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THE IMPORTANCE OF DATA SPECIFICITY IN CLIMATE ACCOUNTING OF WASTE MANAGEMENT SYSTEMS

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ABSTRACT

Documenting and optimising municipal waste handling and management activities in the environmental impact perspective requires reliable input data in which stakeholders can have confidence. LCA methodology for such analyses is well established, however the parameterization of LCA models often requires time-consuming and costly data-gathering. This partly depends on the perceived need for locally gathered data, specific to the system in question. This paper examines ways in which parts of this onerous exercise might be avoided for plastic packaging, and the implications of doing so.

The study has shown that, for GWP, material recycling is better than energy recovery for all the investigated plastic packaging treatment cases. It seems unlikely that local conditions can alter this conclusion.

INTRODUCTION

The aim of this paper is to show that to environmentally optimize the strategic decisions in Norwegian municipalities' waste management, it is not always important to use specific instead of generic data for climate accounting of the waste management options.

On behalf of Waste Management Norway (Avfall Norge) and 18 municipalities/waste management companies in Norway, Ostfold Research has developed a model for calculating the Global Warming Potential (GWP) for several waste types and different treatments. The model is based on Life Cycle Assessment methodology (LCA) and has been employed to calculate the GWP per kilogram waste for the different treatment options landfill, combustion with energy recovery and recycling, including the biological treatment processes biogas production and composting of food waste. The model has been used for comparison of total GWP for different waste treatment options in general (Raadal, Modahl and Lyng 2009; Lyng and Modahl 2011), and it has also been used for development of climate accounts for waste handling in specific cities, municipalities and regions (specific data used for Fredrikstad, SHMIL, Oslo, IRIS, MNA, Porsgrunn, IR, ENVINA, FIAS, HAF, Fosen, Hamos and RIR). These studies have also been used as input to strategic decisions on waste management options.

In most cases use of specific data are preferable to generic data in LCA's (Modahl et al. 2012). This is especially the case for product optimization and comparison of specific products. There are, however, some problems associated with the use of specific data, mostly relating to cost, availability and time frame (snapshot vs. long-term). Hence, the general view/natural assumption is that it is better to use specific data than generic data when a choice is to be made between two or more competing solutions.

METHODS

This paper presents GWP results of different waste management options of plastic packaging in specific municipalities in Norway, performed by Ostfold Research in the period 2009-2012. The specific results are compared to the generic results based on average Norwegian values. This comparison is used to investigate and discuss to what extent local conditions affect the results, for defining the factors that are most likely to influence the results, and to see if local conditions can alter the conclusions regarding which treatment option should be chosen for each waste type.

The net environmental impact of a waste treatment value chain is the sum of specific environmental burdens (costs) and benefits along the value chain. Burdens arise from transporting and treating waste, with benefits arising from replaced energy and/or material from energy recovery and/or material recycling. In principle, specific data is required for a number of steps along the value chain, as shown in the following table for plastic waste treatment.

Table 1 Data parameters for the value chain stages.

Value chain stage	Nature of burdens / benefits	Potential specific data parameters / factors
Transport	Emissions from transport vehicles.	Types of vehicle used, distances travelled, vehicle filling regime/degree of utilisation.
Treatment	Emissions from incineration plants or plants for sorting and material recycling.	Data on plant performance and feedstock (composition), internal transport, use of energy and water.
Replaced materials and energy	Avoided emissions from materials production or heat/electricity generation.	Performance of incinerator and of downstream equipment/transmission infrastructure (e.g. efficiency); what the recovered energy is used for (energy mix replaced), quality of materials produced and what products they replace etc.

RESULTS

The net results are shown in figure 1, and the results for each life cycle phase are shown in figure 2. Both specific and generic results are shown. The scales are those of environmental burden (that is, burdens are taken as positive and benefits as negative).

The results in figure 1 show that there is a distinct difference between the recycling cases and the energy recovery cases. Even the worst recycling case (Fosen) is 1.23 kg CO₂-eqv. better than the best energy recovery case (Fredrikstad) per kilo plastic packaging waste treated. Only one case is given for landfill (the generic case), and this result lies between energy recovery and material recycling. For material recycling, the specific cases lies between +3% (Oslo) to -

50% (Fosen) of the result of the generic case. For energy recovery, the specific cases are from 63% better (Fredrikstad) to 25% worse (MNA 2010).

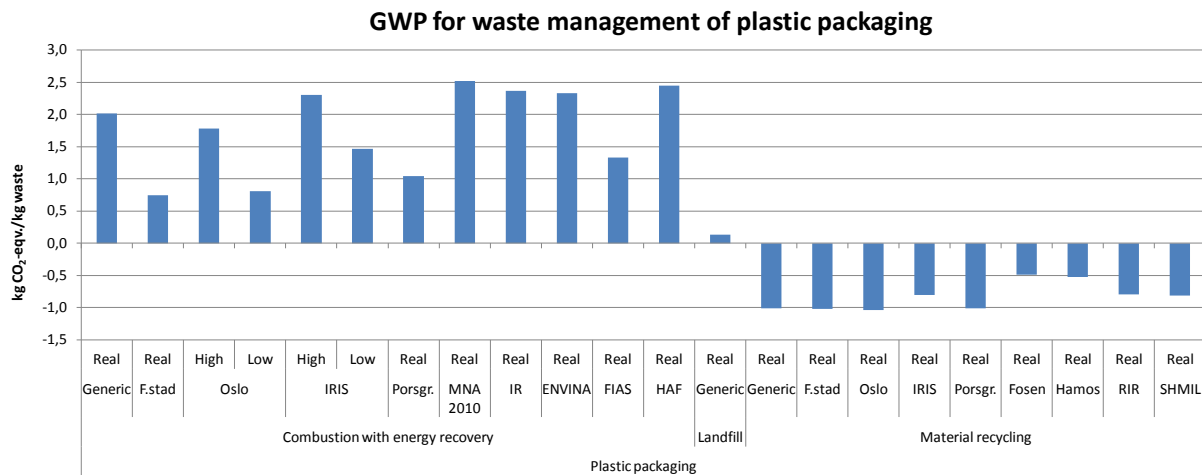


Figure 1 Net GWP for waste management of plastic packaging in Norwegian municipalities.

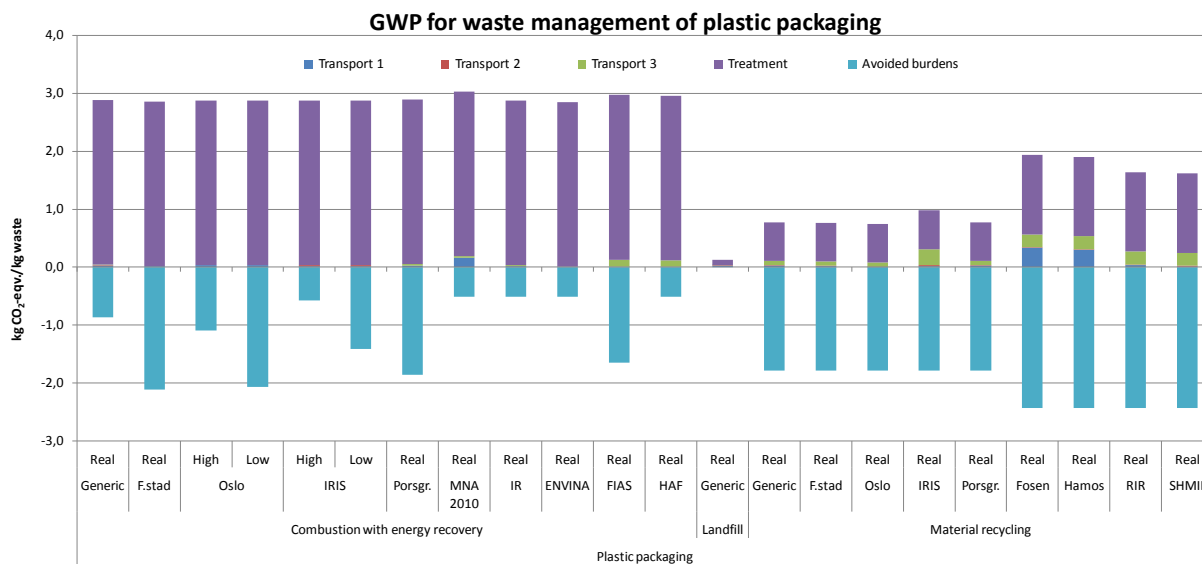


Figure 2 GWP, shown for each life cycle phase, for waste management of plastic packaging in Norwegian municipalities. For each data set, the burdens from different life cycle stages are stacked above the origin with the benefits appearing below it.

In figure 2 one can see that for the energy recovery cases, the burdens from the treatment phase (combustion) are almost the same for all cases, while the avoided burdens vary

considerably. In the case of material recycling, the treatment burdens vary the most, while the avoided burdens are more similar. For both energy recovery and material recycling, transport is, in most cases, of minor significance.

DISCUSSION

A distinction should be made between climate documentation of existing waste treatment options and climate information used as input to strategic decisions regarding waste management of plastic packaging waste. The conclusions regarding GWP used for strategic decision-making are not very sensitive to data specificity; material recycling of plastic packaging is in all cases better than energy recovery. For climate accounting, the results vary to a degree that specific data is needed.

CONCLUSIONS

The study has shown that, for GWP, material recycling is better than energy recovery for all the investigated plastic packaging cases. Local conditions affect the results with regard to avoided burdens in the energy recovery cases and with regard to treatment burdens in the material recycling cases. Hence, in existing plants, efforts should be made to enhance the incinerator efficiency, and to reduce the energy use and increase the material quality in the recycling plants. Transport is, in most cases, not a very significant factor.

It seems unlikely that local conditions can alter the conclusion regarding which treatment option is the best with regard to GWP for plastic packaging waste. Specific data are hence not needed for strategic decision-making. However, for climate accounting of plastic packaging waste treatment, specific data should be used.

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