Waste to Energy

Transforming Municipal Solid Waste (MSW) into Affordable Electricity

Presented by

NEO Green Energy Partners, Inc.

Able Green Solutions
Brier Hill Strategies, Inc.
J. FELTRIC Consulting, LLC

Chapter I. An Overview

A. The Problem:

Our civilization has a problem… and that problem is garbage! The world is being buried in waste… cities are rapidly filling our landfills to capacity… sewage disposal is a major cost for cities and a major source of disease in developing nations… industrial waste… construction and agricultural waste… food scraps… medical waste… the list goes on and the problem grows each year.

But there is some good news. Most un-recycled waste is organic and that means that, in theory, this organic matter could be used to address another of our major problems… this organic garbage could be converted into Energy!

So, if we can make energy out of garbage, why is most organic waste still buried in landfills or just dumped? There are five major reasons why we aren't using garbage as a major energy resource:

1. Historically, the capital and operating costs of waste-to-energy conversion systems have been too high,
2. The conversion processes have often created "long-chain tar deposits" and other by-products that can hamper or interfere with the effective conversion process,
3. The slag and other residual by-products of some conversion technologies include high levels of heavy metals and other environmentally dangerous materials that require expensive additional handling,
4. Existing systems require massive facilities with large (and therefore expensive) "footprints", and
5. "Stack emissions" from many existing waste processing technologies include significant levels of greenhouse gases as well as other pollutants.

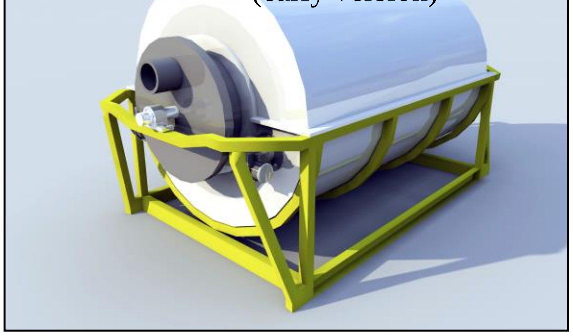
B. The Solution:

Using American innovation to devise solutions, noted engineer Richard Tucker put together state-of-the-art technologies that address each of these issues…technology that will make the large-scale production of energy from garbage a practical reality while preventing large quantities of waste material from entering our landfills. Joining in the effort to bring this revolutionary technology to the public is Able Green Solutions, one of the nation's best environmental amelioration firms, NEO Green Energy Partners and J. Feltric Consulting Services. Imagine a world with no landfills or piles of tires or clusters of plastic in our oceans. No Emissions / 100% recyclable. The solution is here and now.

These firms can provide and operate major, practical, and profitable Waste-to-Energy plants using this patented and proprietary technology. This state-of-the-art technology, called the "Tucker Pyrolator System", is capable of:

1. Creating energy from a wide range of waste product feed-stocks, and at capital and operating costs that are significantly lower than competing technologies,
2. Preventing the formation of system threatening tar deposits,

3. Sequestering sulfur, mercury, heavy metals, and other noxious compounds in charcoal in a manner that will not allow the contaminants to “leach out”,
4. Maintaining a footprint that is a fraction of the size of existing conversion facilities, and
5. Preventing the venting of hazardous materials into the environment by using a “closed loop” system that produces minimal stack emissions that will include virtually no heavy metals and remarkably small quantities of greenhouse gases.


Single Retort Pyrolator unit (early version)

C. Business Description

1. The Process

The Pyrolator process will use waste products, like Municipal Solid Waste (MSW), and convert this waste material into two clean products:

1. A clean combustible methane-based gas that can be converted to electricity, and
2. Recyclable Carbon.

The key component of this conversion is the Pyrolator technology. The Pyrolator technology is a unique Waste-to-Energy process based upon pyrolysis, which is the heating of organic and inorganic feed-stocks in an oxygen free environment.

A variety of feed-stocks can be fed into the “Pyrolator” process including;

- MSW (Municipal Solid Waste) or landfill garbage,
- Animal waste,
- Sewage – Bio-Solids
- Biomass including wood scraps, food scraps, and agricultural and animal waste and
- Medical waste.

The Pyrolator waste-to-energy process includes three major steps:

Step #1: Feed-stock Preparation – This step prepares the feedstock for processing. Different feed-stocks require different preparation steps. For example:

- Municipal Solid Waste (MSW) – A sorting process is required to remove metals, glass and other non-processable materials.
- Woody biomass – Wood products must be chipped and dried for ease of handling and processing efficiency.
- Sewage – Municipal-processed sludge must be de-watered and dried.
- Medical waste
- Manufacturing or construction scrap

Step #2: Pyrolator Processing – In the second step, the prepared feed-stock material from Step #1 is fed into a Pyrolator unit where it is subjected to temperatures well above those of competing systems, in the absence of oxygen. The proprietary aspects of this process result in the creation of large quantities of methane-based gas as well as quantities of carbon.

The heat that is used in the Pyrolator units initially comes from burning natural gas. However, as the process proceeds, a portion of the gas produced is diverted to replace the natural gas and provide heat for the operation of the Pyrolator unit.

The volume of gas produced by the Pyrolator process depends on the content of the feedstock. In the event that some batches of MSW feedstock have a low BTU content, an additive called "feedstock oil" can be added to insure a controlled level of energy production. This feedstock oil additive consists of high-BTU waste such as used cooking oil and used lubricating oil.

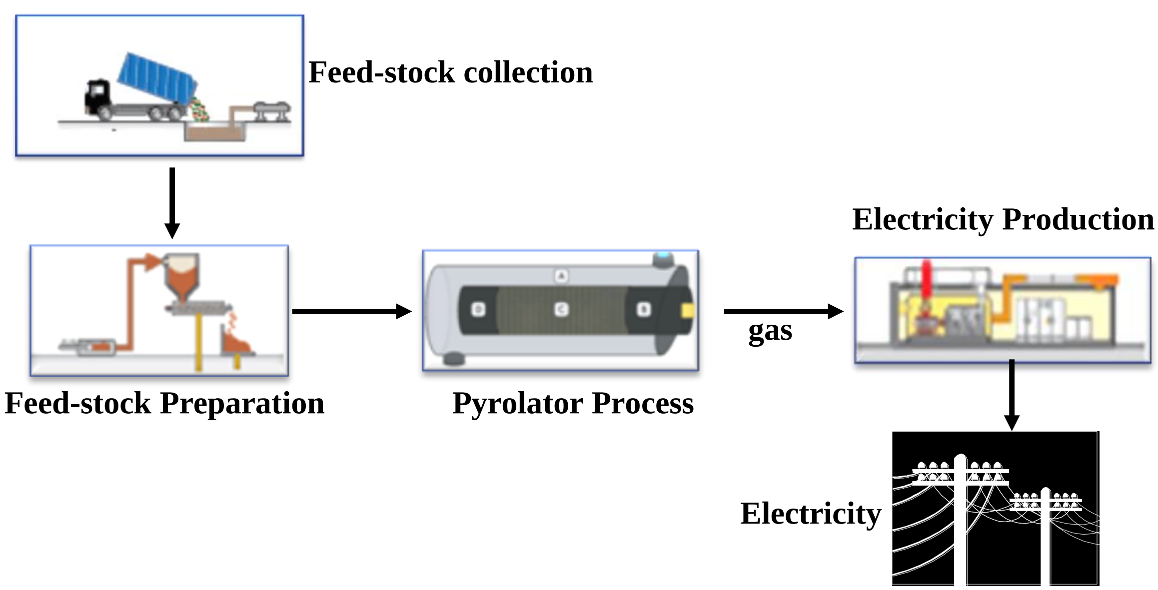
The Pyrolator process also provides carbon dust control, gas cleanup, and cooling. The gas is then compressed and stored or fed directly to a generator or turbine.

The "Pyrolator" unit itself is compact with an 8' wide footprint. With a feedstock that has a high caloric value, one unit will generally:

- Consume up to 2¼ tons of feedstock per hour,
- Produce enough combustible gas to produce 1.4 megawatts (MW) of electricity, or 33.6 megawatt-hours (MWh) per day, and
- Carbon production varies according to the feedstock type and ranges from 8 to 12 tons per day.

Step #3: Energy Generation – This step uses a variety of commercially available generator or turbine units to burn the gas and create electricity. When burning our gas, the air emissions from the unit's burners and the generator/turbine will meet US EPA standards. Gas from this step is used to run the Pyrolator unit. The unit is self-sustaining once up and running.

The Waste-to-Energy Process



The "Pyrolator" system has the potential to revolutionize the waste-to-energy industry and provide energy and jobs for countless communities around the country for years to come.

3. Sustainable Operations

Our business and social philosophy is to "turn waste into resources". And while we are justifiably proud of our ability to take trash from a landfill and turn it into clean electricity and carbon, we have also worked hard to make our own processing and operational functions as sustainable as possible:

- 10% of the gas we make iw used to fuel our own Pyrolator units,
- Our intention is to also compress a portion of our gas production and use it to fuel our company's forklifts, bobcats, and other equipment.
- About 12% of the electricity we generate will power our motors, lights, and electrical equipment, and
- The excess heat from our Pyrolator units will be used to dry the MSW material prior to processing.

In summary, we "waste" nothing!

4. Pyrolator Technology:

While there are various other pyrolysis-based systems in the market place, and even more in various stages of research and development, the "Pyrolator" technology has several proprietary trade secrets and components that set it apart from all other competitors.

First, by utilizing revolutionary, proprietary components in the converter itself, we are able to achieve considerably higher processing temperatures than any comparable technology in the field. This is important because it significantly increases the quality of the gas.

Second, our technology is able to effectively breakdown and "crack" the long chain hydrocarbons that result in tar build up. Our technological ability to nearly eradicate the tar build up from the process is second to none. If not addressed, this issue can render a plant useless because of the significant costs associated with eradication.

Third, Pyrolator uses a superior process that sequesters sulfur, mercury, heavy metals, and other noxious compounds in the carbon. Leachate Testing (TCLP) has shown that they will not leach out.

The Pyrolator system demonstrates dramatic improvements over existing Waste-to-Energy technologies.

The cost of the Pyrolator system and equipment includes installation and 12 months of routine maintenance. This price may vary based on the date of the order, location, and specs to determine each unit's capabilities.

Chapter II. Market Analysis

A. Waste-to-Energy Industry History

While the U.S. has used incineration as a waste disposal method for over a century, the primary goal was volume reduction, not energy production. In 1885, Allegheny, Pennsylvania built the first U.S. municipal incinerator. As their populations increased, many cities turned to incinerators as a convenient way to dispose of wastes. Combustion reduces the volume of solid waste material by about 90 percent and its weight by 75 percent.

These incineration facilities usually were located within city limits because transporting garbage to distant locations was impractical. By the end of the 1930s, an estimated 700 incinerators were in use across the nation. This number declined to about 265 by 1966, due to air emissions problems and other limitations of the technology. During this period of inexpensive land availability, the popularity of landfills increased.

In the early 20th century, some U.S. cities began generating electricity or steam from burning wastes. In the 1920s, Atlanta sold steam from its incinerators to the Atlanta Gas Light Company and Georgia Power Company. Europe, however, developed waste-to-energy technologies more thoroughly, in part because these countries had less land available for landfills. After World War II, European cities further developed such facilities as they rebuilt areas ravaged by war. U.S. cities interested in converting waste to energy tended to acquire European technologies when they built or improved their incinerators.

In the 1970s, the Arab oil embargo and increasing energy prices encouraged the development of waste combustion. The U.S. Navy, for instance, built waste-to-energy plants at two Virginia naval stations, one of which is still in use. Federal laws and policies aided the development of the waste-to-energy industry. The 1970 Clean Air Act authorized the end of open burning at U.S. landfills. City incinerators also were required to install pollution controls or cease operation, and a number of the worst polluters were closed down. Losing incinerators forced cities to consider waste-to-energy plants and look again to Europe for technology.

In 1975, the first privately built waste-to-energy plant opened in Massachusetts; it experienced a number of operational problems at first as engineers sought to adapt it to the contents of American waste and made other operational changes. In the late 1970s, the federal government started to fund feasibility studies for local governments interested in setting up new waste-to-energy plants. The 1978 Public Utility Regulatory Policies Act (PURPA), which required the Federal Energy Regulatory Commission to guarantee a market for electricity produced by small power plants, allowed new waste-to-energy projects to find financing. PURPA made waste-to-energy projects financially viable, since projects could find buyers for the electricity they generated.

The 1980 Energy Security Act appropriated funds to support biomass energy projects and required federal agencies to prepare a plan for maximizing its production and use. The act provided insured loans, loan and price guarantees and purchase agreements for biomass projects, including waste-to-energy projects using municipal solid waste. It also directed the U.S. Department of Energy to prepare a municipal waste energy development plan and support it with construction loans, and loan guarantees, price support loans and price guarantees. The act also authorized research and development for promoting the commercial viability of energy recovery from municipal waste.

While the majority of this funding was rescinded in the 1980's, some federal money flowed to businesses and local governments, and about 46 new waste-to-energy facilities were built.

Today, the use of municipal waste combustion for energy is not common; the nation had only 87 such facilities in 2007. The 1986 federal Tax Reform Act simultaneously benefited and harmed the development of waste-to-energy facilities. The act extended federal tax credits available for waste-to-energy facilities for ten years, but also repealed the tax-free status of waste-to-energy plants financed with industrial development bonds. In the 1990s, after the tax credits extended in 1986 finally ended, fewer waste-to-energy plants were built.

However, today, there are steadily mounting pressures to develop waste-to-energy facilities due to:

- The increasing costs of landfill operations,
- Public and government pressure to pursue environmentally friendly strategies, and
- Rising energy costs.

B. Competition

1. Competitive Advantage

Our entry into the gasification industry will succeed by maintaining high quality, durable converters with a significant number of feedstock options. We have found a way to:

- Eliminate heavy metal contaminants from being released into the environment,
- Handle a wide variety of commonly occurring, waste feed-stocks, and
- Economically eliminate tar from the process.

In addition, the Pyrolator design has exceeded all engineering standards. For instance, insulation that is 4” thick would suffice but we install 8” thick instead. All purchased materials and equipment are designed for severe conditions and exceed all engineering specifications.

The foundational research for this technology was initiated many years ago and Pyrolator engineers have developed and optimized many of the techniques that are vital to the continuing development of the units. Pyrolator designers selected a precision control system for its units that utilize a real time communication methodology connecting all system sensors and control devices to an intelligent and expert PLC control system. Feeding the data into the Expert Control System (ECS) performs this precision real time data transfer and device control.

The Pyrolator gasification system is a closed loop system. The system is designed to allow a "multiple sequestrations" process to occur during the processing of any synthetic or organic material meaning an Earth-friendly converter with pollutant free emissions.

For low cost and ease of maintenance, the equipment utilized to construct the converters mainly consists of off-the-shelf components. All components are guaranteed by their manufacturer and conform to IEEE, ANSI and CE specifications. Examples of off-the-shelf components are gas blowers, pumps, regulators, rotary feeders, specialized bearings, seals, thermocouples and pressure sensors. The system is designed to utilize all components within their manufactured specifications of temperature, humidity, pressure, stress, strain, duty-cycle and mass flow rate.

The Pyrolator unit also uses some proprietary components fabricated to proprietary specifications. Although they are specialized, the components are variations of standard components presently used in industrial applications. These components are made from select metallic materials that will withstand high temperatures and other stress demands.

2. Competing Technologies

A number of existing technologies compete in the Waste-to-Energy market:

Technology	Outputs	Issues
Pyrolator	1. Methane-based gas/electricity 2. Carbon	1. Good energy output 2. No smokestack emissions 3. Contaminants sequestered in carbon 4. Short install time 5. Wide range of feed-stock options
Incineration	1. Slightly higher energy output than Pyrolator 2. Ash and tar	1. Smokestack emissions 2. Residual heavy metal contaminants 3. Up to 2 year installation time
Bio-digestion	1. Lower energy output than Pyrolator 2. Contaminated sludge	1. Slow, complex process 2. Residual heavy metal contaminants 3. Effective only with selective feed-stocks
Other Gasification	1. Syn-gas - Same energy output as Pyrolator 2. Char	1. Syn-gas output less flexible than Pyrolator methane 2. Free heavy metal contaminants
Plasma	1. Syn-gas – Lower energy output than Pyrolator 2. Contaminated exhaust and hazardous slag	1. Larger size and cost 2. Syn-gas output less flexible than Pyrolator methane 3. Free heavy metal contaminants

Chapter III. Operations Plan

A. The Waste-to-Energy Process

The Pyrolator process begins with the arrival at the plant of trucks carrying a feed-stock… in this case, animal waste and Municipal Solid Waste (MSW) from a local waste collection company. Pyrolator will then process this animal waste and MSW into gas, electrical energy, and carbon, using a number of discrete processing steps and utilizing a variety of types of equipment:

Pyrolator Processing (assuming MSW feed-stock)

Process Step	Equipment Required	Equipment Source	Comments
1. Feed-stock transport to plant	Truck	Usually provided by supplier	
2. Open trash bags	Bag ripper unit	Pyrolator	
3. Remove glass from MSW	Pick line conveyor	Pyrolator	
4. Shred MSW material	Pre-shredder and secondary Shredder	Pyrolator	
5. Remove ferrous metal from MSW	Cross-belt magnet separator	Pyrolator	
6. Remove non-ferrous metal from MSW	Eddy current separator	Pyrolator	

7. Dry remaining MSW	Dryer	Pyrolator	
8. Transport dry MSW	Belt conveyor	Pyrolator	
9. Compress dry Feed-stock • 9.a Carbon cooling • 9.b Packaging	Constriction device • Heat Exchanger & Chiller • Packager	Pyrolator	
10. Pyrolator gas and carbon production	Pyrolator unit	Pyrolator	
11. Gas cleaning	Gas filtration units	Pyrolator	
12. Gas storage	Tanks	Pyrolator	
13. Electricity production • 13.a Generate electricity	• Generator	• Caterpillar	

This process will operate 24 hours per day, seven days a week. The equipment will be non-functional for 24 hours each month for preventative maintenance and cleaning.

B. Quality Assurance

Quality Assurance will be performed on an on-going basis. The Pyrolator system will monitor gas quality, exhaust content, and 30 other factors by automatically testing output samples at specified intervals. Each Shift Supervisor will monitor the Mass Spectrometer data and file reports as required.

In addition, the quality and content of the carbon product will be periodically analyzed and assessed.

C. Warranty and Support

While most of the Pyrolator equipment is well-proven technology with years of operational history, several key proprietary components have limited operational time. And while we believe the technology to be stable and dependable, management also believes in providing protection in the event of a lengthy "down-time" period.

The Pyrolator System has four levels of support:

- **Replacement Parts** - With the exception of the retort assemblies, most parts and assemblies are readily available for replacement in a short time-frame.
- **Manufacturer's Warranty on Equipment and Materials** – Most of the equipment and material provided with the Pyrolator System is warranted by the original manufacturer. These warranties vary but all meet or exceed industry standard warranties.
- **Operations Insurance** – Operational Insurance will cover costs and lost revenue for significant "down time".

Pyrolator Processing Flow