WHY CHANGE?
Looking Toward the World's Future

Sixty percent of the United States population lives in or around an urban area. This trend toward urban growth significantly impacts the amounts of waste produced, the energy that it takes to heat and light the homes of citizens, and the cleanliness and safety of the air that we breathe. Forward thinking such as the Taylor Solution could significantly impact the quality of life for us, our children, and our grandchildren.

WASTE ISSUES

The disposal of Municipal Solid Waste (MSW) is becoming an increasingly serious problem throughout the United States. In the period from 1990 to 2000, MSW generation rates increased by 17 percent. Generation rates have moderated somewhat in recent years but continue to rise by approximately 4% per year reaching a total of over 250 million tons annually or approximately 4.5 lb per person, the highest of any industrialized nation in the world. Current generation rates are over 65 percent higher than 1980 levels. Large quantities of other solid wastes, commonly referred to as construction and demolition wastes (C&D) are also generated annually further increasing the problem.

Currently all waste is handled or processed using mainly one of the following methods:

- Landfill - over 50% of existing waste is collected and then deposited in permitted landfills. A minor amount of waste is deposited in dumps along roadways or on private property.
- Incineration – less than 10% of existing waste is collected and then burned in waste incineration plants a portion of these facilities recover energy in the form of heat or electric power.

Both of these conventional approaches, however, have limitations.

Landfills

In New York State, Taylor Biomass Energy's home state, the areas damaged by landfills and the limited land available for landfill space in New York State and other northeastern States, have focused interest on the disposal of C&D materials and MSW. The result is that the fees for disposal within the State continue to rise exceeding $100 per ton in some areas. Recent analysis by Wall Street financial firms indicate that the cost of collection is rising by over 3% annually and operating costs (which contribute to the overall waste disposal costs) are rising by over 5% annually throughout the U.S. Wastes are being transported to surrounding states for disposal at lower cost, however, such transport contributes to significant costs and deterioration of the environment by adding tons of pollutants to the air each year from truck and rail transportation of these materials to out of state landfills.

Landfills themselves further contribute to environmental deterioration as the organic material contained in these wastes decays anaerobically emitting large quantities of greenhouse gases to the environment. The emission of these greenhouse gases contributes significantly to the environmental deterioration as a large fraction of the gases emitted is methane. Methane has a global warming potential (GWP) 21 times that of carbon dioxide, the major component in greenhouse gases. Over 75% of the methane emissions in the environment originate from MSW decomposition in landfills. Landfills also emit nuisance odors, toxic compounds, and can be fire hazards. If not properly controlled, they can contaminate aquifers that supply us with drinking water.

In highly populated areas, landfills are filling up and are closing at a high rate. New landfills in these areas are getting harder to permit due to the associated environmental issues.

Incineration

When conventional approaches to energy recovery such as incineration from mass burn processing of MSW or residue derived fuels are used, other environmental problems caused by the inherent properties of the technologies themselves arise. In incineration and direct combustion, for example, emissions of criteria pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO), particulates, and volatile organics (VOC's) can be quite high due to the process conditions found within these conversion systems. Depending on the contaminants fed along with the residual materials, sulfur oxides (SO_x) can also be formed, even though sulfur is typically not a contaminant found in biomass. Other more hazardous materials such as dioxins can be produced from chlorine containing species in the incoming fuel.

ENERGY ISSUES

Price volatility for various forms of energy along with uncertainty of long term, stable supply have resulted in renewed interest in alternative fuels. Of significant concern are the sustainability of supplies of premium fuels such as natural gas and distillate oil as these fuels both provide environmental advantages to end users as well as convenience for residential use as heating fuels. Natural gas, in particular, is of increasing concern. Uncertainty over the environmental impacts of fracking for production along with a dramatic increase in natural gas use due to current low prices can lead to shortages in supply in the future (some industry sources believe within 10 years). Both oil and natural gas imports continue despite increased US production. These imports contribute to the negative balance of trade in the United States. Furthermore, such dependence increases the risk of a foreign nation holding the U.S. hostage as energy security declines.

Global interest and a renewed focus on controlling climate change further reduces the interest in continuing the use of fossil fuels. Renewable supplies of energy that do not rely on the use of traditional fossil fuels are in demand. These situations, combined with a desire to provide sustainable energy supplies with minimal environmental impact have resulted in increased emphasis on biomass as an energy source. Energy from biomass is increasing throughout the world as concerns relative to energy supply and environmental impacts grow. Biomass is an underutilized, renewable resource that can potentially reduce fossil fuel dependency as a part of the primary energy supply. Historically, biomass has merely been used for heating. Today's developing energy technologies are broadening the uses of biomass well beyond simple combustion for heating. The flexibility of biomass as an input to conversion processes provides the ability to generate a wide range of energy products.

THE SOLUTION

Taylor Biomass Energy, LLC, headquartered in Montgomery, NY, has developed a unique biomass gasification process well suited to provide the energy flexibility capable of biomass based process systems. In addition, Taylor Recycling, a long – established Montgomery business has demonstrated the means to provide sustainable biomass supplies on a reliable basis and at reasonable cost.

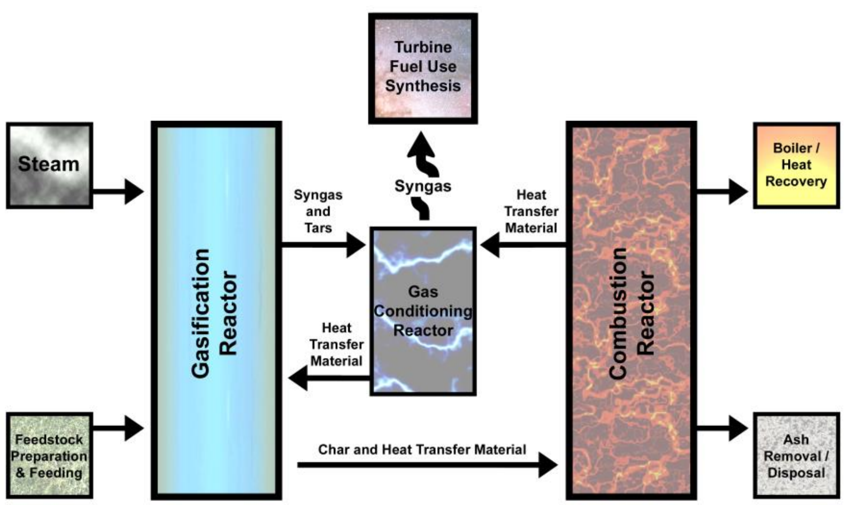
The Taylor gasification process, being developed by Taylor Biomass Energy, is a biomass gasification process that produces a Medium Btu gas having a heating value approximately half that of natural gas. This gas, unlike the low heating value gas produced in air blown gasifiers, provides the ability to directly substitute for natural gas or be used as a fuel for engines, gas turbines, or as a synthesis gas for the production of Biofuels, chemicals or hydrogen.

Incineration and direct combustion are sources of potentially high emissions of criteria pollutants such as nitrogen oxides (NOx), carbon monoxide (CO), particulates, and volatile organics (VOC’s). Other more hazardous materials such as dioxins can also be produced from chlorine containing species in the incoming fuel in these systems. More advanced technologies such as biomass gasification have been proposed to improve the situation by converting the incoming material into a combustible gas that can be cleaned to remove contaminants such as nitrogen containing compounds (preventing fuel bound nitrogen producing NOx), sulfur compounds (reducing SOx by removal of H_2S from the product gas), and particulates prior to its end use, thereby improving overall emissions.   However, most biomass gasification processes are based on starved air combustion and therefore produce a low heating value gas that requires significant modification to downstream combustion devices to be used. In addition, the heating value in such “air blown” gasifiers varies as the moisture content in the incoming fuel changes complicating process control systems. As a further complication, these gasifiers produce a further contaminant in the gas, condensable tars that must be removed prior to end use, particularly end use in high efficiency conversion systems or synthesis reactors.

The Gasification Technology

The Taylor Gasification Technology is an indirectly heated gasification that has been demonstrated to be a flexible and reliable method for efficiently producing a medium heating value gas from biomass based feedstocks. A number of technologies are under development that utilize this type of gasifier. The Taylor gasification process builds upon the results of these technologies, but provides improvements in operation by integrating improvements to the technologies to reduce operational issues such as ash agglomeration and provide in-situ destruction of condensable hydrocarbons, an essential element in gas cleanup and environmental performance of the process. In-situ removal of the condensable hydrocarbons allows for simplified final gas cleanup as the gas may be cooled prior to final cleanup thus reducing the size of the cleanup equipment. Such cooling improves overall process efficiency by providing a means to more effectively recover sensible energy in the product gas stream. The removal of condensable hydrocarbons also reduces potential issues with waste water cleanup by eliminating most, if not all, of the potentially hazardous organics from the gas prior to final scrubbing.

A schematic of the gasification process is found in Figure 1 below.

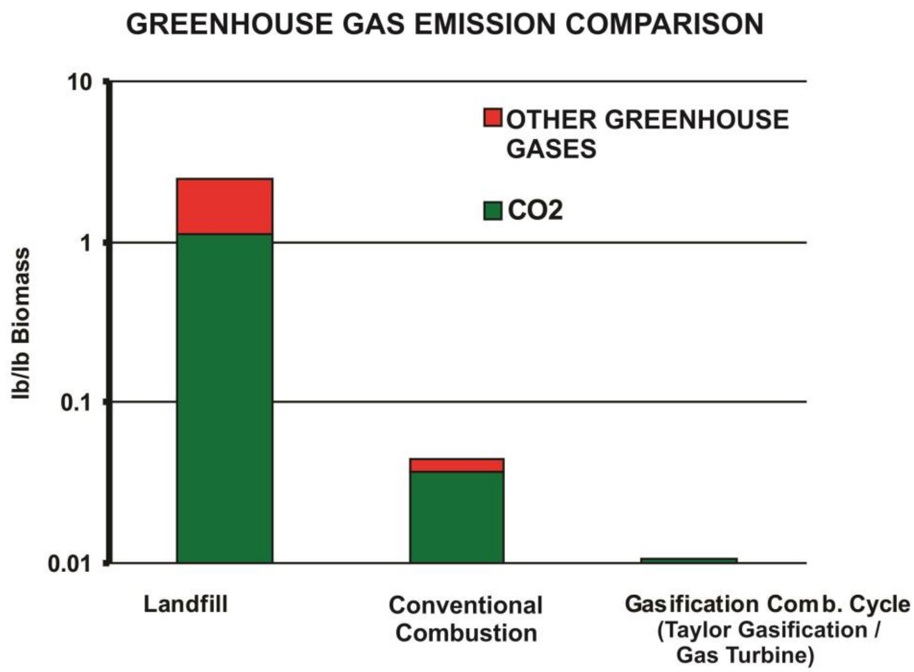


1. The Taylor Gasification Process

Production of gas in the Taylor Gasification Process does not depend on chemical reactions between carbon and oxygen, or carbon and water (steam), but relies upon a rapid thermal breakdown of the incoming biomass to produce the product gas. The process, therefore, is not affected by changes in biomass type, as other, more conventional air- or oxygen- blown gasification processes that rely on these reactions would be. By eliminating the input of air or oxygen into the gasification reactor, a non-nitrogen diluted synthesis gas is produced that is well suited for direct use as a fuel for natural gas replacement, for power, or for synthesis applications.

Environmental Benefits

The limited land available for landfill space in New York State and other north eastern States, has focused interest on the disposal of C&D materials and MSW. The result is that the fees for disposal within the State continue to rise. Wastes are being transported to surrounding states for disposal at lower cost; however, such transport contributes to significant deterioration of the environment by adding tons of pollutants to the air each year from truck and rail transportation of these materials to out of state landfills. Landfills themselves further contribute to environmental deterioration as the organic material contained in these wastes decays anaerobically emitting large quantities of greenhouse gases to the environment. The use of an integrated sorting and separating process such as that developed by Taylor along with the Taylor Gasifier in a gasification combined cycle plant (gasifier CC) can reduce these emissions by over an order of magnitude as shown in figure 2.



2. Reduction in Greenhouse Gases Is Significant By Using Gasification Combined Cycle Systems

BENEFITS FROM IMPLEMENTING THE TAYLOR SOLUTION

Taylor believes that the proposed system provides the best opportunity for the production of renewable, biomass based power at large scale. Furthermore, the gasification technology provides the unique enhanced opportunity and flexibility to operate as a Biorefinery to produce fuels, chemicals, hydrogen, or process heat in a product slate uniquely designed for a specific location.

Reduce Material Placed in Landfills

The widespread implementation of the Taylor sorting and separating process coupled to the Taylor gasifier can, therefore, reduce materials going to landfills by approximately 90%. Because of urban growth, the vast majority of MSW and C&D residues are generated in relatively small areas, thus both exaggerating the problems relative to disposal and simplifying the collection of these materials for use as an energy resource.

An Improved Environment

The limited land available for landfill space in New York State has resulted in the transport of thousands of tons of materials to landfills in other states. The transport of these materials over long distances contributes to significant deterioration of the environment by adding over 1½ pounds of air pollutants such as nitrogen oxides, volatile organic compounds, and particulates to the air for every 100 miles of travel by truck. The installation of one integrated Taylor system of the size proposed for Montgomery, NY will reduce emissions of these pollutants by approximately 140,000 pounds annually by eliminating the transport of wastes alone.

Gasification can improve the situation by converting the incoming material into a combustible gas that can be cleaned to remove contaminants such as nitrogen containing compounds (preventing fuel bound nitrogen producing NOx), sulfur compounds (reducing SOx by removal of H_2S from the product gas), and particulates prior to energy recovery improving overall process emissions.

The ash from an integrated Taylor system is carbon free and, when landfilled, will therefore not produce greenhouse gas emissions.