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ENERGY FROM MUNICIPAL SOLID WASTE

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Abstract—Waste to energy has experienced a tremendous growth due to the technological advancements and its scope as alternate source of energy. This study focuses on the technological and economical aspects of the WTE process. It also focuses on its environmental issues and policies. Despite the huge technological potential, large scale development and deployment of WTE technology still has to overcome a certain number of technical and financial barriers.

Keywords-Waste to energy, WTE, alternate source , tecnological and economical aspects, environmental issues

I. INTRODUCTION

Any material becomes waste when users stop to make a use of it. Municipal Solid Waste is a waste type consisting of everyday items that are discarded by the public. For example – food waste, yard waste, plastic containers etc. Municipal solid waste is an unavoidable residual of human activities. The amount of Municipal solid waste varies greatly with city to city, state to state and country to country and also changes with time.

Waste management is very serious issue on the global level. The quantity of the solid waste generated in the modern world is greatly increased due to the increase in the population growth, industrialization and unplanned economic growth etc.

Today huge amount of solid waste is generated in cities and most of which are remain uncollected. Uncollected wastes are dumped on vacant lands or dumped into sewers or rivers. Collected wastes are generally dumped in the open grounds in a very unacceptable manner which causes several discomforts to a society.

Because of these reasons, optimal solid waste management techniques have attracted the attention of the whole world. Numerous actions are being taken to promote sustainable development focusing on environmentally sound management. The basic approach to the solid waste management process explores the remedial measures to maximize the recycling and reuse of waste and to promote the safe waste disposal.

II. WASTE AS A RESOURCE

Untreated municipal solid waste is being viewed as a valuable commodity to meet the energy requirements of the upcoming generations. With the anticipated global shortage of the non-renewable resources and the increasing demand for the renewable resources solid wastes are ripe for exploitation. WTE applications are being implemented world wide and extracting energy from the waste.

Approximately 130 million tonnes of municipal solid waste are being treated annually in more than 600 waste to energy (WTE) facilities around the world to produce electricity to produce heated steam for district heating. In US, currently 88 WTE plants and in Canada 7 WTE plants are operating which are fuelled by 27 million tonnes of municipal solid waste annually.

III. TECNOLOGY APPLICATIONS

Thermal technologies that are use to produce energy from the municipal solid waste (MSW) are generally classified as

A. *Convensional Combustion*

Conventional Combustion consists of techniques that include batch combustion, mass burn, and modular 2-stage combustion and fluidized bed combustion techniques. 'Mass – burn' is the most commonly used technology and each of these convention technology has many years of operating experience. MSW is combusted in a combustion chamber that produces heat and bottom ash. Heat is used to boil water and produces steam that is used to run the steam turbine generator and produces electricity.

B. *"Advanced Thermal" tecnologies*

Advanced thermal technologies include gasification and Pyrolysis, also ultra-high temperature gasification using plasma. These technologies are less proven on a commercial scale for the MSW processing than conventional technologies.

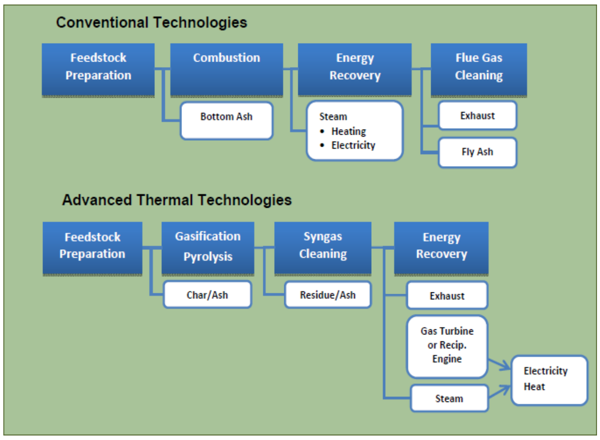

FIGURE 1 - Comparison of conventional and advanced thermal technologies

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Location	Technology	Process Units	Annual Permitted Capacity (tonnes)
Burnaby, BC	Mass-burn	3 X 240 t/ day	280,000
Quebec City, QC	Mass-burn	4 x 230 t/ day	300,000
Levis, QC.	Primary combustion chamber	1 x 80 t/ day	25,000
Iles de la Madelaine, QC	Mass-burn	1 x 31 t/ day	4,500
Brampton, Ont.	2-stage modular	5 x 91 t/day	150,000
Charlottetown, PEI	2-stage modular	3 x 33 t/day	25,000
Wainright, Alta.	3-stage modular	1 x 29 t/day	4,000

TABLE 1 – Overview of Canadian Waste to energy facilities

IV. ELECTRICITY PRODUCTION POTENTIAL

The electricity production potential of the WTE facilities is dependent on the several factors that includes the feedstock heating value , energy recovery process and efficiencies within the combustion. . Table 2 provides a range of electricity produced (expressed on a kWhr per tonne basis) observed in operating facilities using a range of technologies. Energy output from the WTE facilities is generally a consistent source of power because of the regular and consistent supply of waste feedstock. However in some places average daily waste volumes reduces in winter than in spring and summer. This seasonal variability affects potential viability of the WTE plants because the plant would be running at lower efficiency during a period when the demand of renewable energy is at its highest.

Technology	Electricity Production Range kWhr / tonne
Conventional – older	500 – 600
Conventional – newer	750 – 850
Gasification	400 – 800
Plasma Arc Gasification	300 – 600
Pyrolysis	500 – 800

TABLE 2 - Reported Electricity Production Ranges for various WTE Technologies

V. EXPERIMENTAL ISSUES AND OPPORTUNITIES

Waste to energy plants includes a number of environmental considerations that ranges from emission control to the generation of greenhouse gases. Discharge of a number of contaminants that includes, heavy metals, particulates, dioxins and furans, sulphur dioxide and nitrogen oxides is a serious issue regarding potential air emission in waste to energy plants. The use of modern air pollution control equipment and the adoption of standard operating procedures effective controls each of the contaminants listed above, ensuring that the emissions can be achieved.

Operation of a WTE facility can result in the reduction of greenhouse gas emissions. It also leads to the reduction of emissions associated with landfilling of waste. Landfilling of municipal solid waste results in the creation and emission of methane as the waste gradually decomposes. From the Landfill sites where no landfill gas recovery systems are in place, up to 1.6 kg of carbon dioxide equivalent emissions may be emitted from each kg of waste landfilled (IEA 2003). On this basis, a Whitehorse WtE facility could result in the reduction of over 30,000 tonnes of Green House Gases emissions per year through a reduction in methane emissions at the landfill. The actual emission reductions would be somewhat less due to the combustion of non-biodegradable material (ie. plastics).

VI. TECNOLOGY RISKS

Technology risks associated with the Waste To Energy plants differ on the basis of class of technology used. Convention Combustion Technologies coupled with steam cycle electrical power generation are very effective and well proven and are operating since over a decade at waste throughputs less than 50,000 tonnes per year. The waste throughputs at the facilities having conventional combustion techniques are generally at the lower end of the range of WtE applications that generate electricity. This causes the risk of lower efficiency which could be reduced by having a complementary biomass waste source to be used as a backup.

Advanced thermal technologies would carry additional technology risks in short term. These risks are due to the fact that only few facilities with advanced thermal technology have yet been constructed in commercial scale and thus operating experience is very less as compared to the conventional combustion techniques.

VII. ELECTRICITY COST

Capital cost of WTE facility ranges between $600-$1200 based on recently constructed European plants. Operating cost generally range between $50 - $100 per tonne.

The construction and operation of WTE facilities are funded through funds generated from both energy sales and waste tipping fees. The estimated cost of generation through WTE plants ranges between $0.15 - $0.40 per kWhr.

VIII. CONCLUSION

An interest in utilizing waste to energy facilities is growing and being driven by the need of alternative resources , need to conserve landfill space, reduce greenhouse gas emissions and to obtain renewable source of energy. Approximately 130 million tonnes of municipal solid waste are being treated annually in more than 600 wastes to energy (WTE) facilities around the world to produce electricity. Energy from waste has a huge potential

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to be used as an alternative source and is ready to be exploited at a global level but still it has to face some technological and financial challenges before it can be utilized at world level.

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