A cost-benefit analysis study on community composting in Bordeaux Metropole, France

Study

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Executive summary

Within the EU, 10% of food that is available to consumers is wasted, accounting for approximately 60 million tonnes annually.[1] This is estimated to cost the EU €130 billion.[2] Globally, food waste accounts for 8%–10% of greenhouse gas emissions,[3] while approximately 12% of the water used for food is wasted,[4] and 30% of agricultural land is used for food that is lost or wasted.[5]

To address food waste, municipalities across the world are adopting a 'circular' systems approach, attempting to reduce and prevent waste altogether. The vision of 'zero waste' provides a framework for how waste can be managed better and ultimately prevented, seeking to conserve natural resources and avoid environmental degradation. Guided by the waste hierarchy, food waste should be prevented, redistributed to people in need or recovered through biological treatment (e.g. converted into animal feed). The unavoidable food waste fraction should then be separately collected and processed to produce high-quality compost and/or digestate via anaerobic digestion.

In the Metropole of Bordeaux in France, currently, a third of all residual waste, which amounts to approximately 174,000 tonnes annually, is estimated to be food waste, which is sent for incineration. The Bordeaux Metropole is pursuing decentralised composting and anaerobic digestion as a way to divert food waste from disposal to recycling. It has initiated a range of initiatives, including food waste collection for anaerobic digestion within the inner-ring area[6], and the provision of household compost bins and community composting sites within the outer-ring area[7]. The outer-ring area covers approximately 30% of the total population of the Bordeaux Metropole.

During 2025, the Bordeaux Metropole established 100 community composting sites in the outer-ring area, and aims to establish another 300 sites by the end of 2026. This study seeks to determine the overall cost or benefit of establishing these 400 community composting sites to divert food waste from the residual waste stream, and ultimately from being sent for incineration. This research is done using a cost-benefit analysis (CBA) model, which measures the economic, social, and environmental costs and benefits of this initiative,

[1] European Parliament (2024), *Food waste in Europe: facts, EU policies and 2030 targets*.
[2] European Parliament (2024), *Food waste in Europe: facts, EU policies and 2030 targets*.
[3] UNFCC (2024), *Food loss and waste account for 8-10% of annual global greenhouse gas emissions; cost USD 1 trillion annually*.
[4] EU (2023) *COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the document Directive of the European Parliament and of the Council amending Directive 2008/98/EC on waste*.
[5] Geneva Environment Network (2020), *Reducing Food Loss and Waste for a Healthier Planet*.
[6] The 'inner-ring area' refers to the inner-city area or urban core and immediate surrounds which is characterised by densely populated, older, mixed-use neighbourhoods.
[7] The 'outer-ring area' refers to the outer suburb area or outer-most edges of a metropolitan area which is characterised by lower density, newer, suburban homes, greenfield developments and/or semi-rural zones.

compared to the status quo (prior to 2025), where this fraction was sent for incineration as part of the residual waste stream.

The CBA uses both primary and secondary research methodologies. Data and information were provided by the Bordeaux Metropole to understand the current waste management context, gather data specific to the implementation of the community composting initiative, and, through a site visit, view various community composting sites. Secondly, desktop research was conducted to review available reports, research and data to fill gaps in the primary research.

Two scenarios are considered in the study, namely:

- Scenario 1 ('status quo'): food waste disposed of as part of the residual waste stream that is sent for incineration.
- Scenario 2 ('diversion alternative'): food waste is diverted from incineration and channelled into community composting.

In the status quo, the main costs are related to waste management (collection, transport, and incineration), pollution tax charges for incineration, and the cost of emissions generated by incineration. The benefits in this scenario are the sale of electricity and heat produced as part of the incineration process, which is sold into the energy system. Within the diversion alternative, the main costs are those related to establishing and maintaining the community composting initiative, as well as the lost sales from electricity and heat produced. The main benefits are the savings from the compost produced, the avoided waste management costs, and savings from the avoided EU emissions trading system costs and emissions from incineration.

In defining the scope of the CBA, the amount of food waste that can be diverted into 400 community composting bins is used as a baseline to determine the costs and benefits in both the status quo and diversion alternatives. This is calculated as 1,815 tonnes per year, assuming that **65% of households served by the 400 community composting sites use these sites** instead of discarding their food waste in the residual waste. Therefore, only the portion of the cost associated with removing 1,815 tonnes of food waste would be considered in the analysis.

The analysis indicates that the **status quo generates a net cost for the Metropole** over a 5-year period, with a net present value[8] (NPV) of -2.4€ million (or -312€ per tonne of food waste). This is to be compared to the diversion alternative, **which generated a net financial benefit**, with an NPV of 193,595€ (or 25€ per tonne of food waste).

A sensitivity analysis was performed to test the effects of changes in a range of variables on the study's results. **The analysis indicated that the participation rate of households (i.e. the percentage of households that dispose of their food waste into the community composting bins) has the biggest impact on the results**

[8] Net present value (NPV) is a metric that is used in a cost-benefit analysis to calculate the difference between the current value of all future benefits and the current value of all future costs. By 'discounting' all future cash flows to current values, it allows one to compare different decisions (e.g. composting vs incineration of food waste) and determine if the project is considered profitable.

of the model. The cost of monitoring the community composting sites is the most significant cost variable. Since it accounts for more than 81% of total costs, an increase in monitoring expenses by 20% causes the diversion alternative (at 65% participation) to generate a net cost overall.

In a scenario where only 50% of households are participating, the diversion alternative with 400 community composting sites also generates a net cost. Yet, these costs are still lower than the status quo scenario, ultimately saving money compared to the costs of today's model. The benefits generated from potential savings from compost produced, as well as reduced costs for the collection and transport of food waste, also have a significant impact. When the compost price decreases by 1€ per 20kg bag, or when savings from collection and transport decrease by 60%, the diversion alternative generates a net cost.

The results of the study indicate that overall, the community composting initiative is economically preferable to sending food waste to incineration. Even though the community composting initiative has a greater overall cost than the status quo, the system still results in a net benefit over the 5-year timeframe. It is therefore recommended that the Bordeaux Metropole continue to prioritise decentralised community composting over incineration as a means to treat food waste. This further supports the French AGEC Law (i.e. Anti-Waste for a Circular Economy enacted in 2020), which prioritises waste reduction, reuse and recycling over landfill disposal and incineration.

Further, if the participation rate can be improved alongside the overall efficiency of maintaining and monitoring community composting sites (and, therefore, reducing costs), the diversion alternative could generate an even more significant net benefit. This will generate greater financial savings for the Bordeaux Metropole, environmental savings for the local community as well as a range of other co-benefits, such as building social connections and driving environmental awareness.

Acronyms

(CBA) Cost-benefit analysis

(CO2e) Carbon dioxide equivalent

(ETS) Emissions Trading System

(FW) Food waste

(GHG) Greenhouse gas

(KG) Kilogram

(kWh) Kilowatt hours

(MWh) Megawatt hours

(NPV) Net present value

Introduction

Context

Within the EU, it is estimated that about 60 million tonnes of food is wasted on average each year, which is around 10% of the total amount of food available to consumers.[9] This generation of food waste has dire social, environmental and economic consequences:

- There are approximately 40 million people in Europe who cannot afford a quality meal every second day;[10]
- In the EU, food waste is estimated to cost 130€ billion every year;[11]
- Food lost and wasted accounts for 8%-10% of greenhouse gas emissions globally;[12]
- Water used in food that is thrown away accounts for up to 12% of total water used,[13] and;
- About 30% of global agricultural land is used to provide food that is lost or wasted.[14]

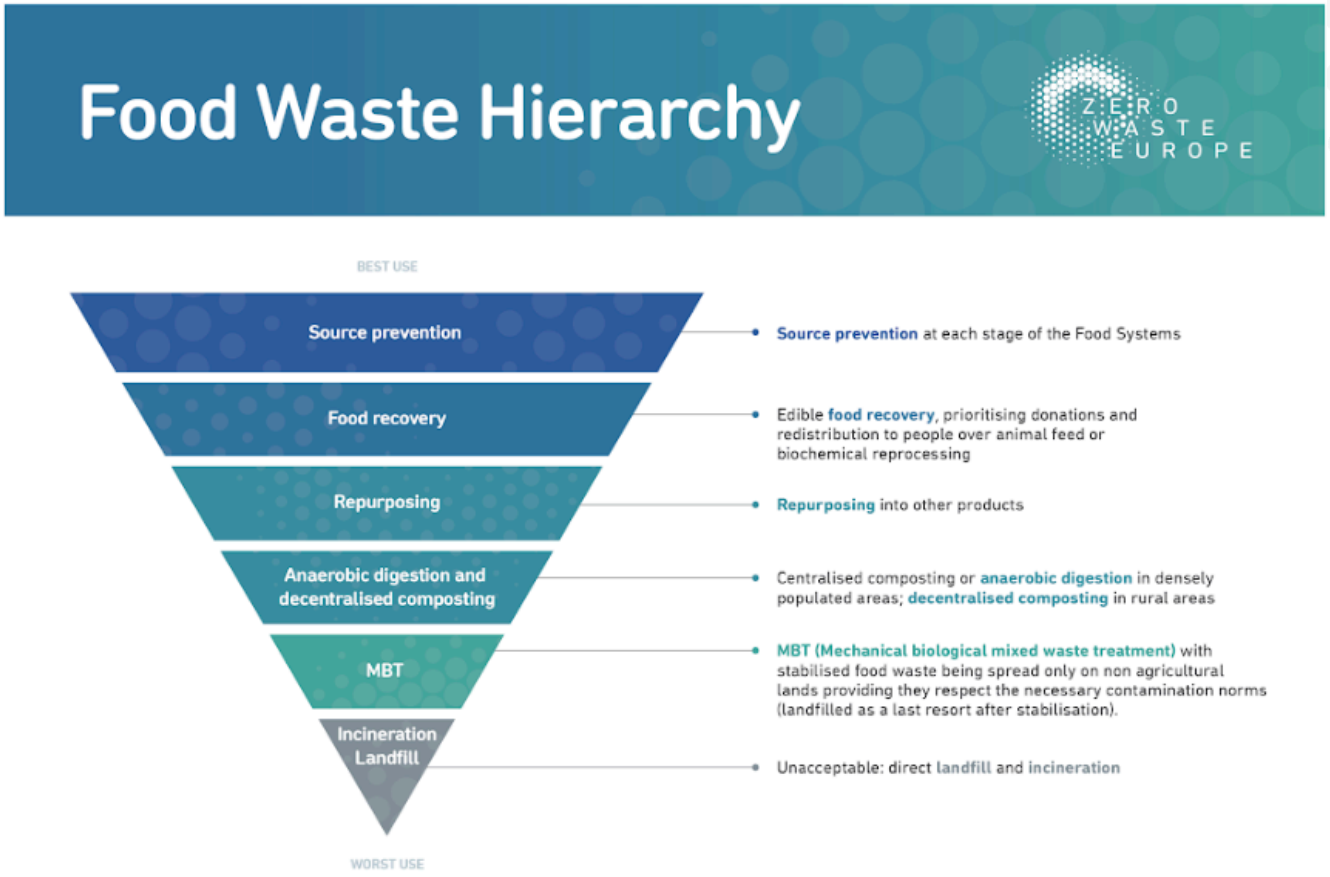
As a means to address these challenges, there has been a shift towards a system built on 'circular economy' principles, which seeks to redesign the traditional 'take-make-waste' model of the linear economy into a more sustainable, circular system. The circular economy, as defined by the Ellen MacArthur Foundation, is a system in which materials never become waste and nature is regenerated, where climate change, biodiversity loss, waste, and pollution are addressed by decoupling economic activity from the consumption of finite resources.[15]

The waste hierarchy is a useful tool for understanding how waste can be managed within the context of the circular economy. Figure 1 presents the food waste hierarchy as developed by Zero Waste Europe.[16] Within the hierarchy, the most preferred option is to prevent food waste altogether, and where this isn't possible, food should be recovered for redistribution for either human or animal consumption, or for biological processing. If these options are not achievable, food should then be repurposed into other products. Thereafter, the next preferred option is either anaerobic digestion or decentralised composting, after which comes mechanical biological treatment. The least preferred option for food waste is incineration and landfill.

Globally, however, food continues to be wasted and sent to landfill or to be incinerated, and opportunities for food waste to be reduced, redirected, or diverted into value-added activities that promote soil health and reduce methane emissions are being lost.

[9] European Parliament (2024), *Food waste in Europe: facts, EU policies and 2030 targets*.
[10] European Parliament (2024), *Food waste in Europe: facts, EU policies and 2030 targets*.
[11] European Parliament (2024), *Food waste in Europe: facts, EU policies and 2030 targets*.
[12] UNFCC (2024), *Food loss and waste account for 8-10% of annual global greenhouse gas emissions: cost USD 1 trillion annually*.
[13] EU (2023) *COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the document Directive of the European Parliament and of the Council amending Directive 2008/98/EC on waste*.
[14] Geneva Environment Network (2020), *Reducing Food Loss and Waste for a Healthier Planet*.
[15] Ellen MacArthur Foundation (2025), *What is the meaning of a circular economy and what are the main principles?*.
[16] Zero Waste Europe (2026).

Figure 1: Food waste hierarchy[17]



Background

The Bordeaux Metropole is an administrative region in France that comprises 28 municipalities and 831,534 inhabitants in 2023.[18] It is estimated that the inner-ring area (i.e. inner-city, urban core area and immediate surroundings characterised by densely populated mixed-use neighbourhoods) comprises of 70% of the total population, with the remaining 30% residing in the outer-ring area (i.e. outer suburban area or outer-most edges of the metropolitan area characterised by lower density suburban homes, greenfield developments and/or semi-rural zones).

A total of approximately 412,190 tonnes of waste was generated in 2024, which equates to 496 kilograms per inhabitant per year, when assuming no increase in population from 2023. The metropole has a range of waste collection mechanisms, which include the collection of separated glass, mixed recyclables, separated recyclables from recycling centres, food waste (within the inner-ring area only), residual mixed waste, and waste from community and communal service facilities.

[17] Zero Waste Europe (2019), *Food Systems: a 'recipe' for food waste prevention*.
[18] Bordeaux Metropole (2025).

The waste collected is channelled into a range of waste management activities. Recyclable materials are sent to material recovery facilities (MRFs), where about 29% of the waste is recovered for valorisation, while commercial composting facilities treat 13% of total waste (mostly garden waste), incinerators treat 52% of total waste, and the remaining 6% of waste is sent to landfill.

Currently, all residual waste, which comprises just over 42% of total waste generated, is sent for incineration. **A recent waste categorisation study undertaken by the Bordeaux Metropole found that almost a third of this is considered food waste**. The Bordeaux Metropole has, for over a decade, distributed community and home composting bins, which are operated by volunteers and households. In an effort to expand the diversion of food waste from incineration, they have recently started rolling out community composting bins within the outer-ring area, as well as placing dedicated food waste collection open bins, placed on the street in the inner-ring area, which are collected and treated at an anaerobic digestion facility.

The focus of this study is the community composting initiative that is being implemented within the outer-ring area, home to approximately 30% of the total population. To date, about 100 community composting sites have been established, and the aim is to have a total of 400 sites established by the end of 2026. Each composting site consists of three bins, each with a specific function (see Figure 2 below), which is briefly described below:

1. **Food waste:** household food waste is placed in this bin by each household. The food waste is then covered with a layer of brown material (e.g. leaves, grass etc).
2. **Reserves of brown material:** chipped brown material (garden waste) is provided in one of the bins by a private service provider. This is used by households to cover the food waste they place in the food waste bin.
3. **Maturation:** this bin contains compost undergoing maturation from the previous weeks.

When the food waste bin is full, the 'maturation' sign is moved to this bin, which is then locked while the composting undergoes maturation. Once the compost has fully matured, the bin is emptied, and the empty bin now becomes the 'food waste' bin for the next cycle.

The sites are visited each week, either by Bordeaux Metropole staff or private service providers, and data is collected on a range of variables, including the capacity of the bins or to log issues that have been identified. The intention is for all 400 sites to be managed by private service providers, who will do weekly inspections to ensure the sites operate well and capture data critical for their success.

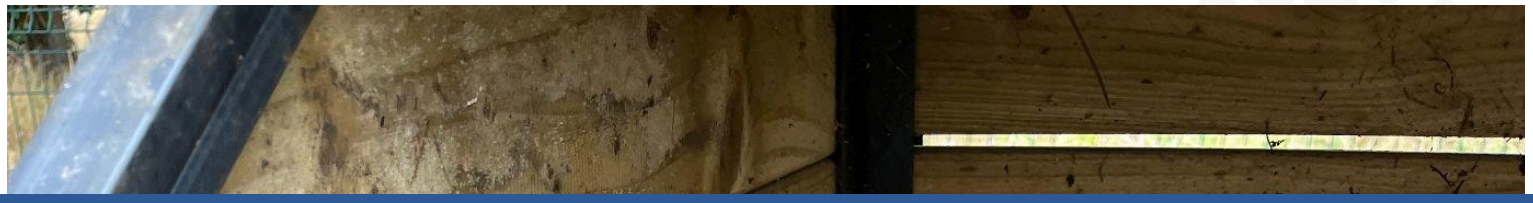
Figure 2: Community composting site in Bordeaux Metropole

Purpose and objectives

With the above context and background in mind, the purpose of this research is to undertake a cost-benefit analysis to determine the overall net benefit or cost of rolling out 400 community composting sites to divert food waste in the outer-ring area (the 'diversion alternative'), in comparison to before the composting initiative was implemented, when this food waste was being sent for incineration (the 'status quo').

The specific objectives of the study are:

1. To determine the economic, environmental, and social costs and benefits associated with sending organic waste for incineration in the status quo scenario, as opposed to diverting organic waste into community composting in the diversion alternative scenario.
2. To calculate the overall net cost or benefit, as measured by the net present value (NPV), of the status quo and diversion alternative.
3. To determine the variables that influence the NPV of the status quo and diversion alternative, and how changes in these variables impact the NPV.



Approach and methodology

Approach

A CBA is an economic tool that is used to evaluate projects and their alternatives. It includes not only the economic costs and benefits (such as revenue and project expenditure), but also the social and environmental costs and benefits. Within the zero waste context, this allows for a more accurate assessment of a project to be done through the inclusion of negative externalities that are avoided from diverting waste away from landfills or incinerators and into circular value chains.

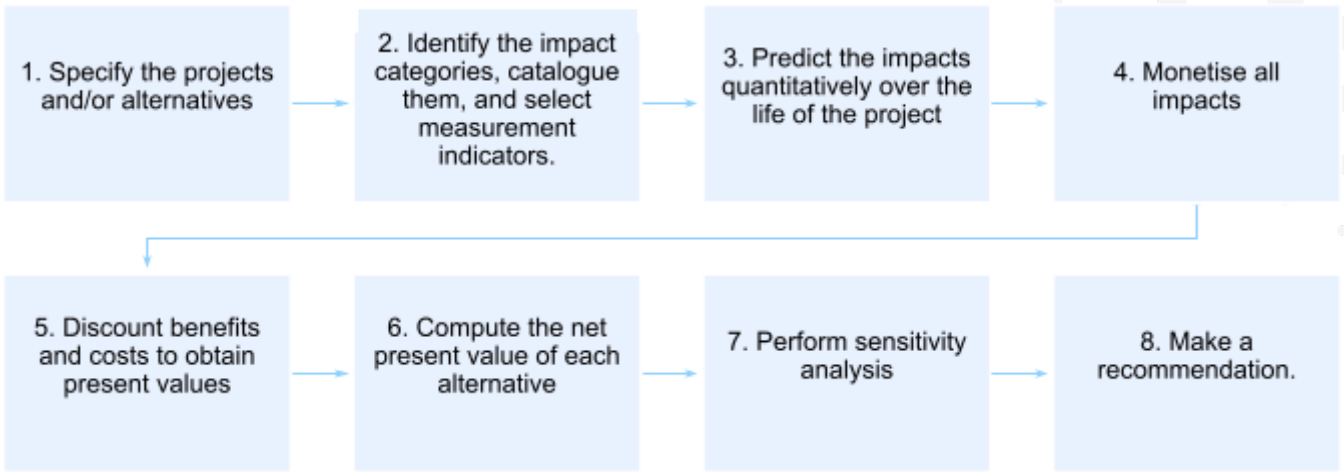
The approach that is generally followed in a CBA is presented in Figure 3 below. To begin, the specific project and/or alternatives are identified. In the case of this study, a comparison is made between the status quo – before the community composting was initiated and all food waste was sent as residual waste for incineration – with the diversion alternative, where all 400 community composting sites are rolled out by the end of 2026.

Thereafter, all the impact categories (i.e. categories of costs and benefits) are identified, along with specific measurement indicators for each. The study identifies all the economic, environmental and social costs and benefits associated with both the status quo and diversion alternatives.

The timeframe of each impact is then projected (i.e. over what period does each impact occur). In this study, the costs and benefits are projected over a 5-year timeframe. Thereafter, all the impacts are monetised and projected over this timeframe. The impacts are then discounted using an applicable discount rate to obtain present values for each, which then allows for the net present value (NPV) of each to be calculated. NPV is a metric used in a cost-benefit analysis to calculate the difference between the current value of all future benefits and the current value of all future costs. By converting all future cash flows into current values, using an appropriate discount rate, and subtracting total costs from total benefits, you arrive at either a net cost or net benefit. This allows one to compare different decisions. In this case, it compares the total net cost or benefit of composting versus incineration of food waste, and determines whether the project can be considered profitable.

A sensitivity analysis is then conducted, which tests critical indicators in order to determine how sensitive the model is to changes in these variables. Finally, based on the results of the model, recommendations can be made.

Figure 3: Approach followed in the CBA study



Research methodology

The study utilises both primary and secondary research methodologies. These methodologies are briefly described below:

1. **Primary research** was conducted to gain insights from the Bordeaux Metropole team responsible for the implementation of the community composting initiative. This was done via a series of virtual meetings, as well as a site visit and an in-person meeting in the Bordeaux Metropole. Initial meetings were held to better understand the broader context within which the community composting initiative is being implemented, and to refine the project scope. Once the project scope was defined, subsequent meetings were held where data and information specifically related to the project were shared. This included data on waste generated and treated, capital and operational costs related to the community composting sites, and emissions data related to the project. Finally, a site visit and an in-person meeting were conducted to view various community composting sites, gain more detailed insight into the composting processes and management of the sites, as well as to gather data required to develop the CBA model.
2. **Secondary research** was conducted by assessing reports and other information that was shared by the Bordeaux Metropole, as well as to fill data gaps as required for the development of the CBA model. This included assessing annual reports and operational reports related to the Metropole's waste management functions and gathering secondary data on incineration costs, carbon and pollution taxes, emission factors, and inflation and interest rates.

Limitations of the study

The analysis has been undertaken using the most reliable and up-to-date data and information available to the project team, and the results of the analysis are considered to be accurate and reflective of the current conditions under which the community composting project is being implemented. However, some limitations must be noted:

1. **Data on community composting sites:** Specific data on the exact amount of food waste deposited into community composting bins, as well as the subsequent amount of compost produced, is not captured. As such, the data provided is a best estimate by the Bordeaux Metropole's project team about the number of households that each site serves, the percentage of households that are using these sites rather than disposing of food waste in their residual waste, and the average amount of food waste generated per household. Therefore, the data is not considered to be exact but rather an approximation. That being said, given that the team visits these sites weekly and observational data is collected, the estimates are expected to be a relatively true reflection of the realities on the ground.
2. **Emissions data:** Emissions data relating specifically to the manufacture, transport, installation, and end-of-life of the compost containers, as well as emissions generated through the production of compost, have been provided by the Bordeaux Metropole team. These are based on certain assumptions and estimates, and on available emission factor calculators. Although care was taken in determining this emissions data, it is considered to be an approximation rather than definitive.
3. **Potential vs realised costs and benefits:** The model seeks to compare two approaches for managing food waste. The benefits and costs associated with each approach (i.e. the status quo and diversion alternative) are based on a range of assumptions, and in certain instances, these are 'potential' costs or benefits and not actual costs or benefits. The findings are therefore indicative of the impact that each approach would have within the Bordeaux Metropole and are not considered to be the actual or 'realised' costs or benefits. The results of the study should be viewed accordingly.

Data and assumptions

Costs and benefit indicators

Table 1 illustrates the indicators, indicator category (cost or benefit), type of indicator (internal or external) and the applicable scenario (status quo or diversion alternative). Internal indicators are those directly related to the functioning of the status quo or diversion alternative for the Bordeaux Metropole, such as waste collection and transport costs or the tax paid on incineration. External indicators are the environmental impacts resulting from activities in the status quo or diversion alternative on society as a whole, such as savings from avoided emissions.

Table 1: Categorisation of the cost and benefit indicators for each scenario

CATEGORY	INDICATOR DESCRIPTION	TYPE	SCENARIO
Benefit	Sale of electricity produced through incineration	Internal	Status quo
Benefit	Sale of heat produced through incineration	Internal	Status quo
Benefit	Savings from compost produced for households	Internal	Diversion
Benefit	Savings from avoided waste management costs (collection & transport)	Internal	Diversion
Benefit	Savings from avoided waste management costs (incineration)	Internal	Diversion
Benefit	Savings from avoided waste management costs (landfill of ash residue)	Internal	Diversion
Benefit	Savings from avoided emissions from compost produced	External	Diversion
Benefit	Savings from avoided emissions generated through incineration	External	Diversion
Benefit	Savings from avoided pollution tax for incineration (TGAP)	Internal	Diversion
Benefit	Savings from avoided pollution tax for landfill of ash residue (TGAP)	Internal	Diversion
Cost	Cost of waste management (collection & transport)	Internal	Status quo
Cost	Cost of waste management (incineration)	Internal	Status quo
Cost	Cost of waste management (landfilling of ash residue)	Internal	Status quo
Cost	Costs from emissions generated through incineration	External	Status quo

CATEGORY	INDICATOR DESCRIPTION	TYPE	SCENARIO
Cost	Costs from pollution tax for incineration (TGAP)	Internal	Status quo
Cost	Costs from pollution tax for landfill of ash residue (TGAP)	Internal	Status quo
Cost	Cost to establish community composting (capital cost)	Internal	Diversion
Cost	Costs to operate community composting (operational costs)	Internal	Diversion
Cost	Cost of emissions generated from composting (establishment & end of life)	Internal	Diversion
Cost	Cost of emissions generated from composting	External	Diversion
Cost	Lost sales of electricity produced through incineration	Internal	Diversion
Cost	Lost sales of heat produced through incineration	Internal	Diversion

Key assumptions and data

The key assumptions, along with the relevant key data that has been utilised, are presented below.

Timeframes and operational days

The timeframe for the CBA is 5 years, from 2025-2029. Since collection and treatment of residual waste occurs daily during the week, the number of operational weeks is 52 weeks per year.

Interest and inflation rates

A real discount rate is used in this study, which excludes inflation. The discount rate is calculated by subtracting inflation from the prime interest rate for commercial banks as of December 2025 at 3.65%. With average inflation projected over the next 5 years at 1.73% per annum, the discount rate was calculated as 1.92%. It is assumed that there is no change in the prime interest during the timeframe of the project. The sensitivity analysis tests a 1% lower and 1% higher discount rate.

Inflation is calculated as an average of the expected inflation rate for France from 2025-2029 as per Statista data.[19] Real costs and benefits are used (i.e. not adjusted for inflation) and as such, remain constant over the 2025-2029 period.

Food waste disposed of and diverted

The amount of food waste as part of the residual waste stream is calculated using available data from the Bordeaux Metropole's Waste Prevention and Management Department's 2025 annual report[20]. This is calculated using two approaches, and the average value is used for the purposes of the study. The first approach uses the percentage of residual waste that is considered to be 'putrescible' food waste (that is, able to decay), of 32.8%, which is 57,071 tonnes annually, while the second approach uses the amount of food waste per person of 70.9 kilograms per inhabitant per year, which is 58,995 tonnes annually. As such, an average value of these two amounts is used, at 58,013 tonnes per annum.

To calculate the relevant amount of food waste as part of the residual waste stream in the outer-ring area specifically, this is done by applying the percentage of the population residing in the outer-ring area to the total amount of food waste disposed of in the residual stream, resulting in a total of **17,867 tonnes per annum**.

Community composting sites

In 2025, 100 community composting sites were established, while a further 300 sites are planned for 2026, resulting in a total of 400 sites in the outer-ring area. For the purposes of this study, it is assumed that all sites would have been established by the start of 2026, and between 2027-2029, no new sites are established. Costs and benefits directly related to the establishment of the composting sites are distributed across the timeframe in accordance with the proportion of sites established.

The 400 community composting sites are used to define the scope of the study. Although there are approximately 256,100 households in the outer-ring area, the study will only consider the households that are serviced by the 400 community sites. The Bordeaux Metropole team estimates that each community composting site serves approximately 50 households, and as such, the community composting initiative will serve 20,000 households (about 15% of the total population in the outer-ring area).

Another key assumption is that, although household composting is active in the outer-ring area (as the other key strategy for the Bordeaux Metropole, along with community composting sites), the 20,000 households that are the focus of the study will all be within multi-family housing that do not do home composting.

[19] Statista (2025), *Average inflation rate in France from 1980 to 2031*.
[20] Bordeaux Metropole (2025), *Stratégie déchets: Bilan d'étape et perspectives*.

As per the INSEE,[21] the average number of inhabitants per household in France is 1.97. Given the average amount of food waste generated per person per week in Bordeaux Metropole of 1.36 kilograms (70.8 kilograms per year), the amount of food waste per household per week is 2.69 kilograms. Based on the assumption that 65% of households currently utilise the composting sites to dispose of their food waste, 1,815 tonnes of food waste is diverted via the community composting sites annually (once all 400 sites have been established in 2026). In this baseline scenario, this is approximately 10% of the total food waste that is currently disposed of as residual waste by households in the outer-ring study area. The sensitivity analysis will consider two additional scenarios: one in which only 50% of the households participate and the other where 80% of the households participate.

Chipped garden waste (i.e. brown material) is added to food waste to generate compost within the composting containers. Based on the Bordeaux Metropole team, this is being added at a ratio of 1:1: for every kilogram of food waste that is added, 1 kilogram of chipped garden waste is added. This calculation is based on feedback and evidence from Bordeaux Metropole staff. To determine the amount of compost produced, it is estimated that the organic and food waste is reduced by 50% during the maturation phase.

The site establishment costs for the community composting sites were provided by the Bordeaux Metropole team. These include manufacturing of the compost containers with associated equipment (e.g. garden claws), site monitoring costs paid to the service provider for one visit to each site per week, the cost of two deliveries of brown material to each site per year, and the human resource costs of the Bordeaux Metropole team required to oversee implementation and operation of the community composting initiative.

Waste management costs

The collection and transport of residual waste, as well as the cost of incinerating it, are the main waste management costs in the status quo scenario, and represent a saving when avoided in the diversion alternative. The cost per tonne of collection and transport of residual waste, and the cost per tonne of incineration of residual waste, was provided by the Bordeaux Metropole based on internal calculations related to the total cost of waste management divided by the total tonnage of waste collected and disposed. **This is 214€ per tonne for collection and transport, and 56.70€ per tonne for incineration, totalling 270€ per tonne**. This is applied to the amount of food waste that is diverted to community composting to determine the cost of waste management when the food waste in the residual waste stream is sent to incineration, or the savings from avoiding the waste management costs when diverting waste to composting. However, since in practice, the collection frequency and/or rerouting of collection vehicles would not be reduced proportionally (as only 10% of food waste would be diverted to community composting), this will be tested in the sensitivity analysis using a reduced collection and transport cost per tonne of waste.

[21] INSEE (2026).

The cost of disposing of the ash produced from incineration is a cost in the status quo, and represents a saving in the diversion alternative. The amount of ash generated per tonne of residual waste incinerated is calculated as the average of the two incinerators, and then applied to the amount of food waste diverted to community composting. An average landfill gate fee for France, as per Waste Watchers,[22] 68€ per tonne is used to calculate the cost of disposal of ash from the incineration of food waste contained in the residual waste stream, or the savings from avoiding this ash generation when diverting waste to composting.

Savings and lost revenue from treatment

Electricity and thermal heat is generated from the incineration of food waste as part of the residual waste stream. The energy that is sold is a benefit in the status quo scenario, while the lost sale when food waste is diverted from incineration is a cost in the diversion alternative. The total amount of electricity and thermal heat generated at each of the two incinerators that serve the Bordeaux Metropole was divided by the total tonnage of residual waste treated at each incinerator in 2024 to arrive at the kilowatt-hours (kWh) per tonne. An average of the two values was then applied to the price of electricity and thermal heat per kWh. The price of electricity was determined by dividing the revenue from electricity sold by the amount of electricity sold (resulting in a price of 0.20€ per kWh), while the price of thermal heat was provided by the Bordeaux Metropole team (20€ per MWh or 0.02€ per kWh). Since the thermal energy production yield for the two incinerators varies widely, the sensitivity analysis will test both the low and high values.

The compost that is produced represents a saving for residents in the diversion alternative. This is however a 'potential' saving rather than a 'realised' or actual saving, since there is no monetary exchange for the compost produced. As such, the 'potential' savings that households could achieve by using compost produced from their food waste instead of purchasing commercially produced compost is included in the model. A price of 260€ per tonne is used as the price of compost, which is the price excluding VAT calculated per tonne of compost based on a market price of €5.20 per 20-kilogram bag. The sensitivity analysis will test a lower price of compost.

Pollution tax costs and savings

General Tax on Polluting Activities (TGAP) is levied on each tonne of waste disposed of via incineration or landfill. Within the status quo, TGAP for incineration of 15€ per tonne is levied on waste sent to incineration as per the category 'Authorised installations achieving high energy recovery with an energy efficiency greater than or equal to 0.65 (C)'.[23] This will increase by 1€ per tonne per year[24] from 2026 onwards. Additionally, TGAP is applied to the residual ash remaining after incineration that is sent to landfill. A value of 65€ per tonne is

[22] Waste Watchers (n.d.), *How industries transform waste into resources*.
[23] Entreprendre (2025), *Taxe générale sur les activités polluantes (TGAP)*.
[24] Dechets Infos (2026), *TGAP : le calendrier 2026-2030 est fixé*.

applied, which is the average cost per tonne for France.[25] This will increase by 4€ per tonne per year[26] from 2026 onwards.

External costs and benefits

Emissions are generated during the incineration of waste, during the manufacture, transport and end-of-life disposal of the compost containers, and during the composting process. In addition, emissions are avoided during the production of compost. Emissions are measured as carbon dioxide equivalent (CO_2e) based on specific emissions factors for each activity. In the status quo scenario, emissions generated during incineration are a cost. An average emissions factor of 1.12 tonnes CO_2e per tonne of waste for France is used.[27]

In the diversion alternative, emissions from the manufacture, transport and end-of-life disposal of the compost containers and emissions generated during the compost production process, are a cost. Emissions avoided from waste diverted from incineration and from the use of compost as a natural amendment to the soil are both benefits in the diversion alternative . Emissions factors were provided by the Bordeaux Metropole team.

The total emissions for each of these indicators (tonnes CO_2e) was applied to the carbon tax in France in 2025 of 44.60€ per tonne CO_2e[28] to arrive at the relevant cost or benefit.

Finally, the European Union has adopted a reform requiring municipal waste incinerators to monitor their emissions under the EU Emissions Trading System (EU ETS), with a decision on their full inclusion to follow (July 2026) with the potential inclusion from 2028. Therefore, in our model, ETS fees are only applied from 2028, covering the last two years. A price of 108€ per tonne of CO_2e is applied, and the FBC Scenario is used (which relates to both fossil and biogenic carbon, since both organic and non-renewable materials are incinerated). This results in an additional 106.92€ per tonne of waste sent for incineration, which is a cost in the status quo and a saving in the diversion alternative.

[25] Ficha (2023), *TGAP in 2023: operation, calculation and challenges*.
[26] Dechets Infos (2026), *TGAP : le calendrier 2026-2030 est fixé*.
[27] CE Delft (2025) *Waste Incineration under the EU ETS: An assessment of climate benefits*.
[28] Tax Foundation (2025), *Carbon Taxes in Europe, 2025*.

Results of the study

Costs and benefits

The results of the CBA model are presented in Table 2 and Table 3 below. This includes the sum of the present value of all future costs and benefits and the same value per tonne of waste. The latter is calculated by dividing the total costs and benefits over 5 years by the total tonnes of food waste either sent to incineration or diverted over the same period.

Table 2: Sum of total and discounted benefits and costs per tonne over the 5-year timeframe for the status quo

STATUS QUO SCENARIO	TOTAL VALUE	TOTAL PER TONNE OF FOOD WASTE
Benefits	**€514,550.21**	**€66.68**
Sale of electricity produced through incineration	€443,243.40	€57.44
Sale of heat produced through incineration	€71,306.81	€9.24
Costs	**€2,925,513.45**	**€379.10**
Cost of waste management (collection & transport)	€1,579,445.63	€204.67
Cost of waste management (incineration)	€418,479.29	€54.23
Cost of waste management (landfilling of ash residue)	€9,611.00	€1.25
Costs from pollution tax for incineration (TGAP)	€127,860.44	€16.57
Costs from pollution tax for landfill of ash residue (TGAP)	€10,500.80	€1.36
Costs from EU ETS (FBC scenario, from 2028)	€410,941.21	€53.25
Costs from emissions generated through incineration	€368,675.08	€47.77

Within the status quo scenario, the main benefits are those generated from the sale of electricity from waste incinerated. The cost of collection and transport of waste is the main cost driver, as well as the cost of incineration, the cost of EU ETS (although only for a 2-year period), and the cost of emissions generated through incineration.

Within the diversion alternative, the main benefits are the savings from compost produced and from avoided collection and transport costs of the waste diverted from incineration. In addition, the savings from avoided EU

ETS costs (although only for a 2-year period) and from avoided emission costs from incineration also contribute to the total benefits. The cost of operating the community composting sites is the biggest cost factor, driven largely by the price paid to the service provider for site visits, as well as the cost to purchase brown material and human resource costs. Additionally, lost sales of electricity due to waste being diverted from incineration is a significant driver of cost in the diversion alternative.

Table 3: Sum of total and discounted benefits and costs per tonne over the 5-year timeframe for the diversion alternative

DIVERSION ALTERNATIVE	TOTAL VALUE	TOTAL PER TONNE OF FOOD WASTE
Benefits	**€4,907,009.18**	**€635.88**
Savings from compost produced	€1,918,952.63	€248.67
Savings from avoided waste management costs (collection & transport)	€1,579,445.63	€204.67
Savings from avoided waste management costs (incineration)	€418,479.29	€54.23
Savings from avoided waste management costs (landfill of ash residue)	€9,611.00	€1.25
Savings from avoided pollution tax for incineration (TGAP)	€127,860.44	€16.57
Savings from avoided pollution tax for landfill of ash residue (TGAP)	€10,500.80	€1.36
Savings from avoided EU ETS costs (FBC scenario)	€410,941.21	€53.25
Savings from avoided emissions generated through incineration	€62,543.09	€47.77
Savings from avoided emissions from compost produced	€368,675.08	€8.10
Costs	**€4,713,413.42**	**€610.79**
Cost to establish community composting (capital cost)	€328,955.41	€42.63
Costs to operate community composting (operational costs)	€3,863,951.27	€500.71
Lost sales of electricity produced through incineration	€443,243.40	€57.44
Lost sales of heat produced through incineration	€71,306.81	€9.24

DIVERSION ALTERNATIVE	TOTAL VALUE	TOTAL PER TONNE OF FOOD WASTE
Cost of emissions generated from composting (establishment & end of life)	€655.66	€0.08
Cost of emissions generated from composting (annual)	€5,300.87	€0.69

Net Present Value

NPV is a metric used to calculate the difference between the *current value of all future benefits* and the *current value of all future costs*. By converting all future cash flows into current values, and applying a discount rate (in this study, 1.92%), and subtracting total costs from total benefits, you arrive at either a net cost or net benefit. The net present value (NPV) for each scenario is presented in Table 4. Again, this is provided both as total value over the 5-year period and total value per tonne of waste.

The results indicate that within the status quo scenario, where food waste is being sent for incineration, the costs far outweigh the benefits, leading to a total NPV of -2,4€ million or -312€ per tonne of food waste over the 5-year period. Within the diversion alternative, where this waste is being diverted into community composting, the benefits outweigh the costs, leading to an NPV of 193,595€ or 25€ per tonne of food waste over the 5-year period. As such, even though the costs in the diversion alternative are more than 1.5 times that of the status quo, the overall benefits generated are substantially greater and results in a positive NPV in the diversion alternative.

Table 4: Net present value for the status quo and diversion alternative

NET PRESENT VALUE (NPV)	STATUS QUO		DIVERSION ALTERNATIVE	
Total costs and benefits	**Total value**	**Total per tonne of food waste**	**Total value**	**Total per tonne of food waste**
Sum of total benefits	€514,550.21	€66.68	€4,907,009.18	€635.88
Sum of total costs	€2,925,513.45	€379.10	€4,713,413.42	€610.79
NPV	**-€2,410,963.25**	**-€312.43**	**€193,595.76**	**€25.09**

Sensitivity analysis

A sensitivity analysis was performed to test the impact of changes in a few variables on the NPV in each scenario. The following variables were adjusted:

- Both a lower (50%) and higher (80%) household participation rate are used, representing a decrease and increase in participation of 15% from the baseline.
- A lower saving from avoided collection and transport costs per tonne (60% reduction) for waste diverted is tested. This is because collection and transport costs are unlikely to reduce proportionately with the reduction of waste, as certain fixed costs will remain in the short-to-medium term regardless of the marginal reduction in waste being collected.
- A lower cost and higher cost of monitoring the composting sites are used (both a 20% reduction and 20% increase from the current cost).
- The average incineration cost in France of 105€ per tonne is tested against the current price (56.70€ per tonne), which is not considered to be a true reflection of the cost of incineration.
- The average pollution tax for incineration in France of 25€ per tonne is tested against the current tax rate being paid in the Bordeaux Metropole of 15€ per tonne.
- A lower (220€) price of compost is tested against the baseline value of 260€ per tonne, which reflects a 1€ drop in price of compost (including VAT) from 6.50€ per 20kg bag to 5.50€ per 20kg bag.
- A lower (160 kWh/tonne) and higher (805 kWh/tonne) thermal heat energy production yield is tested, since the range between the two incinerators is broad.
- A discount rate of 1% lower and 1% higher than the baseline is tested.

The results of the sensitivity analysis are presented in Table 5 below. The variables that have the most impact on the results of the diversion alternative are changes in the participation rate of households and a reduction in the cost of site monitoring.

Table 5: Results of the sensitivity analysis

SENSITIVITY ANALYSIS	STATUS QUO		DIVERSION ALTERNATIVE	
Participation rate	**Total**	**Total per tonne FW**	**Total**	**Total per tonne FW**
Baseline (65% participation)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
Lower (50% participation)	-€1,854,587.11	-€312.43	-€820,048.62	-€138.15
Higher (80% participation)	-€2,967,339.38	-€312.43	€1,207,240.14	€127.11

SENSITIVITY ANALYSIS	STATUS QUO		DIVERSION ALTERNATIVE	
Savings in collection and transport costs	**Total**	**Total per tonne FW**	**Total**	**Total per tonne FW**
Baseline (214€ per tonne)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
Lower (60% reduction, 85.60€ per tonne)	-€1,463,295.87	-€189.62	-€754,071.62	-€97.72
Cost of site monitoring	**Total**	**Total per tonne FW**	**Total**	**Total per tonne FW**
Baseline (50€)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
Lower (20% reduction, 40€)	-€2,410,963.25	-€312.43	€840,698.59	€108.94
Higher (20% increase, 60€)	-€2,410,963.25	-€312.43	-€453,507.07	-€58.77
Incineration costs	**Total**	**Total per tonne FW**	**Total**	**Total per tonne FW**
Baseline (56.70€ per tonne)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
French average (105€ per tonne)	-€2,767,445.60	-€358.62	€550,078.12	€71.28
Pollution tax for incineration	**Total**	**Total per tonne FW**	**Total**	**Total per tonne FW**
Baseline (15€ per tonne, 2025)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
French average (25€ per tonne)	-€2,484,769.12	-€321.99	€267,401.63	€34.65
Compost sale price	**Total**	**Total per tonne FW**	**Total**	**Total per tonne FW**
Baseline (260€ per tonne)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
Lower (220€ per tonne)	-€2,410,963.25	-€312.43	-€101,627.72	-€13.17
Thermal heat energy yield	**Total**	**Total per tonne FW**	**Total**	**Total per tonne FW**
Baseline (483 kWh per tonne)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
Lower (160 kWh per tonne)	-€2,458,613.34	-€318.60	€241,245.86	€31.26
Higher (805 kWh per tonne)	-€2,363,313.15	-€306.25	€145,945.66	€18.91

SENSITIVITY ANALYSIS	STATUS QUO		DIVERSION ALTERNATIVE	
Discount rate	Total	Total per tonne FW	Total	Total per tonne FW
Baseline (1.92%)	-€2,410,963.25	-€312.43	€193,595.76	€25.09
Lower (0.92%)	-€2,472,006.25	-€320.34	€211,471.75	€27.40
Higher (2.92%)	-€2,352,339.80	-€304.83	€176,529.83	€22.88

When participation declines to only 50% of households, the diversion alternative generates a net cost of -138€ per tonne. This indicates that participation is critical to ensure that the project generates a net benefit rather than a net cost. When household participation increases to 80% of households, the net benefit increases even further to €127 per tonne of food waste in the diversion alternative.

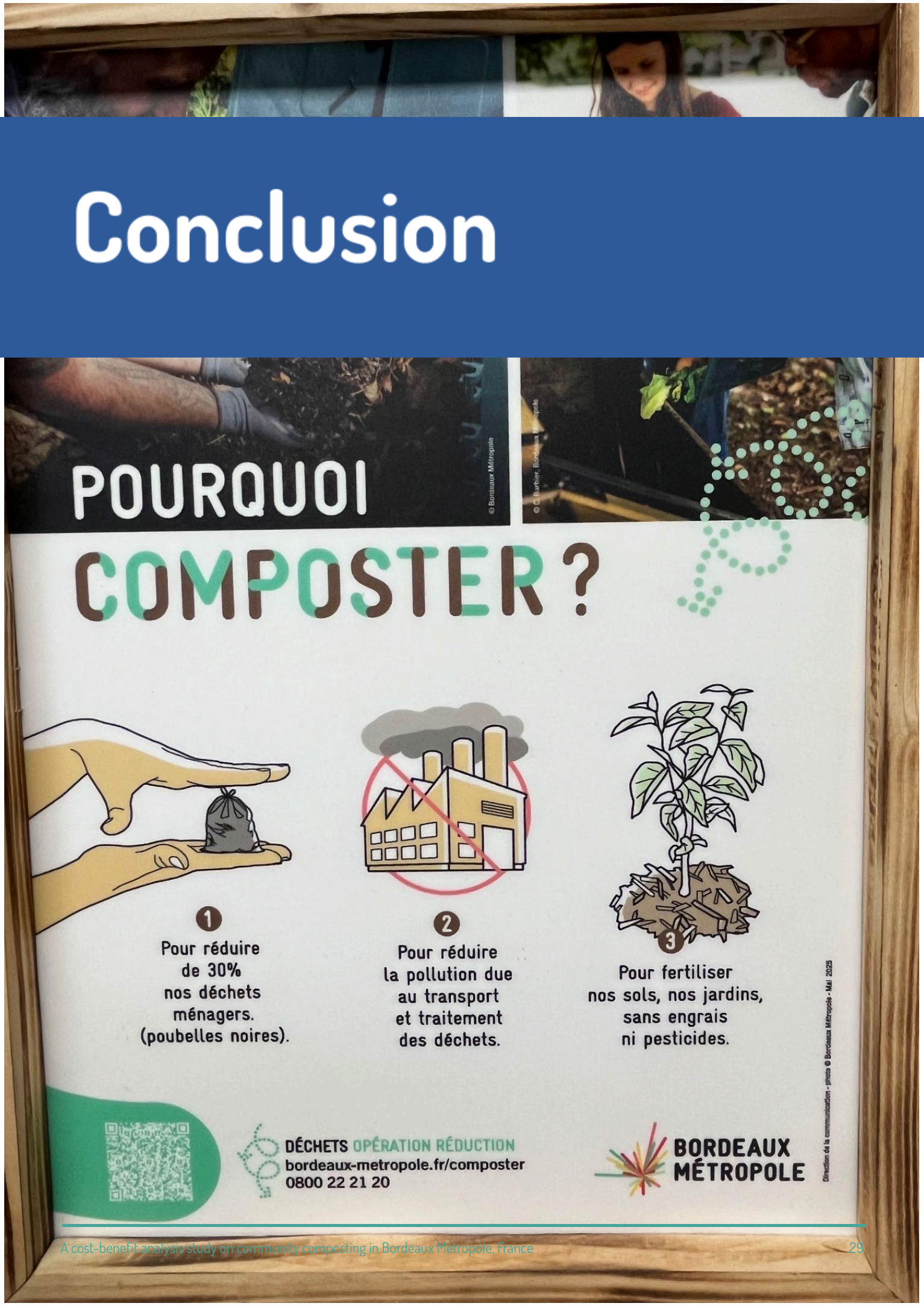
When the savings from collection and transport are reduced by 60%, to account for the fact that these costs would not reduce proportionately in line with the decline in food waste being collected (due to fixed costs remaining in the short-to-medium term), the diversion alternative generates a net cost of -97.70€ per tonne of food. This implies that for these savings to be realised, community composting would need to be replicated across the outer-ring area to an extent that actual transport and collection frequency and re-routing would be possible.

When the cost of site monitoring is reduced by 20% from its current rate (charged as one visit per site per week), the net benefit of the diversion alternative increases to 108€ per tonne of food waste, while a 20% increase in monitoring costs causes the diversion alternative to generate a net cost of -58€ per tonne of food waste. As such, the model is sensitive to changes in the cost of monitoring the community composting sites, and this should be well managed to avoid the project becoming a net cost.

The cost of incineration slightly impacts the results of both the status quo and diversion alternative, while changes in the pollution tax and the discount rate have only a marginal impact on the results of both scenarios.

Since there are potential savings for households from not having to purchase compost, the price of compost impacts the diversion alternative. A decline in the price of compost from 6.50€ to 5.50€ per 20-kilogram bag, resulting in a price of 220€ per tonne (a decrease from the baseline of 260€ per tonne), causes the diversion alternative to generate a net cost of -13€ per tonne of food waste.

Conclusion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Key findings

This study set out to determine the overall net benefit or cost of rolling out community composting sites to divert food waste, compared with the status quo, where this fraction was sent for incineration as part of the residual waste. The Bordeaux Metropole has started to establish community composting sites across the outer-ring area as a means to divert food waste from entering the residual waste stream, and ultimately avoid incineration. By 2026, 400 community composting sites will be implemented. At an estimated 65% participation rate, over 1,800 tonnes of food waste can be diverted, which accounts for approximately 10% of total food waste generated in the area of study.

The study indicates that, when compared to the incineration scenario, which has a total cost of -312€ per tonne, the community composting scenario has an overall net benefit of 25€ per tonne. **Accordingly, it would be financially beneficial for the Metropole to expand the roll-out of community composting instead of continuing to send food waste for incineration**.

When the total values over a 5-year period are discounted, the main costs in the status quo are associated with the collection and transport of waste (204€ per tonne) and the cost of incineration (54€ per tonne), while the sale of electricity and heat generated from incineration are the only benefits (67€ per tonne). The main costs associated with the composting initiative are the costs to operate the composting sites (500€ per tonne), largely driven by the fees paid to service providers to maintain the sites, while the lost sales from electricity produced due to waste being diverted from incineration are also a contributor at 57€ per tonne.

The main benefits in the diversion alternative are the savings from compost produced (248€ per tonne) and savings from avoided collection and transport costs for the waste being diverted to community composting (205€ per tonne), while savings from avoided incineration costs (54€ per tonne), savings from avoided EU ETS costs (53€ per tonne) and savings from avoided emissions from incineration (48€ per tonne) also play a substantial role.

The sensitivity analysis suggests that, should household participation decrease to 50%, the diversion alternative will generate a net cost. However, even when participation is lower than the target - 65% of households - the diversion alternative still is significantly less costly for the metropole than the status quo scenario.

As such, ensuring ongoing participation is critical. A reduction in the savings from avoided collection and transport costs also generates a net cost in the diversion alternative. This could be mitigated by ensuring broader roll-out of community compost sites (and other interventions such as household composting bins), to realise savings from reducing the frequency of collection and transport. A reduction in the cost of monitoring sites by 20% increases the total benefit significantly, but a decline by the same amount will lead to a net cost in the diversion alternative. A decline in the price of compost from 260€ to 220€ per tonne also leads to a net

cost in the diversion alternative. Increases in incineration costs and associated pollution tax only lead to an even larger net benefit overall. Changes in the discount rate do not have a significant impact on the overall results of the study.

Recommendations

This study has indicated that, compared to the status quo, diverting food waste to community composting sites generates an overall net benefit. Although it requires a greater investment per tonne of food waste, the benefits outweigh the costs in the diversion alternative. Within the status quo scenario, although the cost per tonne is lower, the costs far outweigh the benefits.

Since the waste management hierarchy prioritises decentralised composting over incineration, and community composting has a net benefit, it is recommended that diversion into community composting continue to be pursued as a key strategy of the Bordeaux Metropole. In addition to the benefits identified in this study, there are other benefits that are generated from community composting initiatives that cannot easily be quantified. These include building social connections and relationships within the community, supporting food security and improving local soil health, as well as creating greater awareness and education to support collective climate action.

Furthermore, it is recommended that the household participation rate be increased as a means to further increase the net benefit. This can be done through enhanced awareness among participating households, or ideally also by enforcing food waste diversion via changes in policy. The roll-out of additional community composting to cover a greater share of the outer-ring household population would also ensure that the potential savings from avoided collection and transport costs can be realised. Finally, since the cost of the service provider to manage the composting sites is the largest single cost driver, any efficiencies in this process would go a long way toward reducing the overall cost and increasing the net benefit.

In conclusion, a combination of reducing the cost of site monitoring, increasing participation in the initiative, and expanding the roll-out of sites across the outer-ring area, along with any other changes (such as an increase in the cost of incineration), would ensure an even greater overall benefit and long-term sustainability for Bordeaux Metropole.

Zero Waste Europe (ZWE) is the European network of communities, local leaders, experts, and change agents working towards a better use of resources and the elimination of waste in our society. We advocate for sustainable systems; for the redesign of our relationship with resources; and for a global shift towards environmental justice, accelerating a just transition towards zero waste for the benefit of people and the planet. www.zerowasteeurope.eu

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