

## **LCA OF MECHANICAL BIOLOGICAL TREATMENT OF RESIDUAL MSW IN THE CITY OF ROME: CURRENT PRACTICES VS. ALTERNATIVE STRATEGIES**

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Mechanical Biological Treatment (MBT) is being increasingly adopted throughout the EU as one of the main elements of integrated waste management strategies with the aim of diverting waste from landfills and reducing the environmental impacts of waste landfilling, mainly related to leachate and biogas production and composition. Italy, in particular, has a long tradition in mechanical biological treatment of residual municipal solid waste (MSW), i.e. the unsorted waste remaining after at-source segregation and collection of recyclable fractions. According to the Italian Environmental Agency, in 2014 a total of 117 MBT plants were in operation in Italy, treating roughly 9 million ton of waste, corresponding to 32% of the yearly amount of produced MSW. Furthermore, in some Regions (e.g. Lazio Region), due to the establishment of more restrictive regional laws and regulations compared to National legislation, unsorted MSW waste has to be preliminarily treated through mechanical and biological processes before it can be landfilled or thermally treated, leading to the key role of the MBT technology within this context. The main environmental benefits of a MBT plant are generally associated to the recovery of recyclable materials (such as plastics, paper, metals and compost), the production of high calorific combustibles (i.e. Refuse Derived Fuel, RDF) for energy recovery and the biological stabilization of putrescible organic matter in waste in order to reduce methane and leachate emissions of treated waste when disposed of in landfills. Despite these advantages, potential environmental impacts may be generated also from MBT plant operations and, moreover, from downstream treatments and disposal of MBT output flows. Depending on the MBT facility configuration, the feedstock source, the biological treatment (e.g. aerobic, anaerobic or a combination of the two) and post-treatments (e.g. maturation), the quality of MBT produced wastes and, hence, potential emissions related to their disposal may significantly vary. The present study aims at evaluating the overall environmental burdens related to the current practices adopted for the management of unsorted MSW in the municipality of Rome (Lazio Region, Italy), which is essentially based on MBT plants, by Life Cycle Assessment (LCA) employing the waste-LCA model EASETECH using operational and experimental data.

Previous LCA studies on MBT systems recognized the global environmental benefits of MBTs compared to direct landfilling but only few highlighted the need of carefully accounting for the downstream management of residuals and sorted fractions (e.g. the recovery of recyclables, RDF incineration, wastewater treatment, landfilling of stabilized waste and other residues), and of including uncertainties related to LCA modelling and inventory analysis (see e.g. Montejo et al., 2013; Beylot et al., 2015). For this reason, in the present study, emphasis was placed on the development of a robust and specific MBT inventory, through the collection of operational data from a MBT plant of the city of Rome, and characterization data of all input and output waste streams obtained through several sampling campaigns. The experimental data were interpreted and modelled in order to estimate the liquid and gaseous emissions that can be assumed as representative in a landfill disposal scenario for the analyzed system. Furthermore, experimental results were used to identify feasible alternative strategies for managing MBT output wastes. Up to now, only RDF (24.7% of the unsorted feed MSW) is sent to incineration for energy recovery, whereas all other residues (heavy scraps, stabilized MBT waste and stabilization scraps), corresponding to 55% of unsorted MSW, are landfilled. However, with the introduction of Solid Recovered Fuel (SRF) instead of RDF, and new standard values for SRF classification based on specific chemical and physical waste properties, it appears that thermal treatment may be applied also to MBT scrap flows such as heavy scraps and/or stabilization scraps. Incineration of these two flows was hence included in the LCA study and compared to the current practice of scraps landfilling in terms of total environmental impacts.

### **References:**

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