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GASIFICATION / COGENERATION USING MSW RESIDUALS AND BIOMASS

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ABSTRACT

The City of Edmonton presently collects and processes about 230,000 tonnes of municipal solid waste (MSW) and recyclables per year at the composting and materials recovery facilities located at the Edmonton Waste Management Centre. Over 60% of the waste materials that are brought to the facilities are recycled and composted.

Remaining residuals from both the composting and materials recovery facilities have little value in terms of being further recycled and are currently being landfilled. The residuals do have a significant calorific value and have the potential to produce enough electricity to provide 100% of the power and heating for facilities at the Edmonton Waste Management Centre (EWMC), with remaining energy for adjacent developments. The City is considering advanced thermal treatment (not conventional incineration) of the residual waste (after recycling and composting) as a way to close the loop in waste management in terms of minimizing waste materials that are landfilled and reducing the net energy requirement for waste processing and disposal to nil.

Other renewable biomass waste streams (e.g.: wood or agricultural waste) could complement operation of the facility and make it more economically viable (economies of scale). There are also other environmental benefits such as reductions in the overall greenhouse gas (GHG) and other harmful emissions by displacement of fossil fuel as an energy source.

Background

The City of Edmonton (the City) owns and operates North America's largest composting plant for unsorted residential solid waste. In conjunction with the composter, the city operates a materials recovery facility (MRF), which accepts recyclable materials from the City's Blue Bag and Blue Bin programs, and from recycling depots. The compost plant is designed to accept 190,000 tonnes of residential waste per year, and the MRF takes in another 40,000 tonnes per year. Together, both facilities help the City to achieve a residential waste diversion rate of over 60 percent.

The City's extensive recycling and composting programs capture practically all recoverable organics and recyclables. What is left as a residue from the composting plant and MRF has two outstanding features: it has a high calorific value, and it takes up a disproportionate volume of scarce landfill space due to its low density. About 75,000 tonnes per year of residuals are generated (composter primary and secondary residuals, and MRF fibre and rigid residuals). There is also considerable wood waste available in the Edmonton area and it has been estimated at 50,000 tonnes per year.

Objective and Approach

The City of Edmonton, in partnership with the EPCOR Power Development Corporation (EPCOR), a City owned utility company and power retailer, decided to explore innovative ways to capture the remaining value in the residuals, while reducing the volume of residuals going to landfill. Value was identified as a combination of energy, carbon credits, and saved landfill airspace.

Earth Tech was commissioned to conduct a study which examined gasification and pyrolysis technologies for the recovery of energy, as well as fluidized bed combustion for use as a benchmark.

Juniper was part of the Earth Tech team and provided technology assessments and market reviews for gasification and pyrolysis technologies.

Generally, Gasification systems were considered for analysis because:

- They are perceived as environmentally superior to conventional waste to energy technologies;
- They could significantly increase the life of the City owned Clover Bar landfill and defer the investment of siting and building a new landfill;
- They would likely be accepted by the public;