

NAWTEC16-1915

Use of Statistical Entropy and Life Cycle Analysis to Evaluate Global Warming Potential of Waste Management Systems

Scott Kaufman, Eilhann Kwon, Nikhil Krishnan, Marco Castaldi, Nickolas Themelis
Earth and Environmental engineering [HKSM]
Columbia University in the City of New York
New York, NY. 10027

ABSTRACT

The statistical entropy (SE) function has been applied to waste treatment systems to account for dilution or concentration effects on metals. We later extended it to account for carbon flows, especially in waste management systems involving thermal treatment. Now, a simple lifecycle “net energy” metric – encompassing the “lost energy” that would have been gained when high-calorific materials are landfilled rather than combusted with energy recovery – is introduced to account for additional influxes of carbon when using landfilling as the primary disposal method. When combining net energy calculations and long terms effects of landfilling, waste to energy (WTE) becomes a more attractive option for dealing with non-recycled municipal solid waste (MSW). A greenhouse gas-forcing factor is also introduced to account for the entropy generating effects of methane. When incorporating forcing and lost energy, WTE performs notably better than landfills with respect to entropy generation and carbon.

INTRODUCTION AND METHODOLOGY

There are many different methods available for quantifying the environmental impact of waste management systems [1, 2]. An intriguing alternative method was developed that