MUNICIPAL SOLID WASTE PROCESSING

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Executive Summary

The production of municipal solid waste (MSW) has steadily increased over the last 45 years from 88 million tons in 1960 to 246 million tons in 2005. Of the waste produced in 2005, about 54% was landfilled, 14% was combusted, and 32% was recovered through recycling or composting. Over the last 18 years, the number of operating landfills has decreased from approximately 8,000 to fewer than 2,000. Due to the decreasing landfill space, especially in densely populated cities, it has become necessary to explore alternative methods for MSW disposal.

Pyrolysis, used for municipal solid waste management, has a variety of benefits. The process drastically reduces the mass of waste that must be disposed, remedying current problems related to insufficient landfill space. Additionally, pyrolysis produces synthesis gas which can be further processed to produce a saleable end product, making it more profitable than current incineration facilities. The profitability of a MSW pyrolysis facility is dependent on the end product produced. Several different end products were examined, based on estimates of total capital investment, operating cost, and revenue from sales, to determine the optimum choice of final product. The comparison of net present worth and rate of return of all of the products proved that production of urea is the best choice for final product. Urea is most commonly used in fertilizers and is produced by reacting ammonia with carbon dioxide.

Further analysis of the growing urea market displayed that the maximum plant capacity, in order to refrain from substantially affecting the current urea price, is a facility capable of processing 6,000 tons/day of MSW. At full capacity, this plant will produce approximately 1,960 tons/day of urea.

Throughout the past decade, management of the 25,000 tons/day MSW produced has become a serious concern for New York City (NYC). Due to the large amount of waste generated and high disposal cost, NYC is an ideal location to apply this new approach to waste management. The terms of contracts between NYC and existing waste disposal facilities suggests that an expansion of 1,800 tons/day is possible for each year until the maximum plant capacity, 6,000 tons/day is reached. A drop charge to NYC of $40/day will provide the city financial relief compared to the current waste disposal methods.

The total capital investment for a 6,000 MSW ton/day waste-to-urea facility is approximately $418 million. This project has a net present worth of $259 million with an expected rate of return of 21%. These economic results are more sensitive to fluctuations in urea price than the ability to operate at full capacity. The break-even urea price for this project is $60/ton.

The economic analysis shows that this approach is a feasible and profitable solution to the municipal solid waste management crisis facing NYC.