LANDFILL: A GASEOUS OPPORTUNITY

Time to start making money from landfills.

In 2010, over 50% of the waste went into landfills even though the waste stream contains high quality fuel resources that can be refined into clean burning fuels.

Waste to energy (W2E) presents an opportunity to address two major environmental problems, the need for new energy resources and the abundant waste going into landfills. Modern waste gasification technologies provide the means to achieve zero waste by ensuring that all materials can be reused instead of wasted.

Gasification provides the capability to separate materials at a molecular level, sifting out contaminants and providing clean fuel outputs. Using any carbon-based material — biomass, coal or waste — gasification subjects materials to high temperatures inside of a sealed vessel with oxygen carefully controlled. The materials are not allowed to combust into flame, but instead break down. The temperatures are extremely high, as much as 10,000 degrees Fahrenheit in some systems, causing molecular disassociation or the complete break down of molecular bonds. Elements either flow off the reactor as a gas or melt into magma where organic toxins are destroyed.

Mineral elements — metals, stone, or glass — melt, flow and harden into slag, which looks like volcanic glass or obsidian. Slag can be used as a versatile construction material. The gas is cooled or scrubbed, which removes impurities such as nitrogen, sulfur, mercury and other heavy metals, leaving a synthetic gas or 'syngas'.

Syngas is a clean-burning gas similar to natural gas, but with lower BTU. Syngas is readily

upgraded into a wide variety of commodity products such as clean liquid fuels, natural gas, plastics and chemicals. The impurities, now refined, can be sold as valuable commodities. The heat generated by the process is captured in heat exchangers and cycled back into the process.

Gasification is poised to replace combustion in a wide swath of industrial processes because it cleans contaminants prior to combustion: it is much more efficient to scrub the fuel inputs rather than the exhaust.

Another advantage of gasification is that materials that are commonly burned, creating pollution, can be cleaned to the level of natural gas, while the polluting elements are transformed from liabilities into assets. The combustion process itself is vastly improved, minimizing the formation of dioxins and furans which form during combustion.

As important, 'low-grade' fuel resources, such as municipal solid waste (MSW), high sulfur coal, and debris like telephone poles, railroad ties and tires, can be used in a gasification process.

On the output side, syngas is a versatile, transportable and storable commodity that can be used to produce transportation fuels or electricity. Syngas can be made back into plastics and reused. Biomass, coal and waste can all be used together in a common system to produce commodities that can replace imported oil with proven technology available today.

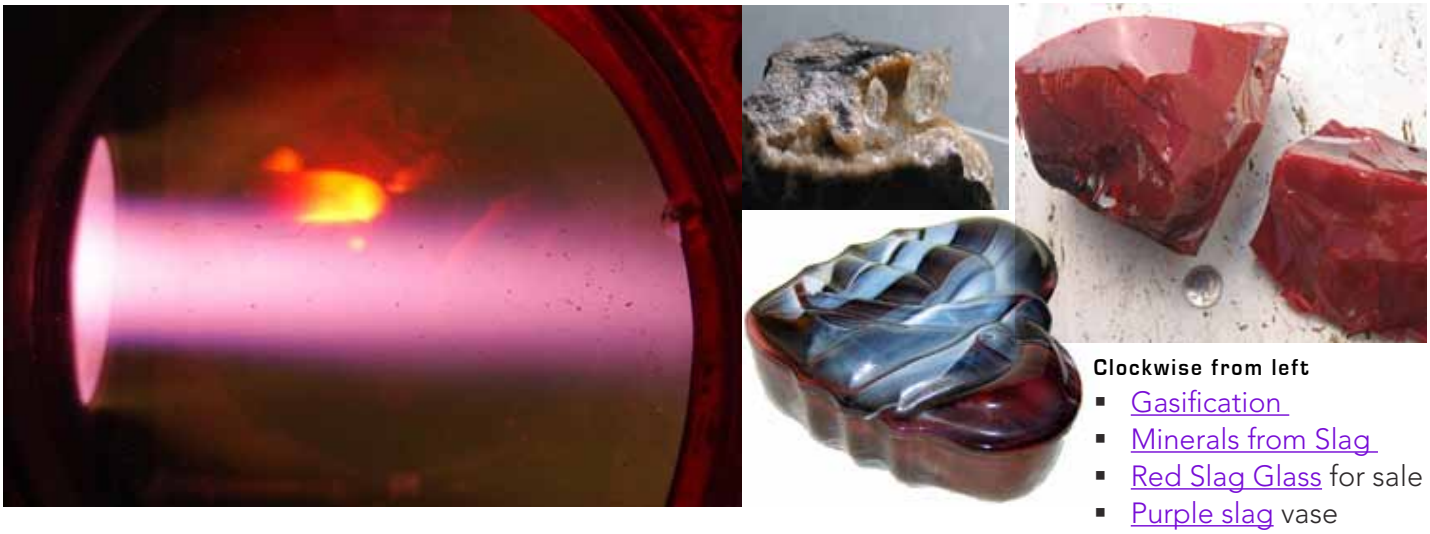
"Clean Coal," widely touted by industry, is coal gasification. Because of the long history in coal and biomass gasification, there are many different system designs. All systems share in common that high temperatures are applied inside a sealed vessel or reactor with controlled oxygen, air or water inputs. Steam may be used to enhance hydrogen content of the resulting gas, which improves fuel value.

Historically, the combination of landfills and incinerators are the most traditional means of getting rid of waste. While

landfills have been around for a very long time, a survey in 2010 showed that 76% of communities did not want one in their neighborhood. That's down from 87% in 2007, but not a resounding approval for the most prevalent means of getting rid of trash.

inefficient because the methane is contaminated with other gasses, which means it must be 'scrubbed'. This process reduces its usefulness for utilities as a natural gas, while increasing costs.

The second means of disposal has been incineration, but is popular in Europe, it has failed to catch on in the US, possibly due to the poor performance of past incinerators, local environmental regulations and NIMBY (Not In My Back Yard). Debate over W2E in New York is fever pitched, while New York City has some of the most difficult waste dis-



Clockwise from left

- Gasification
- Minerals from Slag
- Red Slag Glass for sale
- Purple slag vase

Modern landfills continue to be a basic means of reducing waste because they are cheap to operate. Using liners and covers, they can minimize seepage and odor, although still producing significant amounts of methane, a greenhouse gas twenty-one times more potent than CO_2.

Some of the methane from landfills is captured and used by utilities as a renewable fuel. However, the process is

is out of favor in the United States. Historically, crude incinerators burned unsorted waste, producing massive amounts of pollution. Most incinerators were phased out for environmental reasons. Those that remain received extensive upgrades to their exhaust stacks to reduce air pollution, making them more expensive.

Although incineration as a means to produce energy

posal issues in America. As a result, no new waste incinerators — or gasifiers — have been built in the U.S. in nearly 20 years.

Reduce, reuse and recycle — the 3Rs — is a more modern approach that has gained traction since the 1970s. Creating many new markets for recycled raw materials, such as aluminum, metals, glass, plastics, paper and

compostable organics, is an important step in the right direction. The 3R's:

- Reduce the amount of consumption and minimize packaging.
- Reuse everything that can be reused without reprocessing.
- Recycle everything else.

However, there are broad categories of waste with no efficient market or technology for their reuse or recycling. In addition, some waste is contaminated with other materials, making recycling inefficient. Waste gasification completes the circuit, avoiding landfills by reprocessing all those non-recyclable materials for use as W2E.

On a technical level, for waste gasification to be effective, the raw materials need to be sorted and pre-processed. Glass and metals have no fuel value, so should be removed. The remaining percentages are then melted into slag.

The challenge, both economically and technically, in converting waste to energy is the fact that garbage is by nature heterogeneous and difficult to work with physically. MSW (Municipal Solid Waste) may be contaminated with all sorts of chemicals. MSW also varies dramatically in content, as well as size and shape. The MSW must be shredded, sifted, sorted, dried and physically processed before it is in a form suitable to be efficiently gasified.

The pre-processing is expensive and requires heavy machinery that can require intensive maintenance. The technical processes are improving all the time and there continues to be innovation, but the physical processing is very complex.

A solution is to encourage recycling, which is complementary. Recycling creates 'cleaner' waste stream, which means more value can be extracted at less expense. Countries in Europe with the most W2E also have the highest rates of recycling.

ThinkOutsideTheBin.com
statistics

- Since 1960, America has tripled our waste
- About 1/10th of all solid garbage in the U.S. gets recycled.
- * EVERY DAY, the U.S. throws away enough trash to fill 63,000 garbage trucks.
- Almost 1/3rd of waste generated in the U.S. is unnecessary packaging.
- Each year, Americans toss out enough disposable utensils and cups to circle the equator 300 times.
- In the state of Ohio, the second highest point is Mount Rumpke, at over 1100 feet. But this "mountain" is not a mountain, but a mound of trash.
- As of 1992, 14 billion pounds of trash were dumped into the ocean annually around the world.
- There is a plastic island twice the size of Texas in the Pacific ocean, created from waste.
- Enough hazardous waste is generated in 12 months to fill the New Orleans Superdome 1,500 times over

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Economically, glass, metals, high-grade plastics and papers — as well as clean organics — can be sold for much higher prices on recycling markets than as fuel or slag. Natural market forces ensure that all materials end up where they capture their greatest value.

The trick is making sure that those markets physically exist. Where there are no facilities or transportation systems in place to deal with recyclables, there is no market. This means that the low grade, highly contaminated — but potentially valuable — wastes that are precisely the material best sent to the gasifier, are not likely to find a market. They simply go to a landfill, where they continue to cause air and water pollution.

For municipalities wrestling with waste disposal problems, landfills are not a sustainable solution. As communities continue to fight new facilities, while demanding the closure of existing ones, solutions seem hard to find. High costs, technical complexities, tight budgets and polarized politics make construction of an expensive new technology difficult.

However, pressures caused by rising transportation costs, make shipping trash to a distant landfill more expensive, which is making municipalities search for newer solutions. For such pressures, a nearby W2E facility would create clean hydrocarbon fuels for electricity and transportation, while developing markets for potentially dangerous materials.

As cities embrace the challenges of climate change along with heightened concern about carbon pollution, resistance against any form of carbon-based fuels is rising. A renewable energy from the trash that is inevitable in crowded cities offers many benefits.

Natural gas equivalents are an improvement over coal, gasoline and diesel, in terms of energy efficiency, carbon emissions and overall pollution. Landfills produce significant quantities of methane and some analysis argues that waste to energy reduces greenhouse gas emissions over landfilling. Clean natural gas equivalents are the most efficient and environmentally sensitive way to consume hydrocarbons.

Society is not going to stop burning hydrocarbons anytime soon, because there is no viable replacement. It is critical to at least do it in the cleanest manner possible. It is equally critical to embrace domestic resources, lessening the need for conflicts abroad. America has ample resources that are literally going to waste and can be used today to provide heat, electricity and transportation. Gasification and scrubbing are one of the key technologies needed to clean fuel supplies, achieve zero-waste and energy independence.

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