waste Send to Landfills

No	Type	Source	Waste to Landfill			
			2013	2014	2015	2016
A	Inorganic		Ton	ton	ton	Ton
1	Sea Waste	Water Intake	1540	1597	1616	1011
2	Paper	Office	0.704	0.643	0.655	0.217
3	Plastic	Office, Canteen	0.678	0.851	0.68	0.362
4	Metal	workshop	0.042	0.039	0.044	0.047
Total Inorganic			1541.424	1598.533	1617.379	1011.626
B	Organic					
1	Leaf	Park	9.883	8.32	9.475	4.838
2	Wood	Park, Civil Workshop	0.093	0.092	0.104	0.04
3	Leftover	Canteen	0.028	0.029	0.022	0.013
Total Organic			10.004	8.441	9.6	4.891
Total			1551.428	1606.974	1629.979	1016.517

Organic waste is used as compost. Composting is done at composting facilities in Muara Tawar. Fig. 5-7 shows the amount of organic waste utilization in period 2013-2016. Utilization of organic waste shows stable amount per year. For leaves, the amount of waste utilized is about 17500 ton per year, for leftover food, the amount of waste is about 0.094 ton per year, and for wood waste the amount of waste utilized is about 0.057 ton per year.

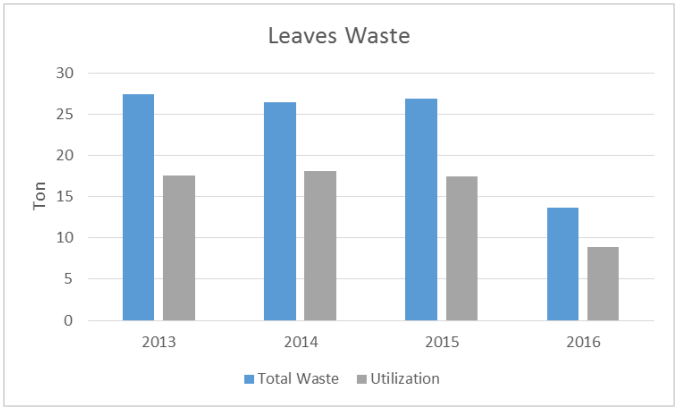

Figure 5. Leaves Waste Utilization

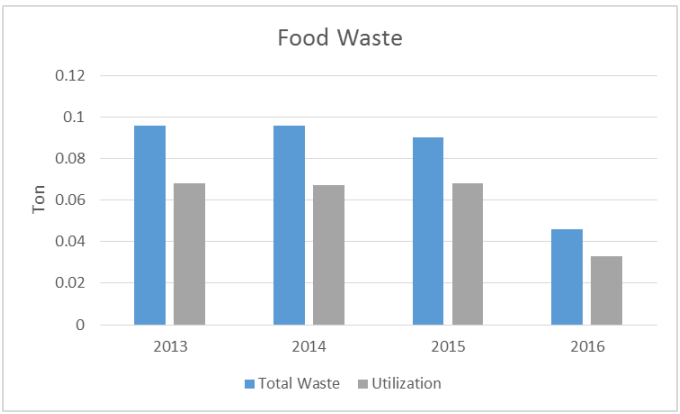

Figure 6. Leftover Food Waste

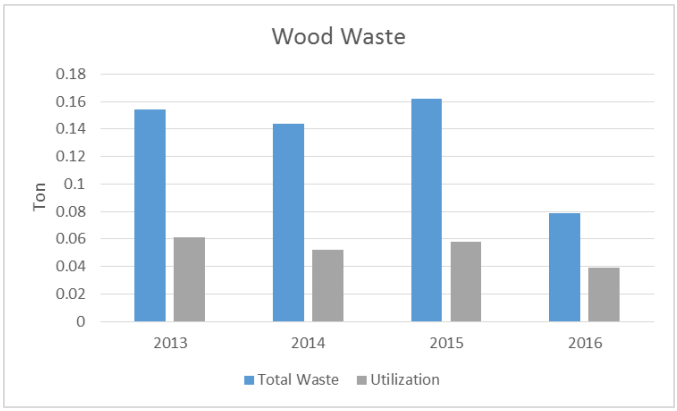

Figure 7. Wood Waste Utilization

Fig. 7 shows utilization of plastic waste in 2013-2016 period. Plastic waste is reduced by cleaning and further processing. It can be sold to other industry which required plastic. Fig. 7 shows that plastic waste reduction is increasing per year. In 2013-2015 period, reduction of plastic waste is increased about 0.008 ton per year.

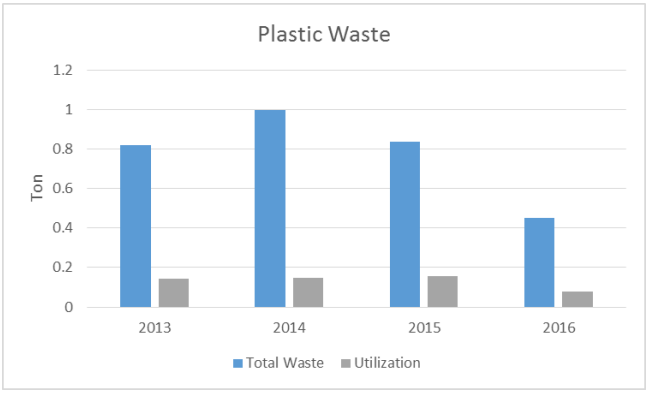

Figure 8. Plastic Waste Utilization

Fig. 8 shows utilization metal waste in period 2013-2016. Metal waste are used for another purposes. In Muara Tawar metal waste is used to make iron fence. Iron fence from metal waste is shown in Fig. 9.

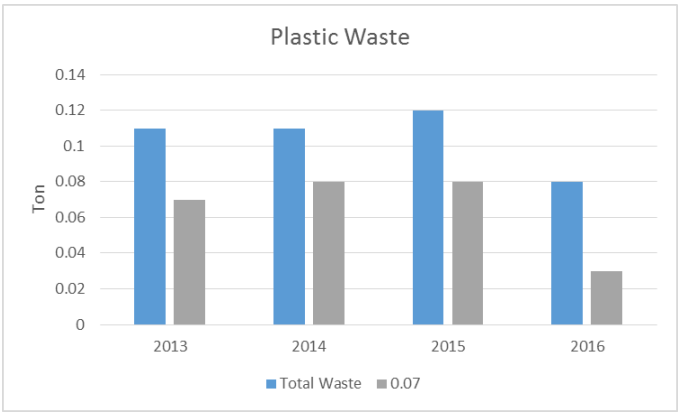

Figure 9. Metal Waste Utilization

Figure 10. Iron Fence from Metal Waste

From Table. 1-4 and Fig. 4-9 it is shows the waste are reduced by implementation of this program. Organic wastes are reduced by 0.8 ton in 2013, 511 tons in 2014, 401 ton in 2015 and 271 ton in 2016. Inorganic wastes are reduced 19 tons in 2013, 529 ton in 2014, 418 ton in 2015 and 279 ton in 2016.

V. Conclusion

This program had been successfully implemented. From this program the amount of solid wastes are reduced. Organic wastes are reduced by 0.8 ton in 2013, 511 tons in 2014, 401 tons in 2015 and 271 ton in 2016. Inorganic wastes are reduced 19 tons in 2013, 529 tons in 2014, 418 ton in 2015 and 279 ton in 2016.

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