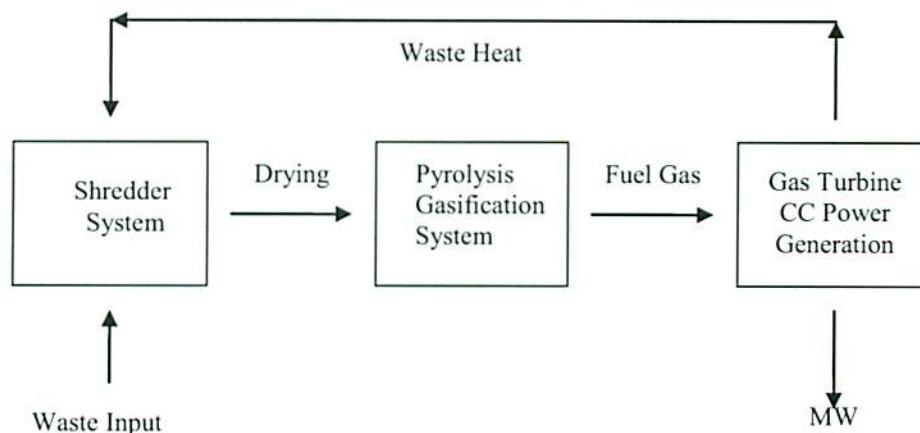


## A. Executive Summary

### A.1 Technology Overview

The overall project design is based on producing electrical power, using a series of three integrated processes shown in Figure 1.



**Figure 1: Basic Flow Diagram of the Proposed Three-Module System**

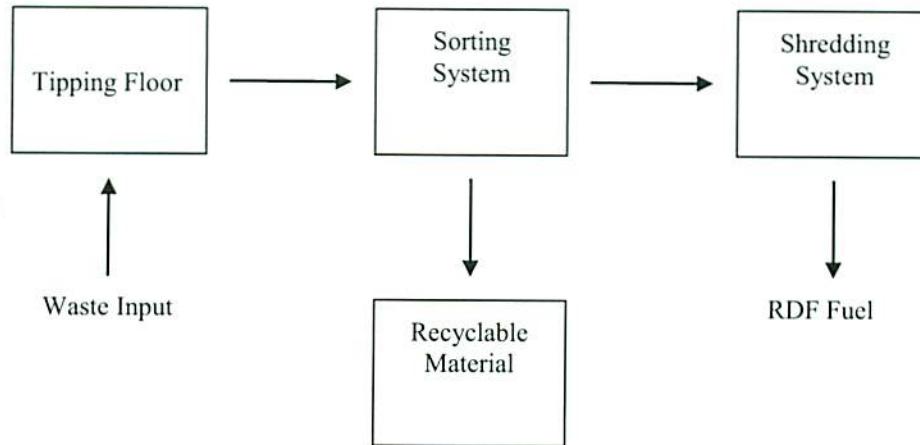
Municipal Solid Waste (MSW) is delivered to an enclosed receiving floor and fed into a shredder system to convert the MSW into refuse derived fuel having a size of <2 inches and < 20 percent moisture content. This fuel is delivered to a pyrolysis gasification system (KUG) to form a clean fuel gas by a process called slow pyrolysis. The fuel gas is then fired in Siemens SGT 500 gas turbines to produce electrical power. Existing LMU unit # 5 will be retrofitted into a Heat recovery steam generators (HRSG) are utilized in order to capture exhaust heat from the gas turbines and generate steam for existing LMU # 4 steam turbine. Each of these processes is described herein. The KUG and turbine systems were specifically chosen by Pyrolyzer LLC to optimize production of electricity from MSW.

#### A.1.1 Preconditioning Equipment Shredder

The shredder system is designed to break down incoming waste and dry it to the moisture content required by the KUG pyrolysis system.

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**Figure 2: Shows a Basic Breakdown of the Preconditioning System and the Unit Operations Involved**

MSW is delivered to the receiving floor and fed by conveyors to the sorting system. The Recycleable materials like metal, glass are separated and stored for sale. The remaining MSW is shredded into pieces that are less than 2 inches in diameter. The shredder also reduces original moisture content by 50% due to the air cyclone system employed. After shredding, the MSW enters heated screw conveyers that further dry the fuel to less than 20% moisture with waste heat from the reactors.

The project includes four MSW shredders provided by Inergy Plus technologies operating three online with one in backup mode. Each unit is capable of handling 600 TPD of raw MSW.

#### **A.1.1.1 Sorting Process**

Raw MSW will be directed to a bag ripper, double magnet system (over belt and drum magnet) to take out the Ferrous, then an Eddy Current to take out the Non-Ferrous (aluminium etc) material. The glass and stones are sorted in the ballistic separator and collected in a container.

#### **A.1.1.2 Drying**

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The drying system is included within the KUG system and features indirectly heated in-feed screw conveyors using exhaust heat from the primary and secondary reactors along with the cracker reactor as discussed herein.

### **A.1.2 Conversion Reactor**

The Pyrolyzer system uses a slow pyrolysis method developed by the German company KUG GmbH. It is an innovative state of the art pyrolysis process for the gasification of carbon based waste materials to produce fuel gas. The fuel gas (PyroGas™) reaches a calorific value of 7 KWh/m<sup>3</sup> or 700 BTU/ft<sup>3</sup> when using MSW feedstock. PyroGas™ made with the KUG process can be used interchangeably with natural gas or for highly efficient, extremely low-emission power generation in gas engines, gas turbines, and combined cycle systems. Alternatively, it can also be used as feedstock for liquid transportation fuels production or separated into Hydrogen and Liquid Natural Gas (LNG).

This process establishes state of the art for pyrolysis fuel gas production. The PyroGas™ produced has been analyzed by GE Jenbacher, Siemens AG, Bayer, and Duetz and found suitable for use in their gas combustion engines and turbines.

#### **A.1.2.1 Characteristics of the KUG Thermolysis process:**

- Gas production: 800 m<sup>3</sup> per metric ton feedstock material.
- Heating value: 700 BTU/ft<sup>3</sup> when using MSW feedstock.
- Very low emissions (50% below German Environmental Air Emission Standards).
- Adjustable to various renewable energy feedstocks, including biomass, wood waste, MSW, rubber and plastics.

#### **A.1.2.2 Innovations of the KUG GmbH Process:**

- Multistage bi-directional gasification reaction is controlled kinetically on a catalytic carbon bed.
- Improved heat transfer by indirect heating using the carrier effect.
- Reaction occurs in the absence of oxygen avoiding Dioxins and Furans.

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- Bi-directional flow of the materials avoiding short cuts in the gas stream that can cause incomplete gasification.
- Multistage gas treatments using new patented technologies.
- Tars treated internally by additional integrated cracking reactors
- Vitrified slag with minimized residues.

**A.1.2.3 Advantages of the KUG Pyrolysis process:**

- Fuel gas with quality standards comparable to natural gas in purity and BTU value.
- Fuel gas can be used directly in gas turbine engines.
- Very low emissions.
- High thermal efficiency (75 - 85%).
- Efficient separation and processing of liquid aromatic oils and tars with conversion into additional fuel gas.
- Continuous process.