ATTACHMENT

FILE: AR-22-048

DATE: January 31, 2022

TO: Kerry Hilts, Acting CAO
Office of the Chief Administrative Officer

FROM: Regan Lefebvre, Senior Manager of Utilities

SUBJECT: Waste to Energy Environmental Considerations

The following is an analysis of the environmental benefits and considerations of Waste to Energy:

Environmental Considerations of Gasification and Pyrolysis Waste to Energy Technologies

Landfills are a considerable source of global methane emissions (methane is considered to be ~25 times worse than CO_2 as a greenhouse gas). The EPA estimates that landfills account for 16% of human sources of methane worldwide (about 55 million tonnes of methane per year). Landfill diversion and beneficial re-use are admirable goals, particularly for the reduction of greenhouse gases. However, gasification and pyrolysis technologies can contribute to the production of greenhouse gases which should be considered.

Past practice for landfilling simply involved digging a hole in the ground and filling it with trash. Old landfills were located in areas considered at the time to have little value including swamps, ravines or abandoned gravel pits with insufficient barriers both above and below. This resulted in significant environmental damage due to groundwater contamination from leachate (rainfall percolating through the landfill) and the release of methane gas from the anaerobic decomposition of organics.

Modern landfills include clay liners, fabric filters, leachate collection pipes, perforated gas collection piping, plastic caps and The EPA estimates that landfill gas energy projects capture roughly 60 to 90 percent of methane emitted from landfills, depending on the design and effectiveness. However, it is admittedly difficult to measure the amount of landfill gas that are not being collected.

Gasification and pyrolysis are related technologies that some consider to be incineration, but they are quite different. Incineration is the full combustion of matter in the presence of oxygen at temperatures of 800°C to 1200°C. Pyrolysis is the thermal conversation of matter in the absence of oxygen at temperatures of 350°C to 650°C to produce combustible liquid and combustible gas. Gasification is the thermal conversion of matter in the presence of small amounts of oxygen at temperatures of 800°C to 1200°C to produce combustible gas. There is little doubt that gasification and pyrolysis technologies provide environmental benefits by extending the life of landfills. The gasification of the organic content within the waste reduces the amount of methane from landfills. There is also the potential for the residual waste streams from these technologies to be recycled and diverted from landfills.

However, the gasification and pyrolysis of waste plastic (and the subsequent combustion of syngas) produces carbon dioxide (CO_2) that would otherwise be permanently stored in landfills. It also produces sulfur dioxide emissions (SO_2 contributes to acid rain) and varying quantities of other gases that are considered air pollution (although such emissions are much lower than incineration). From this perspective, the landfilling of plastic waste is viewed by some to be preferential to gasification or pyrosis, because it is a form of carbon sequestration where these plastics are not released as gases into the atmosphere. Considered on its own, the production of energy from gasifying or pyrolyzing waste plastic is considered by many to be detrimental to the environment. However, he production of energy from MSW and plastic waste is considered to be slightly preferable to the combustion of coal because it reduces the use of these carbon intensive energy production alternatives while providing additional environmental benefits (extending the life of landfills and reducing methane emissions from landfills).

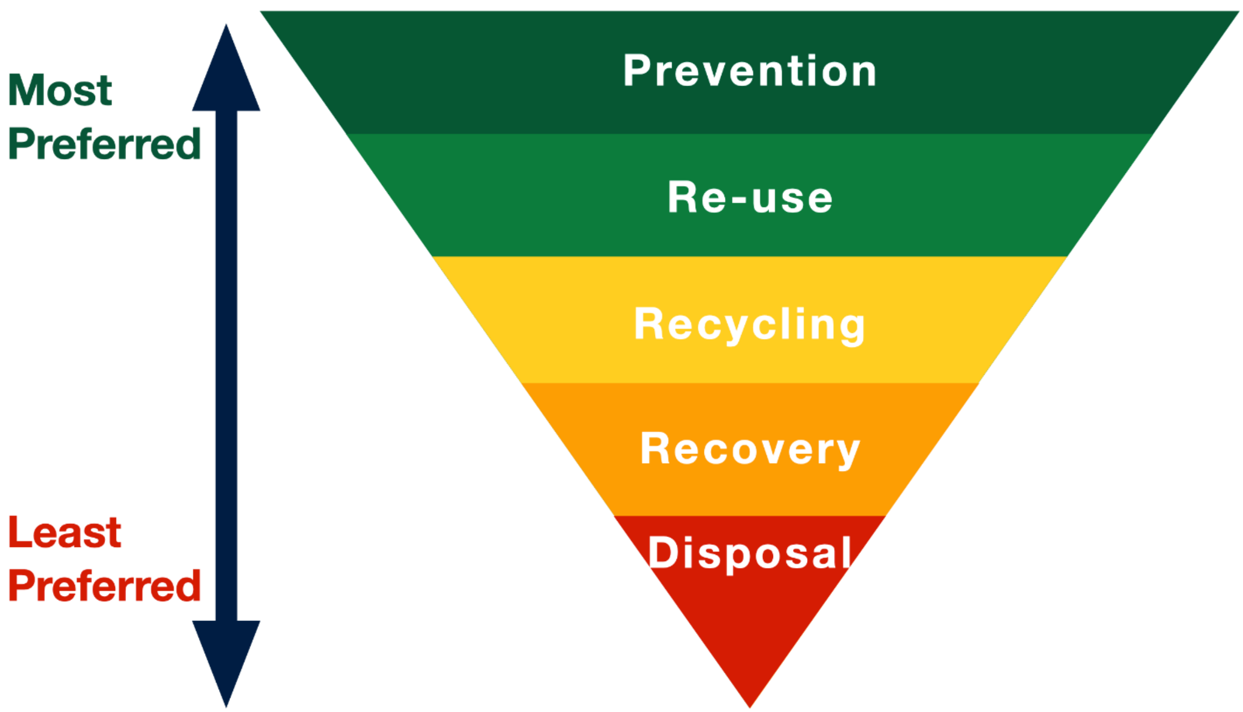

Figure 1 – Typical Waste Hierarchy example from ISM Waste and Recycling web-site

In part because of the reasons listed above, the production of energy from plastic and other waste is considered to be towards the low end of the waste hierarchy in terms of methods to reduce the impact of plastic waste. According to the waste hierarchy, efforts towards prevention and reduction provide the best impact for the environment. In the above waste hierarchy, St. Albert's waste to energy pilot project would be considered "red", because no recycling of residuals is intended and there is no planned recovery of heat or syngas. Ultimately a larger commercial scale project would include some "orange" for heat and energy recovery. A larger commercial scale project could include some yellow or green if metal, biochar and glass can be sorted effectively and viable markets found for their re-use or recycling.

This is a key challenge for those using gasification and pyrolysis technologies. The environmental benefits of gasification and pyrolysis are significantly reduced if markets cannot be found for the metals, biochar and glass residuals and these are still disposed in landfills.

It is generally agreed that the best way to reduce methane emissions from landfills is to prevent organic waste from being disposed in landfills through programs such as source separation with composting (aerobic digestion) or sealed containers (anaerobic digestion). Other technologies such as the organic extrusion of MSW (brown bin waste and waste collected from multi-family sites) can divert additional quantities of organic waste to composters or anaerobic digesters, reducing the amount of organics going to landfills. Gasification and pyrolysis can achieve better results in reducing methane emissions than any of these methods. However, composting and anaerobic digestion can currently be done at a lower cost than gasification or pyrolysis.

According to the waste hierarchy, the best way to deal with plastic waste is to prevent plastic usage in large volumes that generate waste, such as single use plastic for packaging. However, municipalities and consumers can only do so much to advocate for plastic-free alternatives. Such initiatives require provincial, federal and even international support in order to be successful. It is also difficult to recycle plastic that has been contaminated.

Summary

Gasification and pyrolysis are considered to be technologies for the future for their ability to divert waste and reduce methane emissions from landfills. They have the potential to substantially extend the life of landfills and reduce methane emissions. The production of waste from the gasification of plastic waste is still considered detrimental to the environment due to the emissions of greenhouse gases from plastic waste that could instead be stored in a landfill. However, this is still preferential to the production of energy from the consumption of coal. These technologies rely on the ability to find beneficial reuses for metal, glass and biochar residuals.

Further questions or concerns may be directed to the Senior Manager of Utilities, Regan Lefebvre, at rlefebvre2@stalbert.ca and Project Manager, Micah Seon King, at mseonking@stalbert.ca.

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