Application of LCA at local level to test the viability of PAYT systems in Southern Europe: state of the art and new strategies

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The adoption of Pay-as-you-throw (PAYT) waste tariff systems intended for collection and treatment of Municipal Solid Waste (MSW) is experiencing a slow progress in Southern Europe with only a small number of local applications reported (European Commission 2012; Puig-Ventosa 2008; Simão Pires 2013), comparatively with the situation in Central and Northern Europe, where PAYT schemes have found a widespread application (Elia, Gnoni, and Tornese 2015; Reichenbach 2008). The public lack of knowledge in these countries about the potential environmental benefits associated to PAYT systems is one of the barriers preventing PAYT implementation. The application of Life Cycle Assessment (LCA) techniques seems to be a suitable approach to better expose these benefits. Analysing the performance of waste management systems through the LCA technique is increasingly becoming a common practice (Pires, Martinho, and Chang 2011), taking advantage of its capacity to identify the environmentally critical points within a given process. This ability has been improved over time thanks to the sound and extensive research work done by several authors and institutions (Bjarnadóttir et al. 2002; Clift, Doig, and Finnveden 2000; JRC 2011). Regardless of these advances, public administrators are still not always aware of the potential of this analysing tool, and thus rely more on financial issues rather than on environmental priorities when taking decisions (Blengini et al. 2012).

Moreover, it has been pointed out that the application of LCA to specific waste management case studies poses a broad challenge, given the complexity of the systems involved and, furthermore, the need to gather local specific data and to consider all the features typical for the studied site in order to avoid an excessive generalisation (Ekvall et al. 2007; Ripa et al. 2017). When coming to the case of evaluating the performance of PAYT systems, a major issue concerning the application of LCA is to properly reflect the changes on amount and composition within the different waste fluxes, which are expected to be induced by the introduction of the PAYT pricing system. Another challenge is to include, within the boundaries of the considered system, the possible appearance of unexpected streams deviations caused by undesired behaviour –i.e. garbage disposal in inadequate manner, or *free riding*– as a consequence of PAYT misunderstanding among the population.

Under the scope of the LIFE Project *PAYT: A tool to reduce waste in South Europe* several PAYT pilot experiences will be performed at a local level in selected municipalities of three South-European countries, namely Cyprus, Greece and Portugal, and its environmental performance will be evaluated through the application of an LCA analysis of the respective waste management systems. Site specific data will be collected before, during and after the PAYT implementation, encompassing the characterisation of the different waste streams, and indicators measuring the performance of the waste management and evaluating the behaviour of the population involved. The LCA application proposed will focus on each of waste management stages (collection, treatment, valorisation and final destination) with the goal of obtaining a clear portrait of the positive environmental effects typically derived from PAYT application:

1. Reduction of the environmental impacts associated with MSW collection due to the lower collection needs after the decrease on the unsorted MSW production derived from PAYT implementation, also further enhanced by the introduction of home composting.
2. Positive environmental effect through the substitution of primary raw materials by the increase of the amount of source-separated recyclable materials (which otherwise is typically low in Southern European countries) after PAYT introduction.

3. Reduction of the environmental impacts related to the treatment of unsorted MSW, and a positive effect possibly derived from the improved performance of treatment facilities such as MBTs (mechanical-biological treatment) due to the increased source-separation of non-organic materials, leading to a higher quality or yield in final products such as biogas and compost, suitable substitutes of non-renewable energy sources and non-renewable soil amendments respectively.

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