Life cycle assessment of thermal Waste-to-Energy technologies: Review and recommendations

Life cycle assessment (LCA) has been used extensively within the recent decade to evaluate the environmental performance of thermal Waste-to-Energy (WtE) technologies: incineration, co-combustion, pyrolysis and gasification. A critical review was carried out involving 250 individual case-studies published in 136 peer-reviewed journal articles within 1995 and 2013. The studies were evaluated with respect to critical aspects such as: (i) goal and scope definitions (e.g. functional units, system boundaries, temporal and geographic scopes), (ii) detailed technology parameters (e.g. related to waste composition, technology, gas cleaning, energy recovery, residue management, and inventory data), and (iii) modeling principles (e.g. energy/mass calculation principles, energy substitution, inclusion of capital goods and uncertainty evaluation). Very few of the published studies provided full and transparent descriptions of all these aspects, in many cases preventing an evaluation of the validity of results, and limiting applicability of data and results in other contexts. The review clearly suggests that the quality of LCA studies of WtE technologies and systems including energy recovery can be significantly improved. Based on the review, a detailed overview of assumptions and modeling choices in existing literature is provided in conjunction with practical recommendations for state-of-the-art LCA of Waste-to-Energy.

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