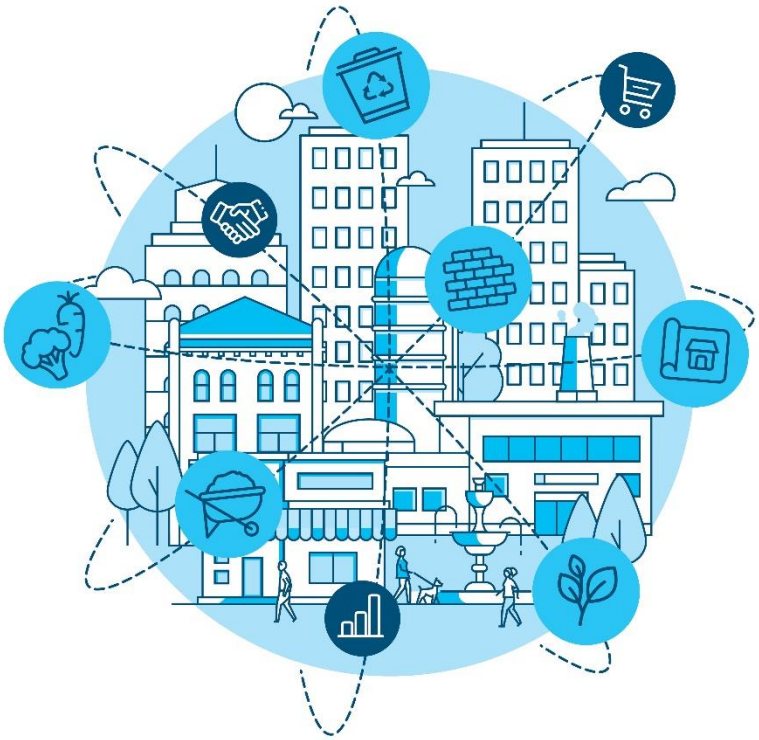
SEVILLA

Optimised Implementation Plan – Biowaste

Limpieza Pública y Protección Ambiental S.A.M (LIPASAM)



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Abstract	This Optimised Implementation Plan explains how the city of Sevilla will implement the tools and processes developed in the project preparation phase in its demonstration actions, and how relevant local stakeholders and CityLoops project partners will be involved.
Keywords	Demonstration; implementation; plan
License	

1. Demo action 1: Implementation of a biowaste collection route in a neighbourhood of Seville.

1.1. Short description

A selective biowaste collection route will be demonstrated within CityLoops in a city neighbourhood by LIPASAM, the municipal waste management company of Seville.

This project aims to improve both the quantity and purity of the biowaste collected by the city. A set of biowaste collection containers will be installed, for exclusive access to neighbourhood citizens and commercial establishments, with an information and awareness raising campaign to accompany this. A software tool designed to optimise the logistics of biowaste collection is also being developed and will be tested in the demonstration neighbourhood.

Alongside the demonstration action a further (mainly digital) awareness raising campaign will be launched across the whole city aimed at encouraging people, mainly large generators such as Horeca bodies (HOtels, REstaurants, and CAtering) to reduce food waste.

If the demonstration action is successful, recommendations will be developed for upscaling across the city.

Biowaste in Seville

In order to comply with the current European objectives in the field of the municipal waste management, LIPASAM and the City Council of Seville is seeking to implement various tools and actions, to advance the deployment of separate collection systems for biowaste in the city of Seville as well as the optimisation of its logistics and the awareness of households and large generators.

In 2020, the production of MSW in the City of Seville amounted to 317,960 tons. The prevailing collection model for MSW in the city covers four fractions (glass, light packaging, paper and cardboard and organic waste + rest), although there are some areas with a collection model of five fractions (including biowaste). It is estimated that around 120,000 tons of organic matter (biowaste) is still collected in a mixed fashion, with only 5% being recovered through composting. Around 15,000 tons of compost and soil amendment are being produced each year. Nowadays, only 2% is commercialized, while the rest of these materials are used for landfill restoration and as cover material.

Currently, there are some large generators (hospitals, municipal markets and malls) and three neighbourhoods in the City of Seville with biowaste collection, with a production of 1,700 tons in 2020.

Directive 2018/851 establishes that the selective collection of biowaste is a key factor for accomplishing the European target of recycling 55% of municipal waste by 2025, in addition to implementing separate collection before 2024. To meet these targets, it is necessary to:

- Promote the selective collection of biowaste, and achieve greater uptake of the flow of organic waste, currently part of the mixed MSW fraction, providing coverage to the entire city;
- Maximize the use of the resources contained in biowaste, by exploring alternatives in addition to- and beyond composting;
- Optimize the available municipal collection systems; going from predetermined routes to dynamic routes depending on the generation of waste per container.
- Raise awareness and increase citizen participation.

1.2. Activities

Activity	Timeline	Responsible partner
Preparation of 4 tender documents and procurement of: 1. 100 containers for the selective collection of bio-waste 2. Access control systems for said containers, 3. Communication campaign associated to the installation of the route 4. Communication campaign focus on avoid food waste. Including circular criteria in the specifications of the tenders.	January 2021 – December 2021	LIPASAM
Determination of the optimal neighbourhood to implement containers and installation.	April 2021 – December 2021	IDENER

Neighbourhood communication campaign on the separated collection system.	January 2022	LIPASAM
Citywide communication campaign on reducing food waste	January 2022 – December 2022	LIPASAM
Lab testing of OMSW flow optimisation tool	April 2021 – December 2021	LIPASAM
Real conditions testing of the flow optimisation tool	January 2022 – March 2023	LIPASAM
Analysis of the results of the actions carried out within the demonstration action, in order to evaluate the preparation of a document / plan with recommendations to be included in the future local waste management program in Seville.	April 2023 – September 2023	LIPASAM & IDENER

1.3. Preparation

In preparation for the demonstration phase, a number of activities were carried out:

- A **preliminary diagnosis report** analysing the current flow of biowaste in the city (in terms of quantity and quality – both separate biowaste collection and organic matter in mixed waste), together with an overview of current collection and treatment systems, the legal framework, and environmental and financial factors. It concludes with an implementation plan for the CityLoops demonstration actions. This report was prepared in collaboration with the local stakeholder group (LIPASAM, EMASESA, Seville City Council and ABORGASE), as well as conversations carried out with other members of the City Council and socioeconomic agents.
- An **OMSW flow optimisation tool**, based on Material Flow Analysis (MFA) is being developed to model different scenarios in terms of routes, as well as the location and expansion of containers. This should serve to improve the management of biowaste and efficiency of the routes implemented.

All CityLoops biowaste tools and reports can be found here: *CityLoops - Biowaste*

1.4. Planned activities

- ***Installation of separate waste collection containers in one neighbourhood***: A specific neighbourhood will be identified for the installation of separate biowaste collection containers. 100 side-loading surface, 2,200 litre containers with electronic locks will be installed (with circularity criteria taken into account in their procurement). Citizens who want to participate in the system will be able to open the container with a card, in order to guarantee, in the long term, the purity of the waste fraction, which is essential for its subsequent valorisation. Once the containers are installed, an operational control of the route will be carried out and the behaviour of the electronic locks and patterns of use by the citizens will be measured periodically.

Image 1. Example of surface container of high-capacity (2.200 L) installed in the city of Seville.

- ***Communication campaigns***: Two communication campaigns will be carried out in order to promote and enhance the selective collection of biowaste, as well as the minimization of food waste.

- The duration of the campaign associated with the installation of containers will be approximately one month. Various actions will be carried out, focused on improving citizen engagement and their participation in the system installed:
  - Meetings will be held with associations in the neighbourhood and with the government body of the municipal district.
  - Information points will be placed in the proximity of the route (2-3 information points).
  - Mailing of leaflets and installation of posters.
  - Communication through LIPASAM social networks.

Image 2. Examples of leaflets and others information formats distributed through.mailing. Communication Campaign.

The information and mailing points will be used to distribute electronic cards to access to the containers. Likewise, citizens who want to participate may give their personal data, in order to receive a kit to support in the separation at source

consisting of a 10-litre bucket for depositing of biowaste, compostable bags and textile bags for the selective collection of other waste fractions.

- The campaign to minimise food waste will be carried out at the city level, mainly through digital marketing actions. The campaign will have a chronological design consisting of at least 3 “periods” or impacts over a year, which is expected to have a persistent effect. Each period will last approximately 1 week.

Image 3. Example physical information point. Communication campaign.

- ***OMSW flow optimisation tool***: The software tool will be used to model different scenarios in terms of routes, as well as the location and expansion of containers. The objectives of this platform are to evaluate the potential options to improve the management of biowaste in the city. Likewise, the tool will support the analysis of organic waste collection in order to improve the efficiency of the different routes. Ultimately, the tool is intendeds to be used to increase the organic waste collection separately to the whole city, including households and large generators.

1.5. Expected outcomes & evaluation

As described above, the demonstration action has a series of activities that will take place in the physical environment of the city in addition to other digital tools that will support decision-making, so that at the end of the project the results expected are:

1. The software tool will support the optimisation of the biowaste management routes and the separate biowaste collection to the whole of the city.
2. Increase the quantities of biowaste collected through the installation of a container route, equipped with an electronic lock, operational in a city neighbourhood.
3. Increase the quality of the material (biowaste) collected in terms of obtaining better quality compost and improve its commercialization and use.
4. Raise awareness and increase citizen participation through 2 communication campaigns, with online and offline actions, which involve households and large generators of biowaste.
5. Accomplish a comprehensive expansion of the separate collection of biowaste throughout the city, through a plan with recommendations of the experiences carried out in CityLoops.

Associated with the demonstration action, an *evaluation plan* will be carried out, which is part of the activities of the CityLoops project, which will allow evaluating and measuring the performance of the actions in terms of circularity. Qualitatively, the demonstration action to be developed is expected to contribute to:

- Advance in the fulfilment of the European, national and regional objectives, in the matter of selective collection, recycling and not disposal in landfill, marked by Directive 851/2018 and 850/2018.
- Strengthen the education, awareness and knowledge of citizens and other socio-economic agents related to the bases of the circular economy in relation to the improvement of biowaste management.
- Promote the inclusion of “circular” indicators and specifications in tender documents and contracts.
- Increase the amount of material that can be recovered / recycled / recovery, and therefore, reduce the amount of material that is deposited in landfills.
- Generate potential economic savings, by optimizing collection logistics.
- Reduce the carbon footprint of waste collection activities.

Further information on Seville’s demonstrations can be seen at:

https://cityloops.eu/cities/seville

1.6. Risks

Potential risk	Mitigation approach
Technical risks	
Delay in the installation of containers, due to lack of human resources (COVID-19) or lack of availability of vehicles.	Preliminary study of container locations. Control and planning in detail with the Service in charge of the installation of urban equipment in the city. In case it would be necessary, outsourcing the container installation.
Failures in the electronic locks of the containers.	Periodic control of the state of the locks. Periodic control of the data send by the electronic locks
Economical Risks	
High investment costs in the acquisition of containers, locks, etc.	Inclusion of criteria in the tender documents that guarantee the achievement of the most economically advantageous bid, as long as it accomplished that the minimum technical and circular specifications established.
High operational costs derived from collection logistics.	Support of the software tool to be developed, in order to optimize the collection logistics.
Social Risks	
Low acceptance by citizens for the installation of a fifth container in the area.	The study phase of container locations will involve neighbourhood associations in the area and the municipal district government body.
Low participation in the selective bio-waste collection system.	Communication and awareness-raising effort to align citizens and other waste generators with the project objectives.
Environmental risks	
Low purity of the waste obtained, which may compromise its subsequent recovery / recycling / valorization.	In communication campaigns, the message of the type of materials to be deposited in the container will be reinforced.
Bad odours emerged by the container due to high temperatures and decomposition of biowaste	Periodic review of the interior / exterior condition of the containers and execution of the established cleaning protocol.

2. Demo action 2: Biomethane production from biowaste in co-digestion with sludge

2.1. Short description

The methane production capacity of the biowaste collected from Demo Action 1, will be tested through a process of co-digestion with sewage sludge in a wastewater treatment plant (WWTP). This is being tested as an alternative to the current collection and transportation of biowaste for composting.

The aim of this action is to reduce the distance travelled by the biowaste (and consequent fuel consumption and CO_2 emissions), and increase the energy self-sufficiency of the WWTP. Furthermore, following this action, feasibility studies will likely be carried out to evaluate the use of biowaste, as source of biogas to be used as fuel for the fleet of municipal vehicles, urban buses and heavy-duty vehicles for waste collection, among others.

Biowaste treatment in Seville

Currently, the biowaste collected in the city of Seville is transported directly to a waste separation, classification and treatment plant for composting. This treatment plant is located 37 km away from the city. LIPASAM, manages a transfer plant nearby to the city in order to optimise logistics to the final treatment plant. As the number of routes and quantity of biowaste to be collected increases in the future, so will logistics costs.

EMASESA, the municipal company that carries out the comprehensive water management in the city, has facilities less than 10 km from the city. For several decades, the city's wastewater treatment plants have had biogas production systems based on an anaerobic digestion of their sludge. Furthermore, in recent years, EMASESA has opted for the co-digestion, together with its sewage sludge, of other industrial effluents with significant biodegradable organic matter content, to increase the production of renewable biogas.

2.2. Activities

Activities	Timeline	Responsible partner
Detailed planning for the testing process	April 2021 – December 2021	EMASESA
Physical characterisation of the biowaste collected.	January 2022 – May 2023	LIPASAM
Lab analysis of COD, BMP and others parameters to determine the capacity of methane production.	January 2022 – May 2023	EMASESA
Calculation of the BW dose to introduce in the pilot plant for codigestion with sludge.	January 2022 – May 2023	EMASESA
Measuring of the methane production. Analysis of the gas produced (sulphide, methane, CO_2, etc.)	January 2022 – May 2023	EMASESA
Revision of the results obtained. Analysing how to design a pre-treatment system or the process strategies to managing the anaerobic digestion of the WWTP using BW.	May 2023 – July 2023	EMASESA
Economic and environmental benchmarking analysis between base scenario and demonstration action.	May 2023 – July 2023	EMASESA & LIPASAM

2.3. Planned activities

Analysis of energy generation from biowaste collected and sludge: In order to measure the quality of the biowaste a characterisation has first to be carried out. This will involve several areas of analysis:

- Physical characterisation, to determine the purity of the biowaste fraction collected.
- Chemical characterisation for COD, BMP, etc. to determine the capacity of methane production.

Once these tests have been done, the dose of biowaste to introduce in the pilot plant can be calculated. The biowaste will be mixed with WWTP sludge before introducing it into the pilot digester of EMASESA.

During the course of the test, the production of methane will be measured. The quality of the gas produced will also be analysed, in order to determine the amount of hydrogen sulphide, methane, CO_2 and other gas concentrations.

All the data obtained will be used to define the methane production potential of the biowaste, in order to design the pre-treatment system or the process strategies for managing the anaerobic digestion of the WWTP.

Moreover, a economic and environmental comparison between the base scenario and the demo action will be done, as part of the analysis results of the demo action.

Image 4. Pilot Plant for codigestion. EMASESA facilities.

2.4. Expected outcomes & evaluation

The demonstration action, is expected to result in:

- A new system for producing biogas from waste water sludge / OMSW co digestion.
- A comparative analysis, in economic and environmental terms, of what it means to manage waste through co-digestion with sewage sludge, compared to the current composting treatment.

This action will also be evaluated through the CityLoops project *evaluation plan*, which will allow evaluating and measuring the action's performance in terms of circularity. Qualitatively, the demonstration action to be developed is expected to contribute to:

- Advance in the fulfillment of the European, national and regional objectives, in the matter of selective collection, recycling and not disposal in landfill, marked by Directive 851/2018 and 850/2018.
- Increase the amount of material that can be valorised by anaerobic digestion, and therefore, reduce the amount of material that is deposited in landfills
- Increase the local energy generation capacity from local biomass.
- Generate potential economic and energy savings by optimising collection logistics, making better use of the resources contained in the waste and increasing the self-sufficiency capacity of the anaerobic digestion facilities.
- Reduce the carbon footprint of waste treatment and management activities.

Further information on Seville's demonstrations can be seen at:

https://cityloops.eu/cities/seville

2.5. Risks

Potential risk	Mitigation approach
Toxicity of the compounds/ elements biowaste, which limits its biomethanization.	Physical and chemical characterization and analysis of biowaste collected.
Low purity of the biowaste collected.	Communication and awareness-raising effort to align citizens and other waste generators with the project objectives. Preparation and conditioning of the biowaste before entering the pilot plant, through manual classification where appropriate, crushing, and mixing with sludge.
Low amounts of bio-waste collected to carry out the tests.	The pilot plant to be used is on a laboratory scale, so it requires few amounts of biowaste for its operation. If it would be necessary, the storage and freezing of biowaste samples can be envisaged.

CITYLOOPS

CityLoops is an EU-funded project focusing on construction and demolition waste (CDW), including soil, and organic waste (OW), where seven European cities are piloting solutions to be more circular.

Høje-Taastrup and Roskilde (Denmark), Mikkeli (Finland), Apeldoorn (the Netherlands), Bodø (Norway), Porto (Portugal) and Seville (Spain) are the seven cities implementing a series of demonstration actions on CDW and OW, and developing and testing over 30 new tools and processes.

Alongside these, a sector-wide circularity assessment and an urban circularity assessment are to be carried out in each of the cities. The former, to optimise the demonstration activities, whereas the latter to enable cities to effectively integrate circularity into planning and decision making. Another two key aspect of CityLoops are stakeholder engagement and circular procurement.

CityLoops runs from October 2019 until September 2023.

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