New York Municipal Solid Waste

By: *Phuong Do, Lino Gutierrez, Asad Khan, Kimberly Ruffel, Marci Wyatt*
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Executive Summary

The creation of valuable end products such as synthetic fuel, hydrogen and methanol from solid waste is both possible and cost effective. The objective of this project is to present an answer to the Municipal Solid Waste management crisis faced by New York City, whose residents and businesses are currently producing nearly 45,000 tons per day of trash. Because of this massive throughput of trash, the City of New York is paying disposal fees as high as $75 per ton to surrounding states, which is twice as high as the fee proposed in this report.

A mathematical model was developed to map a long term solution to the MSW problem faced by NYC. The first step of the solution will be the creation of three hydrogen producing Purox pyrolysis plants located in Islip, NY (4modules), Oxford, NJ(5modules), and Poughkeepsie, NY(1module). Pyrolysis was chosen over the alternative disposal methods of landfilling and incineration. From the trash processed, approximately 19 million SCF of hydrogen will be produced daily per every 4 modules. In all 7 process plants are constructed with the final expansion made 12 years after the opening of the initial sites. The total capital investment will be $1.24 billion, and the net present value of the project will be $631,730,000. Annual revenue includes income from the disposal fee, recovered metal sales, and hydrogen gas sales.

Several factors have gone into the decision making process including process feasibility, environmental impacts, economic outlooks, and social issues. Of the processes and product options considered, pyrolysis and subsequent production of hydrogen gas provides the best answer to all of the imposed concerns. The process is practical and air emissions are below EPA regulations.

The mathematical model developed is capable of finding the optimal construction and expansion timeline for a given set of conditions. It will also give the optimal flow rates of trash from the 15 transfer stations in NYC to the eight possible plant locations around New York. The model is also be able to analyze the sensitivity the final solution has to different variables in the system. The sensitivity is analyzed for the disposal fee, total capital investment, operating cost estimates, and hydrogen gas prices.

The project provides New York City with an answer to the problems associated with the MSW produced in NYC. The proposal would provide NYC with a drop charge of $36 per ton as compared to the average of $63 they are currently paying. This will save NYC millions of dollars yearly on disposal fees. The Total Capital Investment will be nearly $1.4 billion to process all of the trash handled by the Department of Sanitation. Six facilities will be built to handle the DOS trash. By sending the trash to the pyrolysis plants at a lower price, New York City will save nearly $160 million annually in year 10. The overall NPV of the savings over the 20 year project will be $878,000,000, discounted at 12%. The solution will reduce and eventually eliminate any export of New York City trash outside of New York State, providing relief to surrounding states, and providing the region with a hydrogen gas supply capable of fulfilling the needs of the impending hydrogen economy.