International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 9 No. 3 Nov. 2014, pp. 1176-1179

http://www.ijias.issr-journals.org/

Model of an Improved Waste Power Plant in Dhaka

Masuda Akter Tonima[1] and F M Anim Hossain[2]

[1]Department of Mathematics and Natural Sciences,
BRAC University,
Dhaka, Bangladesh

[2]Department of Electrical and Electronic Engineering,
Stamford University Bangladesh,
Dhaka, Bangladesh

ABSTRACT: The amount of waste in the developing Dhaka city is reaching a point where the Metropolitan is running out of space for discarding. This increasing waste is becoming an issue not only for the lack of space but also due to it being the cause of illness, pollution, destruction of natural beauty of the city. The city has already successfully polluted its once primary water source, the Buriganga River. In the current scenario, waste management has become an essential factor. Both quantitative and qualitative disposal is absolutely crucial. In this study a new model of a waste power plant has been proposed which will require less manpower, will create lesser pollution than existing waste power plant models and will put use to a large mass of waste that goes unused in the city.

KEYWORDS: Waste Minimization, energy from waste, waste management, waste power plant, power generation.

1 INTRODUCTION

The inevitable byproduct of any process of production is waste. Whether is it something as small and regular as cooking or production of something as massive as airplane; any processes is bound to produce a certain amount of waste. With the growing economy, population and urbanization this waste has equally gown in complexity as well as in amount, this not only hampers the growth in the processes causing them but also causes pollution resulting into various problems, such as: decrease in fertility of soil, increase in production of greenhouse gas, human health risks …etc. Along with this, mismanagement [e.g.: open dumping] also causes problems such as clogging the urban drainage system and contaminating the water supply. The waste is a definite by product which cannot be helped, management and disposal of the waste can definitely help decrease the degradation of the environment- this is an aspect that has been explored to a certain extent in Bangladesh. The process had begun in 1995, when a national research organization for waste concern was established. A decade later (in 2005) the Waste Concern Group was formed as a Social Business Enterprise that involved numerous social purpose companies. With the main objective of using the waste as a resource the Waste Concern put into perspective the categorization of waste and identifying the type of management involved with such. Numerous initiatives have been taken by both the Concern and the Govt. of Bangladesh; keeping the 3R strategy in mind the focus has been on the composting and reduction of the area of landmines used. Even though the concerned sectors have accomplished much to mention and is still being worked on at every level, the prospect of energy conversion and recovery has been nearly untouched. Combination of energy shortage with this gives the issue a new potential. This aspect has been explored by various countries in Europe [1].

In this paper we explore the possible ways of energy extraction from disposed waste, along with which possible improvement of existing methods of waste disposal and possible use of other renewable sources is mentioned

Corresponding Author: F M Anim Hossain

2 IMPROVED MODEL OF A WASTE TO ENERGY POWER PLANT

2.1 WASTE TO ENERGY

Waste to energy is a well explored sector where various methods have been established with variable efficiency. We mainly explore the industrial aspect of this. The current system of waste to energy conversion is combination of several processes; such as waste separation, gas extraction, heat powered steam turbine and fuel powered gas turbine. The illustration of which shown in Fig.1.0. In the currently existing process extra work is needed in carrying the waste from the waste storage to the fuel tank, regardless of whether it is done by automated machines or manual labour. The gas cleanup process does not extract gases such a dioxin, nitrogen oxide, mercury etc. along with the overall heat produced during the process—released into the atmosphere causes harm to the environment.

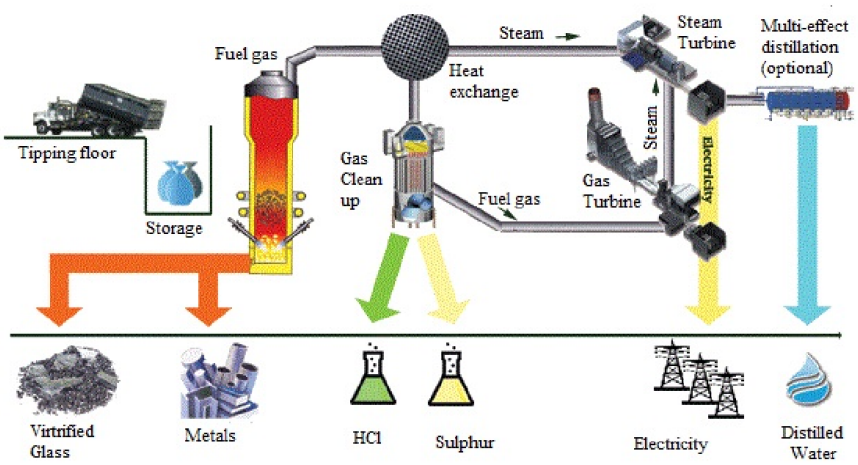

Fig. 1. Existing Model of a Waste Power Plant

2.2 PROPOSED WASTE POWER PLANT

Since this system causes waste of a lot of energy that can be easily used; hence we have come up with an alternative design with better efficiency with same input waste material shown in Fig. 2.

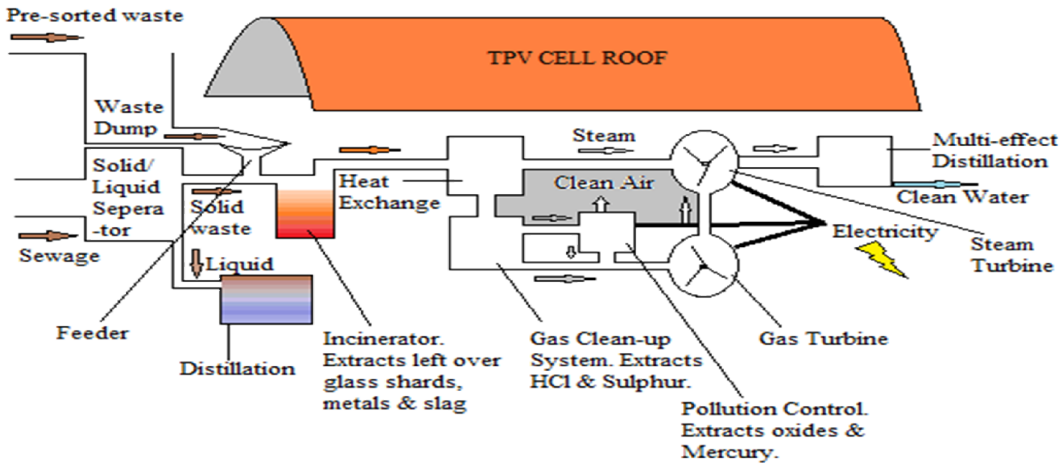

Fig. 2. Proposed Model of Waste Power Plant

- This design saves energy/labour cost for waste transfer due to storage being directly linked to feeder.
- Addition of the pollution control system to the gas clean-up tank—reduces production of harmful gases and ensures release of clean gas into the atmosphere; vapour produced in this process also contributes to the gas turbine, making it faster.
- The addition of TPV dome at the top ensures use of heat produced in production of additional electricity.
- Note that this process works analogous to the currently existing design only with increased efficiency and less pollution. The amount of heat produced during the incineration and also other processes like steam production, does not just release into the atmosphere to eventually add to the greenhouse effect, instead this heat is used by the TPV cells to generate further electricity.

2.3 WASTE POWER PLANT DATA

There are 212 recorded Waste Power Plants according to the data found in Global Energy Observatory website [3] that range in capacity from 1.1 to 677 MW. These power plants generate tons of carbon dioxide gas during the process of incineration of the waste products; municipal solid waste is a big part of this, which is primarily carbon. For example, a waste to energy treatment of 1 ton of household waste can produce almost the same amount of CO_2. This amount might seem a lot; however the same amount of waste dumped into a landfill can produce up to 62 m^3 of CH_4, which in turn is more harmful to the environment than 1 ton CO_2. The pollution control system in the proposed design however reduces this production of this carbon dioxide as well, making is more environmentally feasible compared to the existing.

2.4 ECONOMIC FACTOR

- Cost feasibility is a major issue in the context of Bangladesh. According to the comparative data provided in [1]—waste to energy conversion is economically feasible for Bangladesh in the current condition. According to [5] there has been a contract signed between the Management Environment Finance SRL Ltd and the local Govt. of Dhaka (north and south) in February 2013, where the Italian company is supposed to construct 2 waste power plants for the govt. Management Environment Finance SRL Ltd however has failed to deliver any results so far. The project deadline has been extended four times till date. This is mainly due to lack of funds claim MEF SRL Ltd. The dead stated the local govt. is to lease 43.4 acres of land to the company for 6.944 million taka, where the investors pay 300 million dollar- the lease amount would increase 20% every 5 years. The generated energy was discussed to be purchased by the DPDC at 8.75 taka per unit. This plan however is currently at a position where the Govt. is considering cancelling the plan altogether.
- In the context of Dhaka itself, the process of generating power has advantages compared to any other country, considering the already established market of waste sorting. Table I shows an example of the sorted waste products (in percentage) in Dhaka city in the year 2006 [6]. This saves one step from the separation and filtering, thus saves energy and labor.

Table 1: Collection of Waste in Dhaka

Waste composition	Dhaka (% by weight)
Food & Vegetable waste	70
Paper products	4
Plastics	5
Metals	0.13
Glass and ceramics	0.25
Wood	0.16
Garden Waste	11
Other (Stone, dirt etc.)	9.40

- It should be highlighted that after being dumped in the landfills surrounding Dhaka, the organic waste is entirely left to rot while the waste sorters only sort out plastic, paper, metal and glass waste and use them for recycling. Therefore receiving the primary raw material, organic waste, for a waste to energy plant is plentiful in Dhaka.

3 CONCLUSION

- In the current state of the environment, we have no other way but to consider renewable sources of energy. With the increasing everyday waste—it emerges as the best solution to the current energy crisis which in turn is also environment friendly. With approximately 30 million people living in Dhaka, household waste can be easily considered as a renewable source of energy.
- The existing model of the system causes a lot of harm to the environment resulting into the 'environment friendly' aspect to be nullified; since 100% efficiency is not achievable, the best possible alternative is to utilize all possible harmful aspects of the system to generate more power. And by practically implementing the proposed model it is possible to eradicate two of Dhaka City's major problems at once: a) generating much needed electricity and b) reducing the ever growing amount of waste in the city.
- Further research can be conducted in this field of study to make the model even more environment friendly and more efficient.

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