

Development of a pilot study for waste characterization in the municipality of Cayambe, Ecuador

Summary for Decision Makers

Methane is a greenhouse gas that is more than 80 times more potent than carbon dioxide in driving climate change, and accounts for nearly half a degree Celsius of warming to date (IPCC, 2021). Significant cuts in methane emissions will result in a slowing of global warming and could prevent 0.3 degrees Celsius of warming along with numerous public health and ecological benefits (UNEP and CCAC, 2021). The waste sector is the third largest source of human-driven methane emissions and presents one of the best opportunities for mitigation today (UNEP and CCAC, 2021). Barriers to implementation include, among others, a lack of information and data identifying sources of methane from landfills and dumpsites and access to best practices and evidence-based methane mitigation measures. This document provides a brief description of efforts undertaken to address gaps in data on solid waste generation in Cayambe, Ecuador.

RMI and Clean Air Task Force (CATF), with funding from the Global Methane Hub launched the **Waste Methane Assessment Platform (Waste MAP)** to provide an accessible online tool that highlights emissions, mitigation opportunities, and best practices to reduce solid waste methane emissions, providing a clear pathway for achieving the Global Methane Pledge and other national and subnational greenhouse gas reduction targets. As part of the Waste MAP project in Ecuador, CATF assisted the Ministry of Environment, Water and Ecological Transition of Ecuador (MAATE) in conducting solid waste characterization studies in alignment with the forthcoming Solid Waste Characterization Guide intended for use by the Municipal Decentralized Autonomous Communities (GADM). This work was implemented locally by Ambire Global and Consultora Residuos y Ambiente REYAM SAS.

The waste characterization conducted in the urban, rural and commercial sectors of Cayambe canton, from July 13 to 20, 2023. The Cayambe canton is in the northeast of the Province of Pichincha. It includes three urban parishes: Cayambe (cantonal head), Juan Montalvo, San José de Ayora; and five rural parishes: Ascázubi, Cangahua, Olmedo, Otón, Santa Rosa de Cusubamba. The canton has an estimated population of 113,269 inhabitants in 2023 according to the census carried out by the National Institute of Statistics and Censuses (INEC).

The project piloted the methodology developed by the “Solid Waste Management and Inclusive Circular Economy Project (GRECI)” of the MAATE. The characterization was conducted by six day laborers and three students who were responsible for collection, weighing, dividing and classification of waste, two operators of Empresa Pública Municipal de Agua Potable, Alcantarillado y Aseo Cayambe (EMAPAAC-EP – the municipal department in charge

of water, sewage, and sanitation) who were in charge of developing the sampling piles, classification, cleaning of the site and final disposal of waste after characterization, and a transporter responsible for mobilizing personnel and complying with collection routes. The training of the waste characterization team was done by GRECI with the support of EMAPAAC-EP. The CATF team provided all the sample collection and personal protection equipment (e.g., bins, brooms, rakes, gloves, weighing scale, N95 masks).

Solid waste surveys were conducted to determine the generation, composition, management, and final disposal of solid waste in the community. These surveys addressed demographic information on waste generators (e.g., gender, address, household size, educational level, household income and expenses), the type of waste management services (e.g., waste collection frequency, waste segregation and storage, street sweeping), and communication to waste generators (e.g., receptiveness and preferred means).

A total of 170 households were sampled, of which 84 were urban and 86 rural. An additional 84 samples were taken from non-household generators, which also included 3 samples of the street sweeping system. Educational institutions were not sampled due to vacation period and markets were also not included due to logistical issues that arose during the execution of the study. It was estimated that the canton **generates 75.08 tons/day of which 53% is organic waste and 47% is inorganic waste** with a total density of 185.10 kg/m³. The per capita generation of household waste was estimated by MAATE at 0.65 kg/day with 0.74 kg/day by urban households and 0.58 kg/day by rural areas. Non-household “associated generators” (a category which includes a number of large and commercial generators) generated substantially higher amounts, including shops (2.07 kg/day) and restaurants (4.338 kg/day). Street sweeping generated 8.74 kg/km/day.

The detailed results of the waste characterization are shown in the table below:

Table 1: Waste Characterization for Cayambe, Ecuador

| Type of solid waste | Composition % - Urban generators | Composition % - Rural generators | Composition % - Associated generators | Composition % - Street sweeping | Composition % average cantonal |
|------------------------------------|----------------------------------|----------------------------------|---------------------------------------|---------------------------------|--------------------------------|
| Organic Waste | | | | | |
| Food and yard waste | 47.8% | 47.2% | 64.4% | 55.4% | 53.2% |
| Inorganic Waste¹ | | | | | |
| Paper | 1.0% | 1.9% | 1.3% | 1.2% | 1.4% |
| Cardboard | 4.5% | 23% | 5.3% | 7.7% | 4.0% |
| Plastic | | | | | |
| Polyethylene terephthalate - PET | 2.2% | 2.2% | 1.8% | 2.4% | 2.1% |
| High Density Polyethylene - HDPE | 3.4% | 4.0% | 3.0% | 3.8% | 3.4% |
| Polychloride vinyl – PVC | 2.9% | 1.1% | 1.0% | | 1.6% |
| Low Density Polyethylene - LDPE | 6.4% | 3.5% | 3.1% | 4.7% | 4.3% |
| Polypropylene - PP | 1.3% | 1.5% | 0.8% | 1.5% | 1.2% |
| Polystyrene - PS | 23% | 2.7% | 3.0% | 4.7% | 2.6% |

¹ In Ecuador, paper and cardboard are often defined as inorganic waste.

(table continued)

| Type of solid waste | Composition % - Urban generators | Composition % - Rural generators | Composition % - Associated generators | Composition % - Street sweeping | Composition % average cantonal |
|----------------------------------|----------------------------------|----------------------------------|---------------------------------------|---------------------------------|--------------------------------|
| Tetra Pak (multilayer packaging) | 0.8% | 1.4% | 0.8% | 1.8% | 1.0% |
| Glass | | | | | |
| Clear | 2.7% | 3.8% | 2.0% | 0.9% | 2.8% |
| Colored (e.g., brown, green) | | | | 1.6% | |
| Flat (e.g., window glass) | | | | 1.2% | |
| Metals | | | | | |
| Ferrous | | | 1.2% | | 0.4% |
| Non-ferrous | 3.2% | 1.2% | 1.3% | 1.2% | 1.9% |
| Rubber | 1.1% | 1.6% | | | 0.9% |
| Wood | | 3.6% | 1.3% | 2.1% | 1.6% |
| Textiles | 2.8% | 1.5% | 2.0% | 0.9% | 2.1% |
| Electrical and electronic | 0.8% | 1.1% | | 0.6% | 0.6% |
| Sanitary | 12.0% | 10.4% | 3.8% | 5.6% | 8.7% |
| Inert | | | 2.0% | 1.8% | 0.7% |
| Hazardous | 1.0% | 4.1% | | 0.2% | 1.7% |
| Others, not categorized | 3.9% | 4.9% | 2.0% | 0.9% | 3.6% |

Lessons learned highlighted the importance of suitable equipment usage, streamlined documentation processes, active community participation, and efficient time management. The report stresses the significance of community engagement and effective planning in ensuring successful waste management initiatives and serves as a vital guide for future projects in similar contexts.

References

INEC. (n.d.) Population projection at the cantonal level for the period 2020 – 2025.

IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. In Press.

United Nations Environment Programme and Climate and Clean Air Coalition. (2021). *Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions*. Nairobi: United Nations Environment Programme.