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## Deliverable D6.3

# Set of criteria for the selection of locations where the Decision Support Tool could be applied

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# DECISIVE

A DECENTRALISED MANAGEMENT SCHEME FOR  
INNOVATIVE VALORISATION OF URBAN BIOWASTE



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# A Decentralised Management Scheme for Innovative Valorisation of Urban Biowaste

## D6.3 - Set of criteria for the selection of locations where the Decision Support Tool could be applied

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### ABSTRACT

This report defines a set of criteria for the selection of locations where the methodology (the DST) could be implemented as a test to plan a decentralized valorisation system for urban biowaste and based on those criteria gives a draft list of potential locations to verify the DST potentialities.

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## ABBREVIATIONS AND ACRONYMS

AD	Anaerobic Digestion
DECISIVE	DECentralised management Scheme for Innovative Valorisation of urban biowastE
CAPEX	Capital Expenses
DST	Decision Support Tool
DtD	Door to Door
GA	General Assembly
GrA	Grant Agreement
MBT	Mechanical Biological Treatment
OPEX	Operational Expenditures
WtE	Waste to Energy

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# Table of content



<b>Preface</b> .....	6
<b>Executive Summary</b> .....	7
<b>1. Introduction</b> .....	8
<b>2. Methodology</b> .....	9
2.1 Definition of selection criteria.....	9
2.2 Identification of potential theoretical sites .....	13
<b>3. Results</b> .....	16
3.1 Set of criteria to choose the potential theoretical sites .....	16
3.2 List of potential theoretical locations.....	17
<b>4. Conclusions and limitations</b> .....	21
<b>Annex A1</b> .....	23
<b>References</b> .....	29

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## Preface

The present deliverable D6.3 is the third, after the [D6.1](#) and [D6.2](#), foreseen within the DECISIVE project work package “selection of locations and associated incentives for demonstration implementation of the DECISIVE system”. This report is meant to determine a set of criteria for the selection of the potential sites where the DECISIVE Decision Support Tool (DST) from the previous deliverables [D5.1](#), [D5.2](#) and [D5.3](#) could be applied as planning methodology of decentralized biowaste management. As matter of fact, the aim of the DST is providing a first assessment (by using specific indicators) of decentralized systems for valorization of municipal biowaste in comparison with other treatment options in urban areas.

Based on the potential list of locations obtained by applying the selection criteria, a definitive one, made of the 10 theoretical “tested” sites, as they were named in the GrA (Grant Agreement), will be decided in the next stage. Such final set of 10 locations will be finally used to test the DST and its capacities to characterize impacts and opportunities of different waste management schemes. The application of the DST to different case studies (the two demonstrations sites of the project and a set of theoretical sites) is beyond the scope of this report as this activity will be included in forthcoming deliverable [D6.4](#) - *Report on the simulation of the implementation of the methodology in different types of locations* (to be submitted within June 2020).

# Executive Summary

Overall, the objective of this deliverable is twofold: 1) to define a set of criteria to select the sites where to test the DST and, based on these criteria, 2) to develop a provisional list of sites from which 10 locations will be chosen to test the DST.

The methodology used to determine the selection criteria and obtain a provisional list of “theoretical” sites where to apply the DST is mainly based on a participatory process during which DECISIVE Consortium Partners were involved.

A classification of selection criteria was identified and proposed to the Consortium. A list of 7 relevant fields was defined and starting from each field the specific set of criteria was discussed with all partners. The selection criteria encompassed the following aspects: i) geographic location, ii) data input availability, iii) scale of analysis, iv) economic diversity, v) biowaste input, vi) logistic-transportation, vii) sub-products use and viii) local legal constraints.

It is important to underline that the purpose of the presented site selection criteria is to identify as many diverse cases of biowaste generation and management systems as possible to account for the differences among them and not to select the most suitable sites for the DECISIVE scheme. If some of the locations identified here seem appropriate to implement successfully the DECISIVE solution, this will be verified by testing the DST in the next stage of the project (D6.4).

To test the DST in a specific site means: i) building the baseline scenario related to the biowaste management system existing in that area and ii) comparing it with the DECISIVE system implementation (alternative scenario). The creation of both current and alternative biowaste management scenarios implies compiling inventories for each waste process of the entire chains. Due to the large amount of data required to build these libraries in the DST, Consortium Partners agreed that data availability was the main criteria to consider when selecting the locations where to test the DST. Besides availability of local data, to prove the efficacy of the DST and show its flexibility and capacity to properly characterize different contexts, the chosen sites should be heterogeneous in geographic, economic and demographic terms.

As a result of the application of the identified set of criteria, a list of candidate theoretical locations is given in this report. The proposed sites cover the following countries: Spain, Germany, Italy, Denmark, Belgium and France and the list achieved 18 places. Among them a selection of 10 final locations will be done in a later stage of the project and it will be included in the deliverable D6.4 for the test of the DST. The lack of standardized datasets that properly describe biowaste management systems at local scale has been identified as an important limitation that will be encountered when gathering the data related to the selected sites. Special effort will be dedicated to the collection of real local data to ensure the reliability of the results obtained with the application of the DST.

# 1. Introduction

The DECISIVE project aims at developing and demonstrating eco-innovative solutions to valorise municipal biowaste. The partners of the Consortium developed a Decision Support Tool to assess the performance of biowaste management options (centralized or decentralized systems) in a specific area (e.g. municipality or district of a city). To evaluate the performance of each biowaste management option, the tool uses various assessment criteria including environmental, economic and social aspects. The results obtained with the tool will facilitate the comparison between different biowaste management solutions and among them the three eco-designed decentralised technologies proposed by DECISIVE: 1) micro-scale Anaerobic Digestion (mAD), 2) Stirling Engine (SE) and 3) Solid-State Fermentation (SSF). Besides the two demonstration sites (that will be located in Lyon (France) and in Catalonia (Spain)) the project also includes the theoretical testing of these eco-innovative solutions in 10 locations by applying the DST.

In this report a set of criteria will be identified in order to obtain a list of candidate sites from which 10 locations will be finally chosen for testing the DST in the deliverable [D6.4](#).

It is important to underline that the selection criteria proposed here will be used only to achieve a list of provisional sites chosen independently from their real suitability for the DECISIVE technologies. The purpose of the criteria set is indeed to select as many diverse cases of biowaste generation and management as possible to underline the differences among them. Only in the deliverable D6.4 by comparing the current and the innovative scenario, the suitability of the theoretical DECISIVE systems implementation will be assessed by using the DST. Results from D6.4 will be used to derive a set of considerations that could suggest which “ideal” profiles could typically be better served by the DECISIVE scheme and that can be used in the future in order to choose appropriate locations where the new management system of biowaste can be implemented successfully. Nevertheless, the DST has been projected to be used also for testing the suitability of other management solutions or simply to make a diagnosis of the current biowaste management in a specific place.

The criteria to select the sites for testing the DST have been defined upon discussions and considerations coming from previous stages of the project (Deliverables: [D3.7](#), [D5.1](#), [D.6.1](#)) and from consultations with Consortium Partners. One of the main findings of the work carried out until now was the identification of the crucial role of accuracy and type of the dataset (characteristics related to the different phases of existing biowaste management systems, sources of biowaste, quality of selected biowaste) required to apply the DST in a specific location. Data availability will be indeed the main criteria to consider when looking for potential sites to test the DST but also other criteria have been defined as relevant in order to draft a list of *candidate theoretical sites*.

Overall, the objective of this deliverable is twofold: 1) to define a set of selection criteria and, based on the initial list of total criteria, and 2) to develop a list of candidate sites from which the theoretical locations to test the DST will be chosen and later on applied. In the following sections, for each objective we reported the methodology and the results together with conclusions and indications concerning the limitations of the analysis that has been conducted.

## 2. Methodology

The selection process of the candidate sites where to test the DST consisted of two steps: (1) to determine site selection criteria; and (2) to develop the list of candidate sites and supporting information. Both steps counted on inputs coming from Consortium Partners' consultations. The presented methodology was developed adapting an existing example in literature (EPA, 2011) to the particular context of DECISIVE project and will result in the selection of a list of provisional sites, while the list of the definitive theoretical sites will be defined in the forthcoming [D6.4](#), as shown in [Figure 1](#).

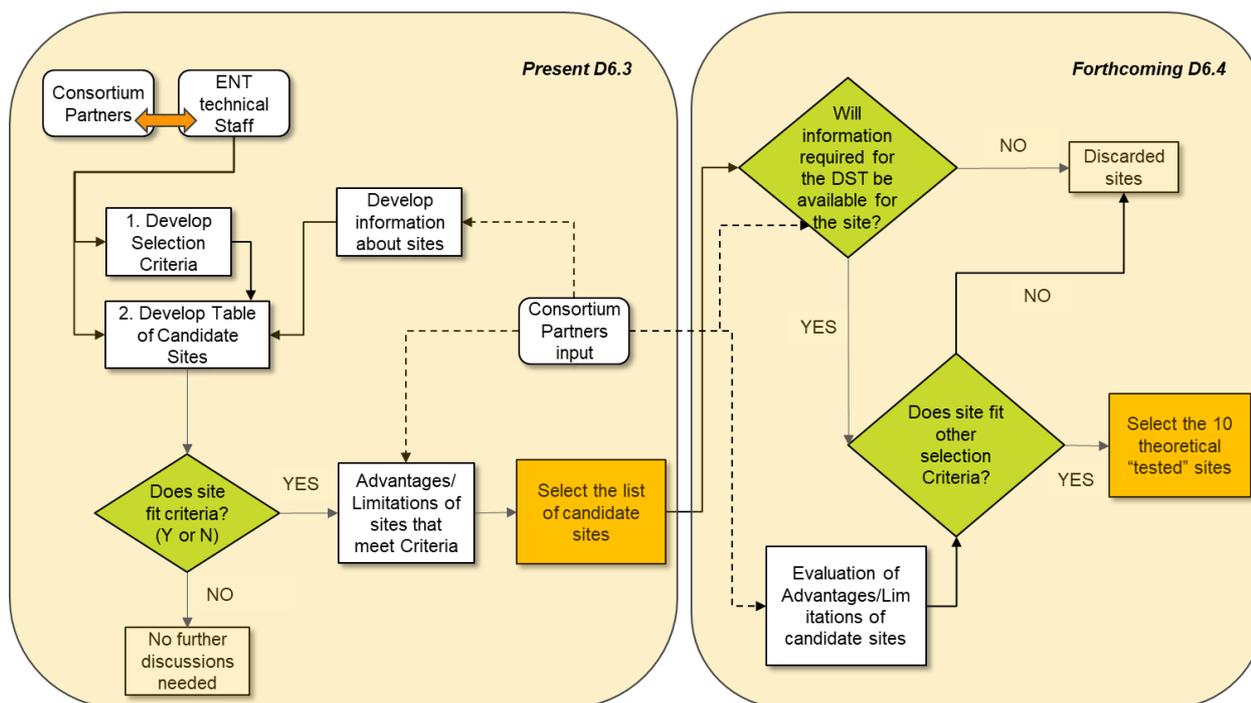


Figure 1 – Decision sites selection process schematic

### 2.1 DEFINITION OF SELECTION CRITERIA

The set of criteria used to choose the provisional locations for testing the application of the DST were based on:

1. Findings discovered during the development of the finalized and on-going deliverables.
2. Consortium Partners' consultations done during the DECISIVE General Assemblies (GA) of April 2018 and October 2018 in Barcelona (Spain) and Trieste (Italy), respectively, and related follow up.
3. Interviews with stakeholders carried out for the deliverable [D3.7](#) where some site selection criteria relevant for social actors were identified.

A first set of site selection criteria was presented in the deliverable D6.1 but in that case the goal was looking for a place where to implement the DECISIVE demonstration pilot in Catalonia. The bilateral connection between the criteria to select the specific technologies for mAD, SE and SSF and the site selection criteria was considered for choosing a place where to install an innovative system. Viability, desirability and potential were the three concepts grouping the selection criteria to select the Catalan demonstration site ([Table 1](#)).

Table 1 – Criteria defined in the D6.1 to select the Catalan demonstration sites

Viability Criteria	
Biowaste input	Type of generation sources (households/commercials)
	Available amount of biowaste in the selected area
	Agreements of biowaste supply
Logistic Transportation	Proximity to waste generators
	Proximity to peri-farms area (to avoid cost of digestate use)
	Logistic of routes and morphology of territory
Technology	Maximum amount and quality of biowaste input
	Biophysical requirements (energy, fuel, water, space, water)
	Costs (fixed and operational)
	Efficiency of Biogas production
Use of products	Digestate treatment cost responsibility
	Quality of produced digestate
	Availability (budget and space) to treat digestate
	Surplus of thermal energy and electricity
Legislation	Regulation limitations & permits
Desirability Criteria	
Institutional constraints and incentives	Availability of incentives
	Acceptance of population, NIMBY effect
	Sensibility to waste management issue
Potential Criteria	
Demonstration potential	Replicability
	Transferability

The viability group included criteria concerning technical, economic, environmental and legal constraints encountered when deciding the demonstration site where implementing the DECISIVE technologies in Catalonia. Desirability involved criteria of social compatibility linked to the consistency of the project with local institutional strategies, legislation and social values. Potential criteria referred to the demonstration potentiality of the project due to its replicability and transferability to another place with the same characteristics or another place that displays different conditions, respectively.

Some of the criteria defined in the D6.1 can also be, upon adaptation, used for identifying the site selection criteria required in this report. For this purpose, among the list presented in Table 1 only viability criteria have been considered valid leaving aside desirability and potential criteria whose assessment is considered too difficult for theoretical sites where too few elements are available during the present stage of the project.

It is worth noting that the scope of this deliverable is not determining the criteria to select the most suitable locations for DECISIVE systems but identify places to test the capacity of the DST at comparing scenarios related to biowaste generation and management systems with different characteristics.

It is fundamental at this point to understand what testing the DST in a site means:

1. Knowing demographic and geographic information in a specific area (e.g. region (NUTS<sup>1</sup> 3), municipality (LAU<sup>2</sup> 2) or district of a city (< LAU 2)).
2. Elaborating a diagnosis about the existing waste management system.
3. Building an alternative scenario by introducing a new biowaste management option (e.g. centralized vs. decentralized system).

<sup>1</sup> NUTS: Nomenclature of Territorial Units for Statistics

<sup>2</sup> LAU: Local Administrative Units

Specific information about each stage (see

Figure 2) of the biowaste management system, (biowaste generation, source separation, collection from generation sources to the first waste facility, pre-treatment, treatment, final disposal, bio-based products use as well as transportation between the different waste facilities), needs to be gathered in inventories/libraries that are the core of the DST. For the description of each stage of the biowaste management system considered in the DST see the deliverable [D5.1](#).

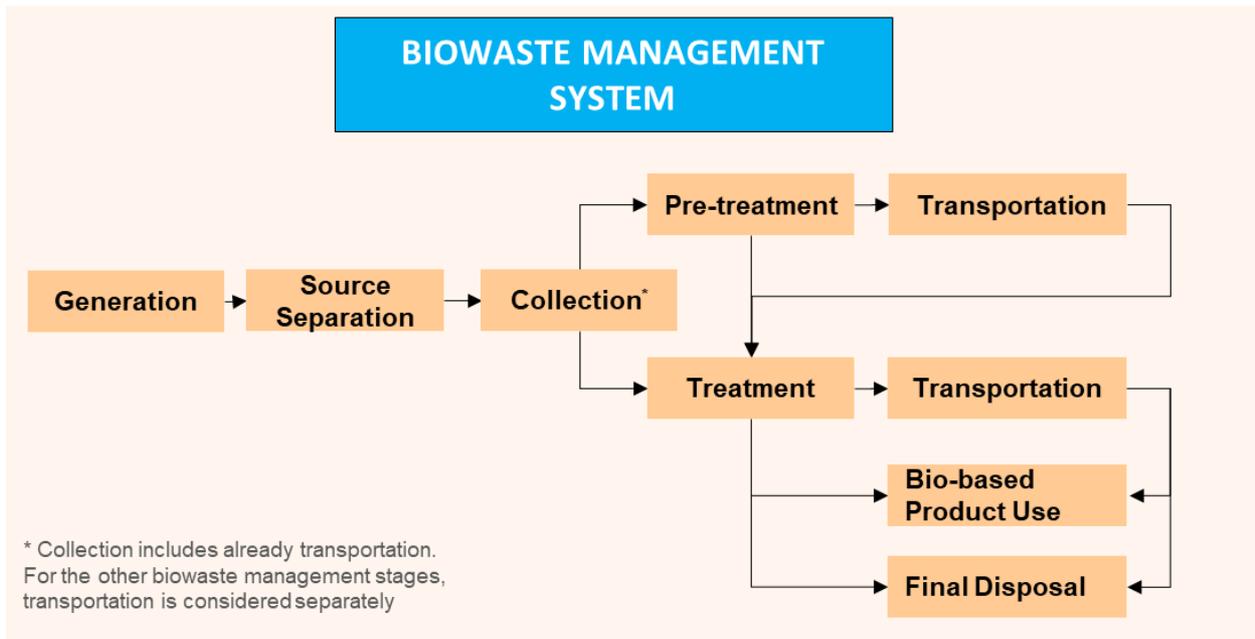


Figure 2 - Phases of biowaste management system considered in the DST

The following data need to be accounted for the specific case to study in the DST:

- Quantity and quality of biowaste generated.
- Impurities (micro and macro) that are thrown away together with the source separated biowaste.
- Emissions released and resources consumed (e.g. electricity, fuel, machinery, etc.) within each phase of the biowaste management system.
- Economic Cost which includes CAPEX, OPEX and Revenue.
- Avoided production of the goods (e.g. material and energy) substituted by the outputs generated from the biowaste management system (i.e. bio-based products such as mineral fertilizers).

The system boundaries included in the tool are shown in Figure 3.

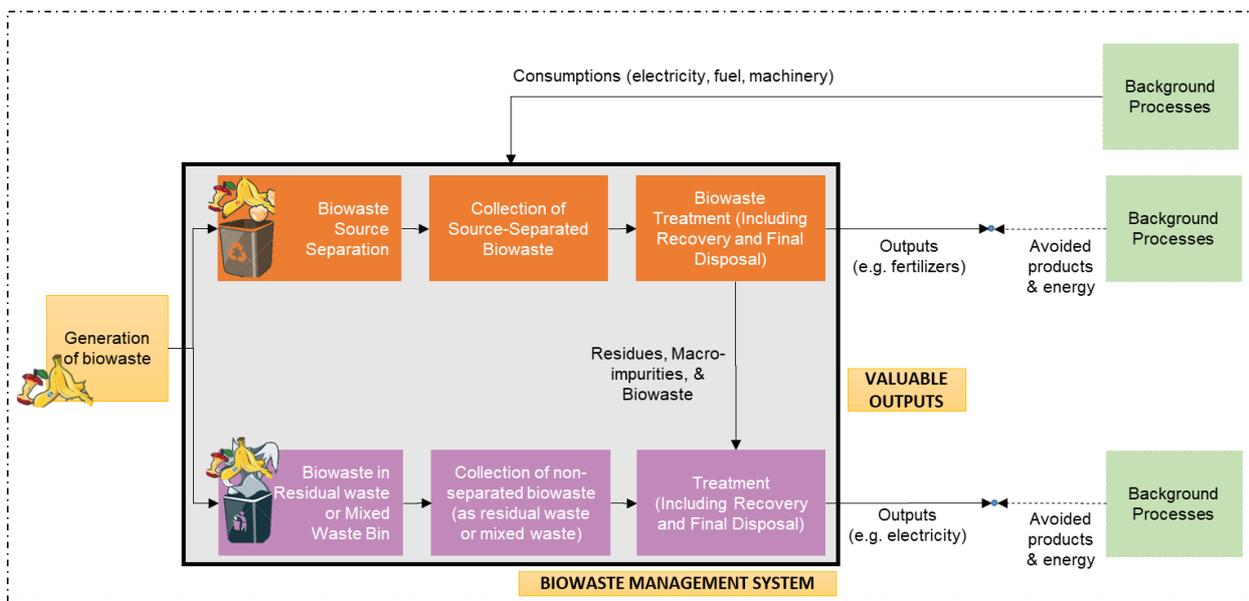


Figure 3 - System boundaries included in the DST (see [D5.1](#) for further details)

An example of the amount of data required for analysing a specific location and each stage of the current biowaste management has been reported in the Annex A1. For further details see [D5.1](#) and [D5.3](#).

Due to the large amount of data needed to build waste processes libraries in the DST, Consortium Partners agreed that data availability was the main criteria to consider when selecting the locations where to test the application of the DST.

Besides availability of local data, the chosen sites should be heterogeneous in geographic, economic and demographic terms to enable proper testing of the DST and show its flexibility and capacity to characterize different contexts. Specific aspects to which the set of selection criteria belongs were identified and proposed to the Consortium Partners during the GA of April 2018 in Barcelona for discussion.

The relevant fields confirmed were (see [Figure](#)):

- 1) Data input availability: available access to local database or existing local contact for providing data is the most relevant criteria.
- 2) Geographic location: various geographical areas in Europe (all of the countries involved in DECISIVE project);
- 3) Scale of analysis: various population densities (small vs large towns) and different type of administrative level (regional level, municipality level) or smaller level such as areas of a city;
- 4) Diversity of type sites: various economical regions (rural/peri-urban/urban/industrial areas, different income areas) and different types of architecture (historical vs. modern settlements);
- 5) Biowaste input: different type of biowaste sources generated from households, markets, hotels, hospitals, restaurants, schools, universities), amount of generated biowaste and quality of source-

- separated biowaste related to different types of collection systems;
- 6) Logistics and transportation: different localizations (short or long distances) between biowaste generation and the biowaste treatment plants;
  - 7) use of sub-products of the biowaste treatment facility: different potentialities in using generated digestate/compost and heat and power.
  - 8) Legal constraints/limits of the area to study: various permitting conditions and legislation framework related to potential mAD implementations

The choice of these aspects that will define a set of criteria to select sites to test the DST is not casual, in fact it will indicate the pros and cons in assessing the performance of different biowaste management options and among them the decentralized system of biowaste valorisation proposed by DECISIVE. Criteria fields from 1 to 4 refer to the data availability and the heterogeneity of the sites. Criteria fields from 5 to 8 are coming from the viability criteria in [Table 1](#) already identified through previous work done in the [D6.1](#), and belong to the main aspects to consider when implementing a biowaste management system.

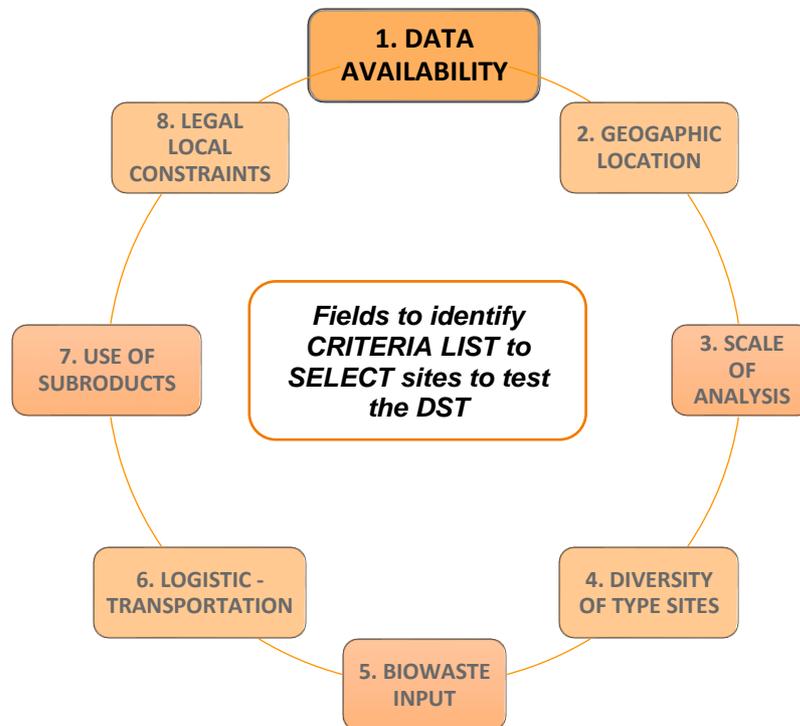


Figure 4 - Relevant fields for the identification of the set of criteria for selecting the locations where the DST will be tested.

## 2.2 IDENTIFICATION OF POTENTIAL THEORETICAL SITES

The lists of the relevant fields and a draft list of selection criteria proposed during Barcelona GA were used during the parallel working session, III-b: “Virtual demonstration of DECISIVE methodology - targeted locations”, organized in Trieste GA (Figure 5).



Figure 5- Consortium partners consultation during the DECISIVE GA of October 2018 in Trieste

In order to pass from site selection criteria to the list of potential theoretical locations, Consortium Partners were asked during the brainstorming session to identify at least 3 potential sites where data is supposed to be accessible to test the DST. To gather the outputs from this exercise, participants used the table in Figure 6 and inserted the first thoughts about potential candidate locations.

## Defining a provisional list of locations DST

- **Short exercise:**
  - ❖ Each partner will create a short list of 3 locations where those data could be available



Partner name	Person name	Provisional site	Country	Type of location	Type of biowaste source	Good local contact	Entity name	Easy access to free database	Database name	Person in charge of data gathering
		Site 1								
		Site 2								
		Site 3								

Deciding provisional list of locations to test the DST • 14



Figure 6 - Exercise carried out during Trieste GA to gather the inputs from the Consortium Partners for defining a provisional list of locations to test the DST

Type and nature of sites, type of sources generating biowaste and data availability were chosen according to the following options:

Table 2 - Options used to define the type of location and the access to related data

Type of location	Nature of location	Type of source generating biowaste	Good local contact	Easy access to available database
City (LAU2)	URBAN	HOUSEHOLD	Y	Y
District	RURAL	HOSPITAL	N	N

(<LAU2)				
Village(<LAU2)	PERI-URBAN	UNIVERSITY	To check	To check
Area(<LAU2)	INDUSTRIAL	SCHOOL		
Region (NUT2)	SERVICE	INDUSTRIAL		
Country (NUT1)	HISTORICAL	HOTEL		
	MODERN	HOUSEHOLD&COMMERCIAL		
	MIXED*	RESTAURANT		
		MARKET		
		MIXED		

\* if the area has mixed characteristics that will be better defined in the forthcoming D6.4.

After Trieste GA, the participants of the working sessions were asked to verify and confirm the info reported during the exercise in **Figure 6**. Also the partners that did not participate at the working session were asked to do the same exercise in order to propose, according to the identified selection criteria, their list of provisional locations.

Partners contributing to this activity made their choices considering both the amount of data needed to test a site in the tool (the table in Annex A1 was also delivered to partners) and keeping in mind that for each country a maximum of 3 or 4 sites with different characteristics was assumed to be sufficient to cover the country specificity (following the first two criteria: data availability and geographic location).

Each site of the provisional list was then characterized according to the fields previously defined (**Figure 4**). **Table 3** can be used to pass from selection criteria to sites. Partners involved in the consultation were asked to include in the column the candidate theoretical sites by taking into consideration the proposed criteria and answering the related questions disposed in rows. **Table 3** was filled out with proposed theoretical sites and the outcomes are visualized in the Results section.

In the forthcoming D6.4 a methodology for evaluating the provisional sites by a Likert scale or a weighted average will be developed to decide the 10 final theoretical sites to test the DST.

Table 3 - Proposed site selection criteria vs. provisional theoretical sites

Proposed Criteria and related questions for selecting sites to test the DST	List of provisional theoretical sites			
	Site 1	Site 2	Site 3	Site n
C1 - Geographic location ✓ <i>Is the site within DECISIVE consortium countries?</i> (Only sites within the consortium will be proposed)	Y/N			
C2 - Data availability ✓ <i>Is a good local contact available?</i> ✓ <i>Is there easy access to available databases?</i> ✓ <i>Is the information on the parameters needed for testing the tool sufficient?</i>	Y/N/to check			
C3 - Scale of analysis ✓ <i>Are the administrative levels of proposed sites different among them?</i> ✓ <i>Are cities, districts, villages and regional levels included among the proposed site?</i>	City/District/Village Area/Region*			
C4 - Nature of location ✓ <i>Which type of sites are we considering?</i> <i>Which is the general geographical aspect of the site? What kind of architecture has the sites?</i>	Urban, Rural, peri-urban, Industrial, Service, Historical, Modern, Mixed			

C5 - Biowaste input ✓ <i>What kinds of sources generate biowaste in the proposed site?</i> ✓ <i>How much is the total amount of biowaste per inhabitant per year?</i> ✓ <i>Is biowaste source separated or not?</i> ✓ <i>How much is the percentage of impurities in source separated biowaste?</i>	Household, Hospital, University, Hotel, Household & Commercial, Restaurant, Market, Mixed				
.....					
Cn - Criterion n					

\*During Consortium Partners consultation, it was decided that the analysis at country level was not useful to carry out since the results would be too general and difficult to be implemented.

Further information regarding criteria for the choice of sites was extracted from the interviews with stakeholders carried out for the D3.7. For this deliverable, relevant key players within waste sector from the six DECISIVE countries (Belgium, Denmark, France, Germany, Italy and Spain) were interviewed to identify essential information on decentralised biowaste collection systems. The opinions of the people interviewed also regarded potential sites where to test decentralised biowaste valorisation schemes instead of the common centralised waste management options. Their considerations have been taken into account to formulate the set of site selection criteria reported in the Results section.

## 3. Results

### 3.1 SET OF CRITERIA TO CHOOSE THE POTENTIAL THEORETICAL SITES

According to the methodology described in the previous section, the overall fields in which the set of site selection criteria could be grouped were defined through consultations with the Consortium Partners. Specific criteria within each field were proposed, discussed and confirmed. The final set of selection criteria is reported in Table 4 where, for each criterion, comments and clarifications are shown in order to specify the type of corresponding sites to be selected in the next phase of the analysis.

Table 4 - Criteria for the selection of locations where to test the DST

Set of criteria for selecting sites		
Fields	Criteria	Comments/clarifications
GEOGRAPHIC LOCATION	C1 - Consortium countries	<ul style="list-style-type: none"> <li>Sites within the countries of the DECISIVE Consortium Partners</li> </ul>
DATA INPUT AVAILABILITY	C2 - Data availability	<ul style="list-style-type: none"> <li>Sites where a good local contact for local data access is available</li> <li>Sites where data access is easy (statistics database free)</li> </ul>
SCALE OF ANALYSIS	C3 - Type of location	<ul style="list-style-type: none"> <li>Sites with different type of administrative level (City, District, Village, Area, Region)</li> </ul>
TYPOLOGICAL DIVERSITY	C4 - Nature of location	<ul style="list-style-type: none"> <li>Sites of different settlement structure (urban, rural, industrial, service, mixed)</li> <li>Site of different architecture (historical vs modern settlements)</li> </ul>
BIOWASTE INPUT	C5.1 - Type of generation sources	<ul style="list-style-type: none"> <li>Sites with different type of biowaste source (household, hospital, university, hotel, household and commercial, restaurant, market, mixed)</li> </ul>
	C5.2 - Biowaste separately collected (quantity and quality)	<ul style="list-style-type: none"> <li>Sites with no biowaste separation or low % of separated biowaste (for obtaining higher margin of improvements)</li> <li>Sites with high % of separated biowaste and/or lower impurities content (locations with higher environmental awareness)</li> </ul>
	C5.3 - Biowaste generation quantity	<ul style="list-style-type: none"> <li>Sites where the amount of biowaste per capita is high, so the margin of improvements are higher</li> </ul>

		<ul style="list-style-type: none"> <li>• Sites where the amount of biowaste per capita is low, so this could be indicative of a major awareness of waste generation</li> <li>• Sites with different population density</li> </ul>
	C5.4 - Potential for waste prevention	<ul style="list-style-type: none"> <li>• Sites with high/low % of avoidable biowaste</li> </ul>
LOGISTIC-TRANSPORTATION	C6 - Distance to biowaste generators – treatment	<ul style="list-style-type: none"> <li>• Sites with different (short, medium, long) distances between the biowaste generation and the waste treatment in the current system of the targeted location)</li> </ul>
SUB-PRODUCTS USE	C7.1 - Digestate/ Compost and other fertilizers produced	<ul style="list-style-type: none"> <li>• Sites with potentiality for nearby use of digestate/compost: rural areas or peri-urban areas</li> <li>• Sites with less potentiality for nearby use of digestate: urban areas or areas with limited available land to spread digestate</li> </ul>
	C7.2 - Thermal energy produced (biogas production)	<ul style="list-style-type: none"> <li>• Sites close/far to existing heat demands</li> </ul>
LEGAL LOCAL CONSTRAINTS	C8 - Legislative framework	<ul style="list-style-type: none"> <li>• Sites where there are existing limitations for localization of mAD</li> <li>• Sites with no legislation limitations but demanding permitting</li> </ul>

### 3.2 LIST OF POTENTIAL THEORETICAL LOCATIONS

As a result of the application of the set of criteria previously shown, a list of potential theoretical locations where the DST will be applied is given in this section. The proposed sites cover the following countries: Spain, Germany, Italy, Denmark, Belgium and France and the list includes 18 sites. Among them a selection of 10 final locations will be done in a later stage of the project and the final list of theoretical sites for testing the DST will be included in the deliverable D6.4.

The list of potential sites reported in **Table 5** has been compiled by using the **Table 4** and it is the result of the contribution of the Consortium Partners indicated in the table itself. For each site (in rows) the specific information relevant to the indicated selection criteria (in columns) has been introduced.

It is important to underline that for the selection of the provisional sites not all criteria reported in **Table 4** were used since the information needed to assess some of them (C5.2, C5.3, C5.4, C6, C7.1, C7.2, C8) was not yet available. In the next stage of the project, all proposed criteria will be taken into account and assessed to reduce the candidate list from 18 to 10 locations. In fact, each site will be scored by using the weighted average of the related criteria after having assigned a specific weight and a site-relative score to each criterion.

In **Table 5**, four columns correspond to the same criterion (C2 - data availability), underlining the importance of data accessibility in this preliminary phase of sites selection. The “comments” column gathers the available information about the existing biowaste management system and/or the general characteristics of each site. This information will be expanded when determining the definitive locations where to apply the DST in the forthcoming D6.4

Besides the columns inserted in the **Table 5**, an internal list of local stakeholders was created to identify relevant actors that will be key in collecting information once deciding the 10 final theoretical sites where to test the capabilities of the DST.

Furthermore, a more extensive list of “properties” such as: latitude, surface, density of inhabitants, will be added to completely characterize the 10 theoretical sites for the next deliverable.

Table 5 – List of potential theoretical locations among which the 10 theoretical sites where to test the DST will be chosen for the D6.4

Item	Proposed site	Selection Criteria used								Comments	Partner name proposing the site	Partner in charge of data gathering
		C1 - Country	C3 - Type of location	C4 - Nature of location	C5.1 - Type of biowaste source	C2 - Local contact	C2 - Local Entity name delivering data	C2 - Easy access to free database	C2 - Database available			
1	Municipality of Argentona	ES	City	URBAN	HOUSEHOLD	Y	Municipality of Argentona or some other from Consell Comarcal Maresme	Y	Y	Good quality of source separated biowaste; door to door collection, waste database well organized	ENT	ENT
2	Planta de Grupo Soteras	ES	Area	INDUSTRIAL	RESTAURANT	Y	Grupo Soteras	To check	To check	Brand managing different Restaurants and Hotels. Waste management could be centralized.	Aeris	ENT
3	Market Ninot	ES	Area	URBAN	MARKET	Y	Gerència de Turisme, Comerç i Mercats	To check	To check	Biowaste input of high quality	ARC	ENT
4	Hospital (Vall d'Hebron)	ES	Area	SERVICE	HOSPITAL	To check	To check	To check	To check	Public hospital with very high quality of biowaste source separated as manual and mechanical pre-treatment is already installed at the site	ARC	ENT
5	Catalonia	ES	Region	URBAN	MIXED	Y	ARC	To check	To check	Being a region maybe is not suitable for the testing DECISIVE scenario but waste facilities info can be inserted in libraries	AU + ARC	ENT
6	Lübeck-Flintenbreite ecovillage settlement	DE	Village	URBAN	HOUSEHOLD	Y	EBL (Entsorgungsbetriebe Lübeck)	Y	TUHH report EBL information on waste collection	Small eco-settlement in the semi-urban area of Lübeck with various housing types and about 200-250 inhabitants; decentralized mAD unit is available, but not in operation.	AU + TUHH	TUHH
7	Lübeck	DE	City (NUT3)	URBAN	HOUSEHOLD	Y	EBL (Entsorgungsbetriebe Lübeck)	Y	Statistik-Nord	Separately collected biowaste with a very high quality delivered to anaerobic	TUHH+AU	TUHH+AU

D 6.3 - Set of criteria for the selection of locations where the Decision Support Tool could be applied

							gsbetriebe Lübeck)		Company data TUHH works	digestion coupled with composting; residual waste bins to anaerobic digestion coupled with landfilling; changes of the processes planned; information of potential of mADs from interest; close cooperation regarding waste collection established.		
<b>8</b>	Hamburg	DE	City (NUTS 3)	URBAN	HOUSEHOLD	Y (11 stakeholder interviews carried out)	SRHH (Stadtreinigung Hamburg)	Y	Statistik-Nord Company data TUHH works	Separate biowaste collection via bio-bins delivered to anaerobic digestion coupled with composting (belong to largest German facilities); residual waste bins are sent to incineration; additional digestion of mixed waste is planned; no interest on decentralized operations, but on decentralized collection operations.	TUHH	TUHH
<b>9</b>	Bargstedt	DE	Region	RURAL	HOUSEHOLD	Y	AWR (Abfallwirtschaft Rendsburg-Eckernförde)	Y	Statistik-Nord Company data	Biowaste is separately collected bi-weekly and sent to an AD plant to produce Biogas production and the digestate is subsequently composted. The residual waste is sent to an MBT plant. There is interest in higher valued application possibilities due to limitations in the current type source-separate collection via bio-bins.	TUHH	TUHH
<b>10</b>	Aarhus City	DK	City	URBAN	HOUSEHOLD	Y	AU	N	Existing studies	Urban/suburban area with no separate collection of biowaste (biowaste sent to WtE)	AU	AU
<b>11</b>	North of Zealand	DK	Country	URBAN	MIXED	N	AU	N	Study in publication/existing	Area (rural/suburban/urban) with no separate collection of biowaste, biowaste sent to WtE	AU	AU
<b>12</b>	Lyon	FR	City	URBAN	MIXED	N	AU	N	To check	Urban area in which biowaste is not separately collected but it is included in the residual bin.	AU + IR	AU+IR

<b>13</b>	Rennes	FR	City	URBAN	MIXED	To check	Rennes Métropole	To check	To check	Urban area surrounded by rural areas	IR	IR
<b>14</b>	Brussels	BE	City	URBAN	MIXED	Y	Brussels Environment	To check	Existing, recent studies on bio-waste arising	Voluntary, weekly collection of biowaste using plastic bags. Collected biowaste is sent to AD in Flanders. DiD collection of garden waste, sent to composting. 200 decentralised composting sites across the region (plus some home composting).	ACR+	ACR+ + ENT
<b>15</b>	San Dorligo della Valle	IT	Village	MIXED	MIXED	Y	A&T 2000 S.p.A.	Y	A&T database	Fractional urban area with huge industrial settlements and several restaurants	ENT+GEO+ITS	ENT+GEO
<b>16</b>	Gemona del Friuli	IT	City	MIXED	MIXED	Y	A&T 2000 S.p.A.	Y	A&T database	City area in the pre-alps, with very heterogeneous sources	ENT+GEO+ITS	ENT+GEO
<b>17</b>	Taipana	IT	Village	RURAL	HOUSEHOLD	Y	A&T 2000 S.p.A.	Y	A&T database	Mountain area, actually rural with household/small agricultural sources	ENT+GEO+ITS	ENT+GEO
<b>18</b>	Dogna	IT	Village	RURAL	HOUSEHOLD	Y	A&T 2000 S.p.A.	Y	A&T database	Mountain area, very fractional with household/small agricultural sources	ENT+GEO+ITS	ENT+GEO

## 4. Conclusions and limitations

The two objectives of the present work included: 1) the definition of a set of criteria to select the sites where to test the DST and 2) the identification of a list of potential theoretical sites according to the proposed criteria.

A set of 12 site selection criteria is provided and based on those criteria a list of 18 potential theoretical sites was identified. This candidate list of sites includes the 10 “tested” locations that will be decided in the forthcoming deliverable D6.4. The 10 selected sites will be used to test the implementation of a decentralized valorisation system for urban biowaste by using the DST.

The methodology applied to identify both the selection criteria and the list of provisional theoretical sites was mainly based on participatory processes involving Consortium Partners.

The selection of the theoretical sites where to implement the tool is crucial since it will determine the study sites for testing the implementation of the DECISIVE scheme. The 10 selected sites are expected to be representative of different types of locations to properly assess the DST performance. Deliverable 6.4 will report such simulation to test the applicability, flexibility and capacity of the DST to effectively characterize contexts that are different and heterogeneous in geographic, economic and demographic terms. The application of the tool in the theoretical sites will provide a first estimate of the comparisons of different biowaste management scenarios and will help in identifying further potential improvements to introduce in the tool itself.

In order to properly test the DST and make the comparison between present and DECISIVE scenarios, inventories will have to be built to properly represent the current and the alternative biowaste management systems. Due to the large amount of data required to build these libraries, data availability has been defined as one of the main selection criteria in this report. The choice of the final list will also determine the waste processes inventories to introduce in the final version of the DST.

Access to the data representative of the state of the biowaste management in Europe is one of the main constraints encountered in this work. Although data might be available at local level from the competent authorities, there is a lack of standardized datasets that properly describe biowaste management systems at local scale. The provisional sites cover various European regions but to limit difficulties in accessing to local database only countries within Partners Consortium have been considered: Western, Southern and Northern Europe are represented but not the Eastern part. This is an important limitation. Once the final list of theoretical sites will be confirmed in the D6.4, the effort to obtain real local data and not general/national statistics will be done to properly model various local systems in order to ensure the reliability of the final results. The usefulness of the DST will depend in part from the waste processes libraries related to the 10 theoretical sites so it will be important to gather as much complete information as possible.

Other limitations are related to fields or criteria that may not be included in the analysis (for one reason or another) such as acceptance of the population, NIMBY effect or existing waste contracts. Even though these aspects related to the compatibility of an initiative with social perspectives/values, or institutional strategies or existing plans can be relevant when implementing a new waste facility, they have not been considered since it would have been difficult to perform their *a priori* assessment for the theoretical sites.

This deliverable resulted in the definition of a provisional list of 18 locations within Europe to prove the “theoretical” application of the new management system of biowaste proposed by DECISIVE. A series of future consultations and meetings will be needed in order to reduce the number of sites from 18 to 10. This step will involve a review of the full table of candidate sites and will require eliminating sites that do not meet minimum criteria requirements. A methodology for evaluating by a Likert scale or using a weighted average approach will be developed in the next stage of the project to support the final selection of the 10

theoretical sites. The application of the DST to these sites will result in a set of considerations that could suggest which “ideal” profile(s) could typically characterize the locations better served by the DECISIVE scheme. The identification of a “typical” site for which the DECISIVE scheme is particularly appropriate could also be used in the future in order to choose the most promising locations where such novel biowaste management scheme can be implemented successfully.

# Annex A1

Example of data needed for each stage of the biowaste management system to test a specific location in the DST.

GENERATION							
Generation Process Name	Key Characteristics						
	Waste type (input)	Generation Unit	Type of Source	Time reference	Location	Source Name	
G_ENT_1	Biowaste	person	Student Residences	2016	(UAB) Catalonia	UAB Vila 1	
Mass Balance Parameters							
Source size (unit/year)	Biowaste Generation (t/unit)	Biowaste Composition (%)				Food Waste Composition	
		Food waste	Green waste	Woody waste	Other organic waste	Avoidable (%) <sup>3</sup>	Unavoidable (%) <sup>4</sup>
1358.5	0.10	78.83	6.99	1.14	13.04	8.7	91.3

SOURCE SEPARATION							
Source-Separation Process Name	Key characteristics						
	Waste type (input)	Source type	Type of collection	Time reference	Location	Waste Outputs	
SS_ENT_1	Biowaste	Student Residence	Bring-scheme	2012	UAB (Catalonia)	Source Separated Biowaste (SS BW); Residual Waste (RW)	
Mass Balance Parameters							
Distribution Generated Food Waste Between Waste Outputs (%)		Distribution Generated Green Waste Between Waste Outputs (%)		Distribution Generated Woody Waste Between Waste Outputs (%)		Distribution Generated Other Organic Waste Between Waste Outputs (%)	
Food waste in SS BW	Food waste in RW	Green waste in SS BW	Green waste in RW	Woody waste in SS BW	Woody waste in RW	Other organic waste in SS BW	Other organic waste in RW
91.86	8.14	91.86	8.14	91.86	11.34	2.83	1.79

<sup>3</sup> Any food waste derived from edible parts of products that have not been consumed. E.g. food products expired or gone bad due to poor housekeeping or purchase in excess, food prepared in excess and not consumed, etc.

<sup>4</sup> Inedible parts of food, as for instance peels, shells and bones.

% Macro-Impurities in the Source Separated Biowaste	Macro-Impurities Composition (% macro-impurity)					
	Glass	Paper & Cardboard	Plastic	Fe	Nfe	Other
73.32	0.00	0.00E+00	22.07	0.23	Bucket	Plastic Bucket, one unit, 10l
Material and Energy inputs						
Amount (unit/t)	Unit	Item name	Amount (unit/t)	Unit	Item name	
1.79E+02	bag	Plastic Bag, one unit, 10l	4.44E-01	container	Container, Biowaste, one unit, 2200l	
Amount (unit/t)	Unit	Item name	Amount (unit/t)	Unit	Item name	
5.72E-03	m2	Private generator space	4.44E-01	container	Container, Residual, one unit, 2200l	
Socio-economic aspects						
Amount (unit/t)	Unit	Item name	Amount (unit/t)	Unit	Item name	
5.75E+00	m2	Public urban space	264.87	h	Private generator time	
Amount (unit/t)	Unit	Item name				
8.23	h	Private generator time				

COLLECTION					
Collection Process Name	Key characteristics				
	Waste type (input)	Type of Source	Type of collection	Time reference	Location
C_ENT_1	Source separated biowaste	Households	Undefined	2016	Catalonia
Material & Energy Inputs					
Amount (unit/t*km)	Unit	Item name	Amount (unit/t*km)	Unit	Item name
2.03649E-06	truck	Truck 18m3, one unit, 100.000km life	9.00E-02	Litre	Diesel production & consumption, truck, litre
Socio-economic aspects					

D 6.3 - Set of criteria for the selection of locations where the Decision Support Tool could be applied

Amount (unit/t*km)	Unit	Item name	Amount (unit/t*km)	Unit	Item name
1.63E+00	person*hour	Worker, person*hour, Barcelona, 2016	4.96E-05	m2/t*km	Public urban space

PRE-TREATMENT											
Pre-treatment Process Name	Key characteristics						Direct Emissions				
	Waste type (input)	Type of pre-treatment	Waste Outputs	Time Reference	Location	Plant Name	Amount	Emission	Parameter		
PT_AU_1	Source Separated biowaste	mechanical and manual separation	Biomass Output (BM_O); Recyclables Outputs (Rec_O); Refuse (Ref_O)	2014	Catalonia	Ecoparc 2 - Organic line					
Mass Balance Parameters											
Food Waste (input)			Green Waste (input)			Woody Waste (input)					
BM_O	Rec_O	Ref_O	BM_O	Rec_O	Ref_O	BM_O	Rec_O	Ref_O			
80.0	0.0	20.0	83.3	0.0	90.0	83.3	0.0	90.0			
Other Organic Waste (input)			Glass - macroimpurity			Paper & Cardboard - macroimpurity					
BM_O	Rec_O	Ref_O	BM_O	Rec_O	Ref_O	BM_O	Rec_O	Ref_O			
0.0	0.0	100.0	n.a	0.0	90.0	n.a	0.0	90.0			
Plastic - macroimpurity			Ferrous Metal - macroimpurity (input)			Non-Ferrous - macroimpurity (input)			Other - macroimpurity (input)		
BM_O	Rec_O	Ref_O	BM_O	Rec_O	Ref_O	BM_O	Rec_O	Ref_O	BM_O	Rec_O	Ref_O
n.a	0.0	90.0	n.a	0.0	90.0	n.a	0.0	90.0	n.a	0.0	90.0
Material and Energy Inputs				Socio-economic Aspects				Capital goods			
Amount	Parameter	Unit	Item name	Amount	Parameter	Unit	Item name	Annual capacity	Life time facility (y)	Investment costs (€)	

D 6.3 - Set of criteria for the selection of locations where the Decision Support Tool could be applied

TRANSPORTATION											
Transport Process Name	Key characteristics					Material and Energy Input					
	Waste type (input)	Size (tonne)	Velocity (km/h)	Time reference	Location	Amount (unit/tonne*km)	Unit	Item name	Amount (unit/tonne*km)	Unit	Item name
Trans_ENT_1	Not specified	14 t	59 km	2016	Catalonia	7.14E-07	truck	Truck 14t, rigid	1.31E-02	Litre	Diesel production & consumption, truck, litre
Socio-economic aspects											
Amount (unit/tonne*km)	Unit	Item name	Amount (unit/tonne*km)	Unit	Item name						
1.21E-03	person*hour	Worker, person*hour, Barcelona, 2016	1.25E-05	m2	Public urban space						

TREATMENT																
Treatment Process Name	Key characteristics															
	Location	Catalonia	Time Reference	2014	Waste type (input)	Source Separated biowaste	Waste Outputs	Material Output_1 (MO_1); Material Output_2 (MO_2); Material Output_3 (MO_3)								
T_AU_1	Plant Name	Ecoparc 2 - Organic line	Type of recovery	Material Recovery; Energy Recovery	Type of treatment			Anaerobic Digestion Wet Batch + composting + cogeneration								
Energy Outputs																
Methane Yield		Gas Output (Biogas composition)				Energy Output_1										
% CH4 potential		% CH4	%CO2	% N2	% H2S	Amount (unit/Parameter)		Parameter	Unit	Item name						
80.0		62.6	36.1	0.0	0.0	2.57E+00		BMP	kWh	Electricity Catalonia						
Material Outputs																
Material Output 1 (MO_1)																
Name	% Input (dry)	C (% input C)	N (%)	P (%)	K (% input)	Cu (%)	Pb (% input)	Zn (%)	Cd (%)	Ni (%)	Hg (%)	Cr (%)	H (%)	S (% Input)	O (%)	H2O%

D 6.3 - Set of criteria for the selection of locations where the Decision Support Tool could be applied

Output	weight)		input N)	Input P)	K)	input Cu)	Pb)	input Zn)	input Cd)	Input Ni)	Input Hg)	Input Cr)	Input H)	S)	Input O)	
Compost	12.0	9.0	10.3	51.4	12.6	100.0	100.0	100.0	100.0	100.0	100.0	100.0	45.0	28.0	45.0	30.0
Material Output 2 (MO_2)																
Name Output	% Input (dry weight)	C (% input C)	N (% input N)	P (% Input P)	K (% input K)	Cu (% input Cu)	Pb (% input Pb)	Zn (% input Zn)	Cd (% input Cd)	Ni (% Input Ni)	Hg (% Input Hg)	Cr (% Input Cr)	H (% Input H)	S (% Input S)	O (% Input O)	H2O%
Centrifuge Liquid Output	7.0	1.1	26.3	8.4	87.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.0	72.0	44.0	95.0
Material Output 3 (MO-3)																
Name Output	% Input (dry weight)	C (% input C)	N (% input N)	P (% Input P)	K (% input K)	Cu (% input Cu)	Pb (% input Pb)	Zn (% input Zn)	Cd (% input Cd)	Ni (% Input Ni)	Hg (% Input Hg)	Cr (% Input Cr)	H (% Input H)	S (% Input S)	O (% Input O)	H2O%
Solid Refuse	29.0	5.7	6.9	28.0	0.0	0	0	0	0	0	0	0	0.5	0	0.5	30
Direct Emissions (excluding Background Process Emissions)							Material and Energy inputs to technology									
Amount	Emission	Parameter	Amount	Emission	Parameter	Amount	Emission	Parameter	Amount	Parameter	Unit	Item name	Amount	Parameter	Unit	Item name
3.50E-02	N2O	Nin	2.39E+00	CH4	Cin	2.30E-01	NH3	Nin	1.20E+02	None	Litre	Water, l, Barcelona	9.26E+01	None	kWh	Electricity Catalonia
Socio-economic aspects	Capital goods					Amount	Parameter	Unit	Item name	Amount	Parameter	Unit	Item name			
	Annual capacity	Life time facility	Investment costs	0.00E+00	None	MJ	Heat Catalonia	3.64E+00	None	Litre	Diesel production & consumption, truck, litre					
Amount	Unit	Item name	Amount	Unit	Item name	t/year	year	€								
5.42E-02	person*hour	Worker, person*hour, Barcelona, 2016	3.08E-01	m2	Industrial space	260000	20	59000000								

D 6.3 - Set of criteria for the selection of locations where the Decision Support Tool could be applied

FINAL DISPOSAL																
Final disposal Process Name	Key characteristics						Material and Energy Outputs									
	Waste type (input)	Type of Disposal	Residues	Time Reference	Location	Plant Name	Residue 1			Residue 2						
							Amount (unit/t)	Unit	Item name	Amount (unit/t)	Unit	Item name				
FD_AU_1	Municipal Solid Waste	Incineration	Residue_1; Residue_2	2008	Milan		0.1180	tonne	Bottom Ash Treatment	2.17E-02	tonne	Fly Ash Treatment				
	Energy Output_1						Energy Output 2									
	Amount		Parameter		Unit		Item name		Amount		Parameter		Unit		Item name	
	7.33E+02		LHV		kWh		Electricity Catalonia		1.67E+02		LHV		kWh		Heat Catalonia	

## References

- Deliverable D5.1 “Methodology for planning of decentralized biowaste management behind the Decision Support Tool”
- Deliverable D5.2 “DECISIVE Decision Support Tool” (in progress)
- Deliverable D5.3 “User manual of the DECISIVE decision support tool” (in progress)
- Deliverable D6.1 “Methodology of characterization of the biowaste management system in the DECISIVE demonstration sites: Current and new systems simulation for the LYON and CATALONIA cases”
- Deliverable D6.2 “State-of-the-art of communication materials and incentive methods”
- Deliverable D6.4 “Report on the simulation of the implementation of the methodology in different types of locations” (forthcoming)
- Deliverable D3.7 “Documentation of models for decentralised bio-waste collection chains with a waste collection database for representative situations (forthcoming)
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