

Analysis of material recovery facilities for use in life-cycle assessment - DTU Orbit (08/11/2017)

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Insights derived from life-cycle assessment of solid waste management strategies depend critically on assumptions, data, and modeling at the unit process level. Based on new primary data, a process model was developed to estimate the cost and energy use associated with material recovery facilities (MRFs), which are responsible for sorting recyclables into saleable streams and as such represent a key piece of recycling infrastructure. The model includes four modules, each with a different process flow, for separation of single-stream, dual-stream, pre-sorted recyclables, and mixed-waste. Each MRF type has a distinct combination of equipment and default input waste composition. Model results for total amortized costs from each MRF type ranged from \$19.8 to \$24.9 per Mg (1 Mg = 1 metric ton) of waste input. Electricity use ranged from 4.7 to 7.8 kWh per Mg of waste input. In a single-stream MRF, equipment required for glass separation consumes 28% of total facility electricity consumption, while all other pieces of material recovery equipment consume less than 10% of total electricity. The dual-stream and mixed-waste MRFs have similar electricity consumption to a single-stream MRF. Glass separation contributes a much larger fraction of electricity consumption in a pre-sorted MRF, due to lower overall facility electricity consumption. Parametric analysis revealed that reducing separation efficiency for each piece of equipment by 25% altered total facility electricity consumption by less than 4% in each case. When model results were compared with actual data for an existing single-stream MRF, the model estimated the facility's electricity consumption within 2%. The results from this study can be integrated into LCAs of solid waste management with system boundaries that extend from the curb through final disposal. (C) 2014 Elsevier Ltd. All rights reserved.

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