

LIFE CYCLE ASSESSMENT OF MSW KERBSIDE SEPARATE COLLECTION SYSTEM APPLIED TO SMALL COMMUNITIES

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This study reports Life Cycle Assessment (LCA) of kerbside municipal solid waste (MSW) collection for hypothetical communities of ten different sizes (varying between 1000 and 10,000 inhabitants, incremented by 1000). It evaluates the economy of scale for MSW collection system in municipalities in terms of their environmental performance, essentially building on a previous study that evaluated the costs and the induced environmental impacts of such systems (De Feo and Malvano, 2012). The scope of assessment includes the management phase (i.e. facilities for treatment and disposal), and the collection and transport phase (i.e. vehicles). The Function of the LCA study was the activities of the MSW components delivery by citizens and the subsequent collection and transport to the MSW facilities. The Functional Unit (quantified performance of a product system for use as a reference unit) was one ton of waste with a defined composition. The Reference Flow (measure of the outputs from processes in a given product system required to fulfil the function expressed by the functional unit) was quantified as the amount of waste treated in a year. The LCA software tool SimaPro and the following three impact assessment methods are used: Recipe 2008, Ecological footprint, and IPCC 2007. Recipe 2008 has been considered in terms of four damage end-point categories (Human Health, Ecosystems, Resources, Total), with reference to three different perspectives (Individualist, Hierarchist and Egalitarian), altogether providing twelve impact categories. Ecological footprint has been evaluated in terms of four impact categories (Land occupation, Carbon dioxide, Nuclear, and Total). IPCC 2007 has been considered for three time horizons (20 year, 100 year, and 500 year). This in total generates 1140 outputs alongside the percentage incidences of the facilities and the vehicles which contribute to the whole impacts. For all the assessment methods applied, the impacts were found to be unaffected up to the threshold of 5000 inhabitants, which is typically defined as a “little municipality” in Italy. Based on Recipe 2008 method, the medium-term perspective Hierarchist, the major avoided impacts were found to be in terms of installations (Figure 1). On the other hand, based on Ecological Footprint method, vehicles related impacts were found to be growing with the number of inhabitants; analogously, avoided impacts due to facilities increased with the dimension of the served community. The percentage incidence of facilities and vehicles were found to be about 40% and 60% respectively in terms of Carbon Footprint (IPCC 2007 for 100 years).

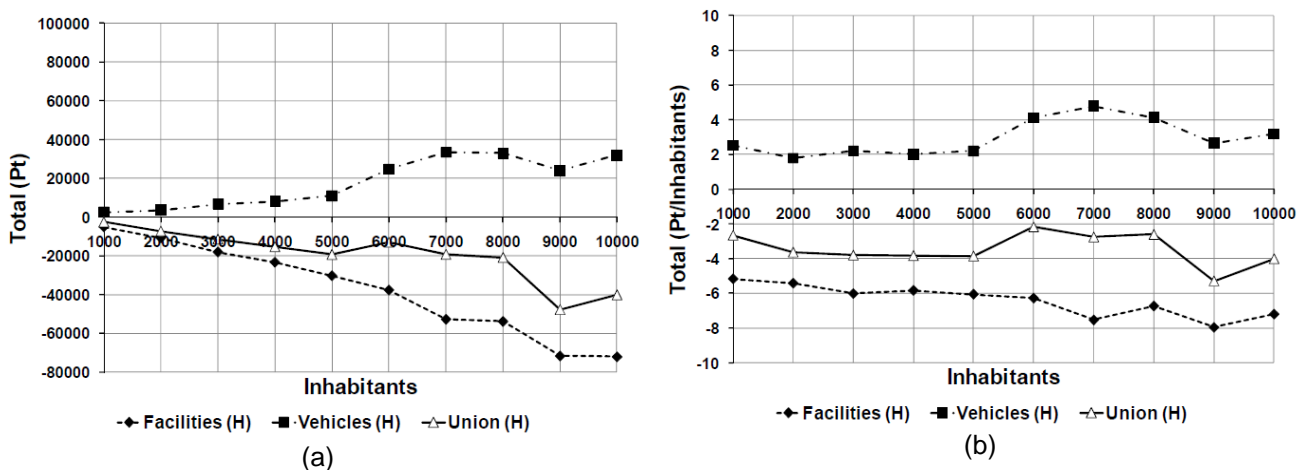


FIGURE 1 – TOTAL - RECIPE POINT (PT) CALCULATED FOR THE MEDIUM-TERM PERSPECTIVE HIERARCHIST: (A) ABSOLUTE VALUES; (B) PER CAPITA VALUES.

References

De Feo, G. and Malvano C. 2012 Technical, economic and environmental analysis of a MSW kerbside separate collection system applied to small communities. Waste Management 32: 1760-1774.