# How does municipal waste collection affect climate change?

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*Waste containers for different types of residues in Madrid. Credits: UCC-UPM.*

Researchers from Universidad Politécnica de Madrid suggest a new methodology to assess the environmental impact of the containers used for the collection of urban waste.

An inappropriate design of a container system might unnecessarily aggravate the impact on the environment when collecting and transporting urban waste. This is the major conclusion of a team of

researchers from Universidad Politécnica de Madrid after carrying out a systematic evaluation of the urban containerization system.

The procedure, which is applicable to other cities and areas, allows researchers to assess the existing differences among the administrative units in which a territory is divided, to detect anomalies and suggest corrective measures to minimize the impact on environment when collecting urban waste.

Municipal solid waste (MSW) management includes the following stages: collection, transport and treatment. They involve various technical operations that depend on the existence of selective collection systems for the refuse constituents, which are usually packaging, organic waste, glass, paper/cardboard and mixed waste. Each of these stages has environmental impacts stemming from the use of bags to hold the waste generated by residents in their homes, including the containers placed in public roads for drop-off, the use of lorries or systems to transport the waste to the processing point, and the construction and operation of plants to treat each waste fraction.

The environmental impact assessment associated with each stage is carried out through the life cycle assessment which allows an objective, systemic and scientific evaluation of its impact on the environment and human health.

While the transport and final treatment of MSW have been extensively studied, there are few works that apply the life cycle to the collection either as a part of analysis of the integrated management system. Besides, the few existing studies fail to take into account aspects regarding endowment, contribution or effectiveness of the containerization system that determines the environmental impact.

This work, developed by the research group of Environmental

Technologies and Industrial Resources at UPM, addresses this gap by focusing on collection, the stage in which containers are at the disposal of citizens.

The methodology determines the environmental impact associated with the total containerization of a city, as well as for each district. This methodology consists of three phases: the first phase is focused on detailed data collection of the city. The second phase assesses the life cycle of each container, and the third phase adds the results for the geographic scope of the study, which is based on the results obtained during the second phase and drawing the conclusions according to the estimated indicators during the first phase.

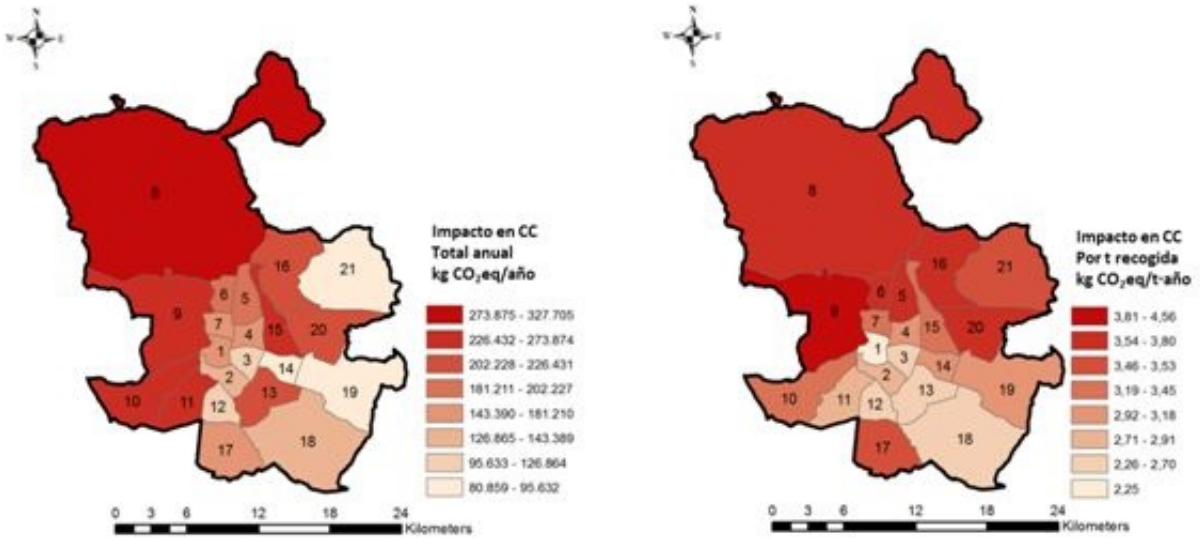
This methodology has been applied to the city of Madrid (Spain) and has allowed researchers to determine the environmental impact associated with the set of containers of the whole municipality and each districts, assessing their differences and establishing a correlation among such impact, the provision of containers (liter of container per capita) and the effectiveness of the collection (MSW mass collected per volume unit of containerization).

According to Javier Pérez, a researcher involved in this study, "the results suggest that the installed containers in Madrid (Spain) cause a climate change impact of 3,907 tons per year of CO2 equivalent, which is 1.22 kg per inhabitant per year ."

The contribution of the containerization systems to the environmental impact caused by the MSW management is lower than the phase of transport or treatment (1.9 percent, compared with 9.9 and 88.7 percent, respectively).

However, an inadequate container capacity, a bad distribution or an improper use at the urban level, can needlessly worsen environmental

impact. In addition, the associated inefficiency also affects the transport stage through unnecessary routes, higher number of vehicles, lower average driving speeds, or increased number of stops, leading to higher emissions.




Climate change impact associated to the containerization system for municipal solid waste collection in the city of Madrid: total and per ton of collected waste (Pérez et al., 2017).

This work, says Javier Pérez, is part of a wider research project that we are carrying out in our research group and aims to evaluate the environmental impact of the MSW management in the city of Madrid. Results regarding the transport stage were also previously published.

An inappropriate design of a container system might unnecessarily aggravate the impact on environment when collecting and transporting the urban waste. This is the major conclusion of a team of researchers

from Universidad Politécnica de Madrid after carrying out a systematic evaluation process of the urban containerization system.

The developed procedure, which can be extrapolated to other cities and areas, allows us to assess the existing differences among the administrative units in which a territory is divided, to detect anomalies and suggest corrective measures to minimize the impact on environment when collecting urban waste.

Municipal solid waste (MSW) management includes the following stages: collection, transport and treatment. They involve various technical operations that depend on the existence of selective collection systems for the different fractions, which are usually packaging, organic waste, glass, paper/cardboard and mixed waste. Each of these stages has environmental impacts stemming from the use of bags to hold the waste generated by residents in their homes, from the containers placed in public roads for drop-off, from the use of lorries or systems to transport the waste to the processing point, and from the construction and operation of plants to treat each waste fraction.

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**More information:** Javier Pérez et al. Methodology to evaluate the environmental impact of urban solid waste containerization system: A case study, *Journal of Cleaner Production* (2017). DOI: 10.1016/j.jclepro.2017.03.003

Javier Pérez et al. A methodology for estimating the carbon footprint of waste collection vehicles under different scenarios: Application to Madrid, *Transportation Research Part D: Transport and Environment* (2017). DOI: 10.1016/j.trd.2017.03.007

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