

15th July 2025, Online

Rosaria Chifari | ENT Environment & Management

Webinar II

“Training webinar on a specific IT tool to support municipal solid biowaste management for the MedCities WG on Integrated Solid Waste Management”

CONTENT

PART I - 10.00-11.30h

BLOCK 1 | Why use IT tools in municipal waste management?

BLOCK 2 | DSWT: overview, aims, features and possible applications

Questions and comments

11.20-11.30h Coffee break

CONTENT

PART II - 11.30-13.00h

BLOCK 1 | Building the simulation for biowaste management in a theoretical MedCity

BLOCK 2 | Results of the simulation and comparing current vs alternative scenarios

Conclusions

BLOCK 3 | Conclusions: strengths vs weakness of the DSWT

Questions and comments



Rosaria Chifari

PhD in Environmental Science and Technology from the Institute of Environmental Sciences and Technology (ICTA-UAB) - Spain
Master of Science and a degree in Engineering for Environment and Territory from the University of Naples Federico II - Italy.
Specialized in Waste Management and Circular Bioeconomy as well as renewable energy with special emphasis on bioenergy with 20 years of experience.

She is an experienced project manager of European initiatives, including H2020 Biocircularcities and LIFE PLP LIFE4EPR, and has contributed to EU-funded projects such as LIFE BIOBEST, DECISIVE, and MARSS in the fields of circular bioeconomy and waste management. With a strong background in EU proposal development, she has led the drafting of numerous successful funding applications. As a senior consultant and researcher, she specializes in waste management, bioeconomy, and renewable energy, with a focus on bioenergy. Her research emphasizes the integrated assessment of urban waste systems, covering environmental, institutional, and socio-economic aspects, and she has expertise in modeling, indicators, and environmental analysis. Since 2007, she has worked with consultancy firms such as Ecofys and SQ Consult. Since 2017, she has served as a senior consultant at ENT Environment and Management, where she currently coordinates the LIFE4EPR project on extended producer responsibility (EPR) within the EU framework. She also delivers training activities in her areas of expertise.

rchifari@ent.cat



ENT is a socio-economic initiative comprising two organisations. Design, analyse and implement public environmental policies.

- Team of multidisciplinary professionals
- Consulting, research, and cooperation
- R&D&I projects, scientific publications, conferences
- Projects at local, regional, national scale
- European and international projects
- Networking
- Collaboration with the academic field
- ISO 9001:2015 and ISO 14001:2015 certified



www.ent.cat

PART I - BLOCK 1

Why use IT tools in municipal waste management?



INTRODUCTION

Municipal waste management (MWM) is becoming increasingly complex (Population growth, Urbanisation, Rising regulatory demands)



MWM requires better planning, monitoring, and coordination

Traditional systems often lack in responsiveness and access to reliable data.



Digital tools (e.g. GIS, real-time sensors, decision support systems) offer smarter planning, scalable solutions and enhanced sustainability of waste operations

These tools also support transparency and accountability, cost-efficiency for local authorities and better engagement with citizens



KEY CHALLENGES IN WASTE MANAGEMENT



Inefficient collection routes and schedules



Low recycling rates



Limited data for decision-making



Poor citizen engagement



Regulatory compliance complexity

IT TOOLS IN WASTE MANAGEMENT

Role of IT Tools

- Enable data collection and real-time monitoring
- Support planning with modelling/simulation
- Dashboards for performance tracking
- Enhance communication with stakeholders



Types of IT Tools Used

- GIS (Geographic Information Systems)
- Waste tracking (RFID, QR codes)
- Route optimisation software
- Citizen reporting apps
- Decision support systems (e.g., DSWT)



BENEFITS IN USING IT TOOLS

Benefits for Local Authorities

- Operational efficiency and cost reduction
- Data-driven decisions
- Improved compliance and reporting
- Enhanced service quality
- Support for circular economy goals



IT Tools are key to sustainable waste management



Improve efficiency, transparency, and accountability



Essential for smart city development

Benefits for the Environment

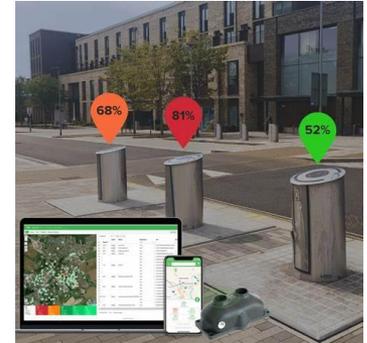
- Lower emissions from optimised routes
- Higher recycling rates
- Better waste segregation
- Early detection of inefficiencies

IT TOOLS REAL-WORLD EXAMPLES

Examples of Digital Waste Innovation

- **Smart bins in Barcelona**

Waste containers equipped with sensors that monitor fill levels in real time. Key benefits: optimised waste collection, improved urban cleanliness, data-driven decision and sustainability and energy efficiency since some bins use solar-powered compactors.



- **Route optimisation in Helsinki**

Using real-time sensor data in route optimisation by equipping containers with fill-level sensors and integrating data into AI-powered logistics systems. Key benefits: reduced unnecessary collections and transport costs by up to 21%. collection routes adjusted dynamically based on real-time needs, lowering fuel use, emissions, and operational costs. This approach not only improves efficiency and sustainability but also enhances service quality for residents.



- **Digital citizen platforms in Milan**

Digital tools designed to empower citizens and foster a smart, responsive, and inclusive urban environment. Key benefits: faster access to services such as real-time waste collection schedules and updates, direct reporting of issues like missed pickups or illegal dumping, quicker resolution of problems, more inclusive decision-making, and better-informed residents



PART I - BLOCK 2

DSWT: overview, aims, features and possible applications



OBJECTIVE OF WEBINAR

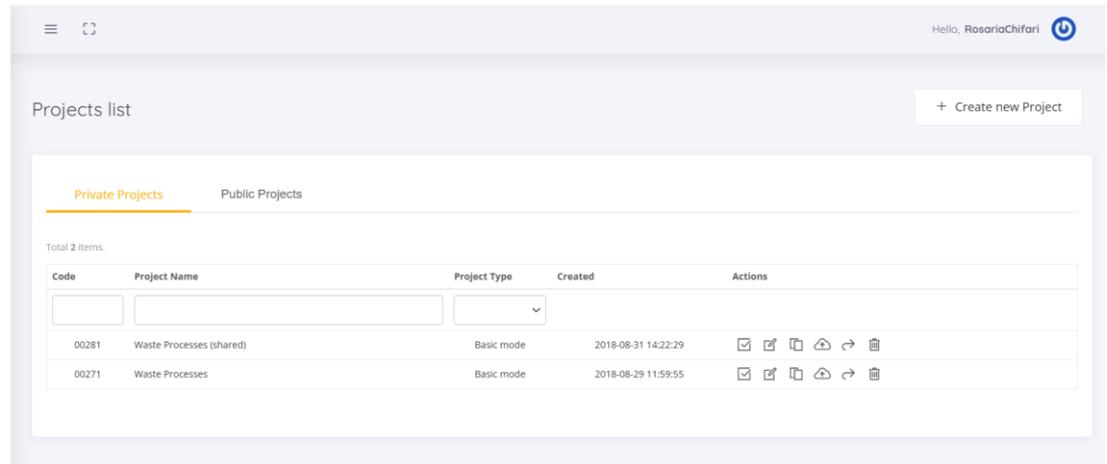
To guide participants through the use of the Decision Support Web Tool (DSWT) to evaluate the performance of biowaste management scenarios.

This tool has been developed by ENT within the framework of two EU projects:

 (2016-2021) and
  (2023-2025)



-  Projects list
-  Process library
-  Emission Factors
-  Glossary
-  Waste Characterization...
-  Waste Processes Docu...
-  User Manual of the DE...

Projects list

Private Projects Public Projects

Total 2 Items.

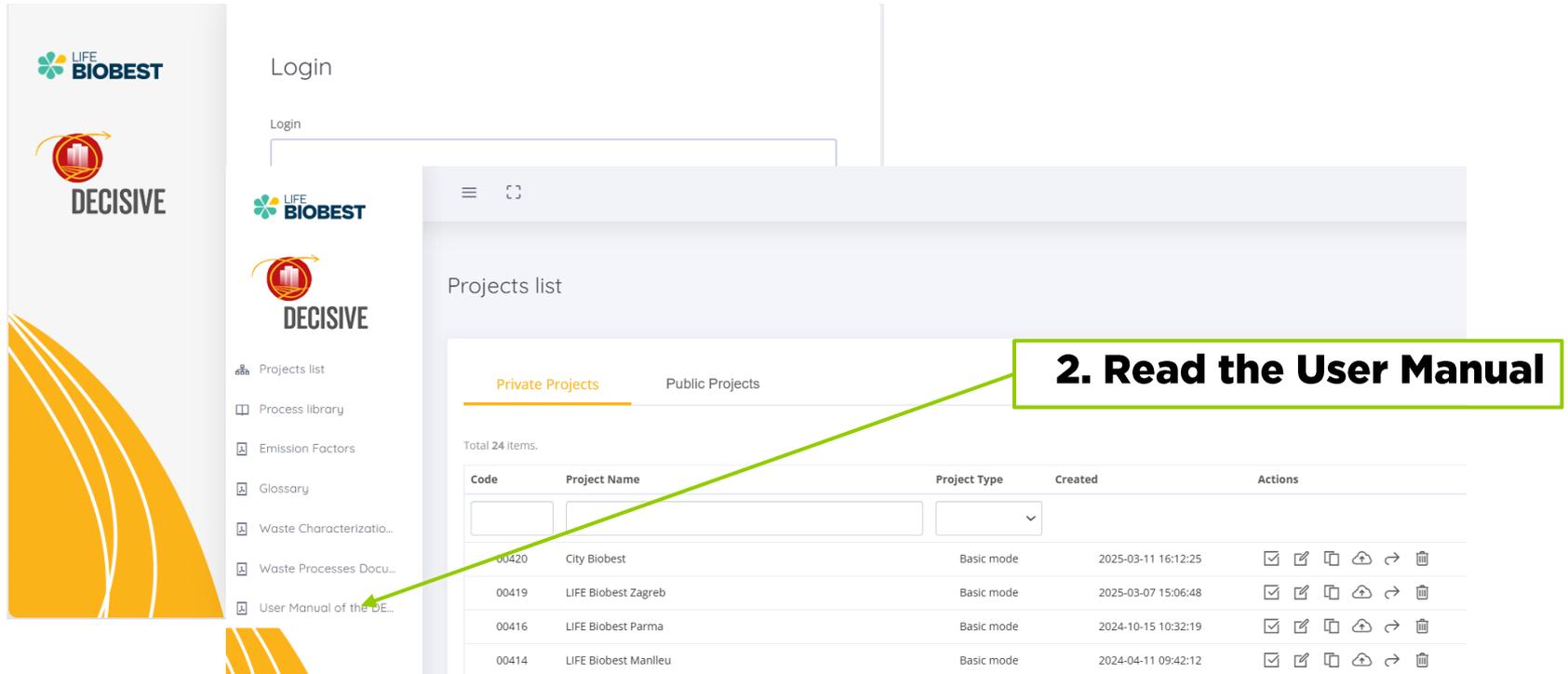
Code	Project Name	Project Type	Created	Actions
<input type="text" value="00281"/>	<input type="text" value="Waste Processes (shared)"/>	<input type="text" value="Basic mode"/>	2018-08-31 14:22:29	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<input type="text" value="00271"/>	<input type="text" value="Waste Processes"/>	<input type="text" value="Basic mode"/>	2018-08-29 11:59:55	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Overview, aims, features of the DSWT



THE TOOL: FIRST STEPS TO USE IT

1. **Login:** <https://dst-lifebiobest.ent.cat/user/login>



The screenshot displays the DSWT interface. On the left is a sidebar with the LIFE BIOBEST and DECISIVE logos, and a menu with items like 'Projects list', 'Process library', 'Emission Factors', 'Glossary', 'Waste Characterizatio...', 'Waste Processes Docu...', and 'User Manual of the DE...'. The main area shows the 'Login' page with a 'Login' button. Below it, the 'Projects list' page is visible, featuring tabs for 'Private Projects' and 'Public Projects', and a table of projects. A green callout box with the text '2. Read the User Manual' is connected to the 'User Manual of the DE...' link in the sidebar by a green arrow.

Code	Project Name	Project Type	Created	Actions
00420	City Biobest	Basic mode	2025-03-11 16:12:25	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
00419	LIFE Biobest Zagreb	Basic mode	2025-03-07 15:06:48	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
00416	LIFE Biobest Parma	Basic mode	2024-10-15 10:32:19	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
00414	LIFE Biobest Manlleu	Basic mode	2024-04-11 09:42:12	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Decision Support Web Tool (DSWT)

The DSWT is an upgraded version of the H2020 DECISIVE DST

GOAL OF THE DSWT



Objective: supporting decision when evaluating the performance of biowaste management

How:

- ❖ Providing a first assessment of the performance of municipal biowaste management systems, considering all the stages i.e., from generation to final disposal) by using a defined **set of performance indicators**
- ❖ Performing **comparative assessments** of different biowaste management systems (current vs alternative scenarios)



Bio-waste (Food Waste + Garden Waste) is the largest (>40%) MSW fraction

Focus: Biowaste



- ❖ source separated biowaste and organic waste included in the Residual Waste (RW)
- ❖ other source separated waste fractions (plastic, glass, paper, textile,...) are not considered

FUNCTIONING OF THE DSWT

- The tool works with **projects** (i.e. case study) and each project can include different scenarios.
- The tool compares scenarios within a project. For each scenario, the tool considers the following key **biowaste management stages**:



- Each project can be built or **using data inventories/libraries of waste processes included in the DSWT database** or creating new/own data inventories/libraries (if available time, expertise and data).
- The values of the **performance indicators** are calculated based on the values inserted in the data inventories/libraries of the waste processes.

INDICATORS USED IN THE DSWT

The set of performance indicators used in the DSW to assess biowaste management systems cover environmental, economical, social and regulatory sustainability aspects:

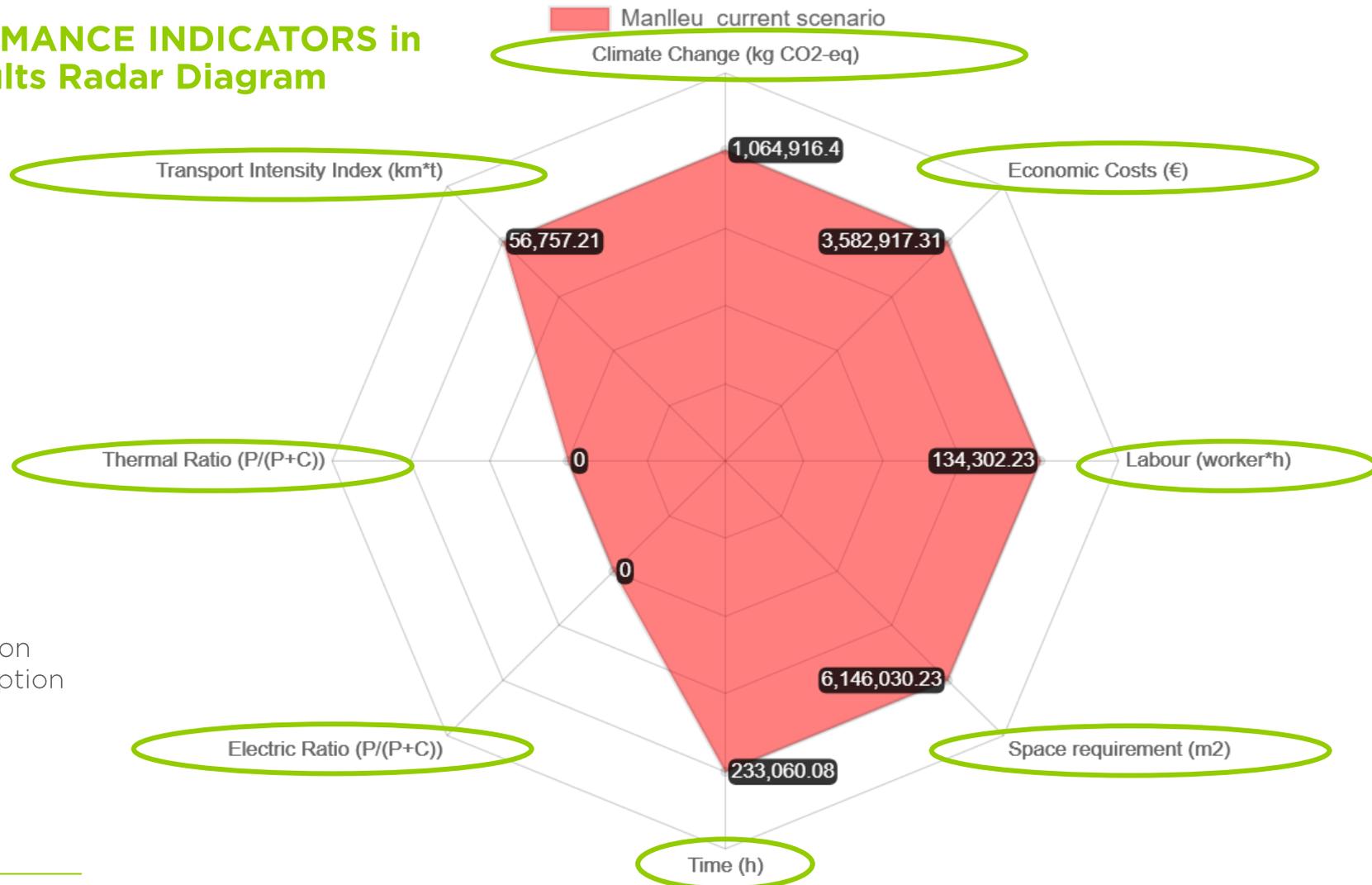
Environment	Economy	Society	Regulation	Mass Flow
<ul style="list-style-type: none"> • Climate Change(kg CO2 eq) • Energy recovery indexes (P/P+C) • Transport intensity (km*t) 	<ul style="list-style-type: none"> • CAPEX (investment costs) • OPEX (operational costs) • Revenues 	<ul style="list-style-type: none"> • Local Labour (worker - hours) • Space requirement (m2) • Sorting Time (hours) 	<ul style="list-style-type: none"> • Fertilizer regulation on heavy metals content (area needed to respect Nitrate limitation) 	<ul style="list-style-type: none"> • Biowaste, • Nutrients • Macro-impurities

PERFORMANCE INDICATORS in the Results Radar Diagram

- Results obtained from the DSWT strictly depend on this list of indicators and from the data used for building data inventories/ libraries of waste processes.

ASSESSMENT RESULTS

PERFORMANCE INDICATORS in the Results Radar Diagram



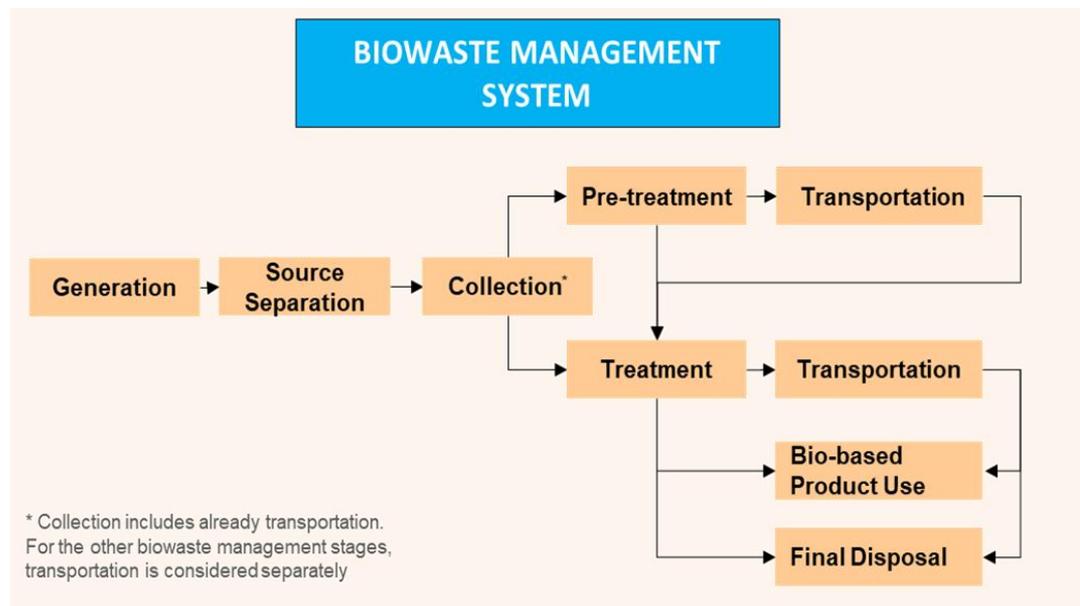
P: Production
C: Consumption

CREATING SCENARIOS IN THE DSWT

To create scenarios, we need to build **data inventories/libraries** for the waste processes of the BioWaste Management System (BWMS) to study

For each stage of the BWMS a list of data are included in the libraries of the waste processes

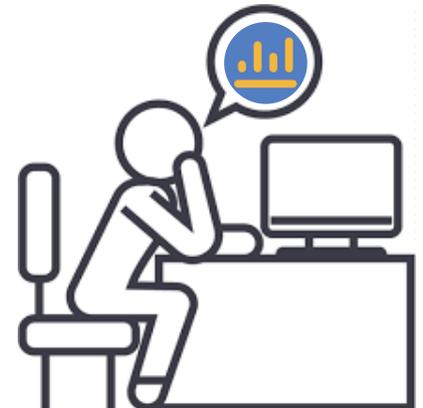
Stages of the BWMS analysed in the DSWT



BUILDING NEW LIBRARIES

If users want to build their **own/new data inventories/libraries** for the waste processes (instead of using the inventories already included in the DSWT), is important:

- To understand which data are needed for the inventories
- To look for the available data (contacting experts, consulting available reports) to calculate the data list required by the DSWT for each phase of the BWMS
- To introduce the list of data for each phase in the DSWT

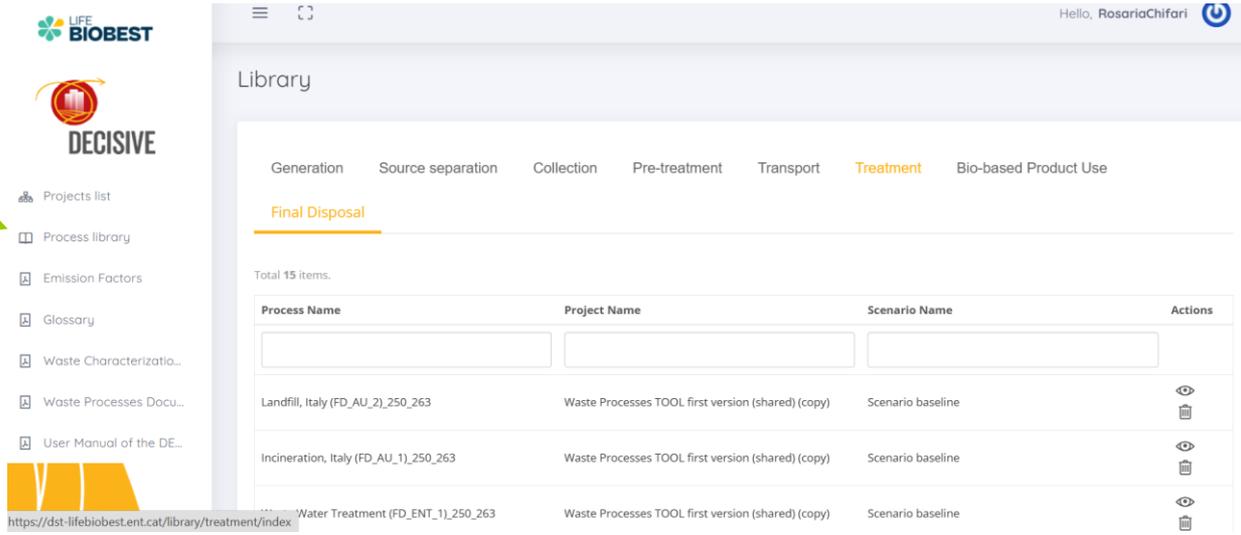


USING EXISTING LIBRARIES

If the user does not have data and time available to build new data inventories/libraries, the section Process Library provided within the tool can be used. However, it is important:

- To understand basic information about the phase in the biowaste management system to study.
- To check which existing libraries in the tool are most like the real situation
- To select the existing libraries and introduce the list of data for each phase in the DSWT

Process Library



The screenshot shows the 'Process Library' interface for the 'Treatment' phase, specifically 'Final Disposal'. The table lists the following items:

Process Name	Project Name	Scenario Name	Actions
Landfill, Italy (FD_AU_2)_250_263	Waste Processes TOOL first version (shared) (copy)	Scenario baseline	View, Delete
Incineration, Italy (FD_AU_1)_250_263	Waste Processes TOOL first version (shared) (copy)	Scenario baseline	View, Delete
Water Treatment (FD_ENT_1)_250_263	Waste Processes TOOL first version (shared) (copy)	Scenario baseline	View, Delete

Possible applications of the DSWT



POTENTIAL USERS OF DSWT

Municipalities responsible for biowaste collection

- Households and commercials
- Big biowaste generators
 - Commercial activities: hotels, restaurants, food distribution
 - Big companies with canteen for the staff)



Entities responsible for biowaste treatment

- Public authorities
- Waste management operators



Waste management consultancies and researchers

- Planning, analysing and improving collection, treatment
- and final disposal schemes



POSSIBLE APPLICATIONS OF THE DSWT



Comparing different scenarios to assess changes in biowaste management systems

Changes in the biowaste treatment schemes

- Local treatment
- Regional treatment
- National treatment

Changes in collection systems

- Street Containers
- Door to Door
- looked containers

Changes in the biowaste treatment technologies

- Home composting
- Composting
- Anaerobic Digestion

Changes in the biowaste transport

- Change in routes
- Change in waste treatment plant location
- Change in type of truck

Changes in the biowaste final disposal

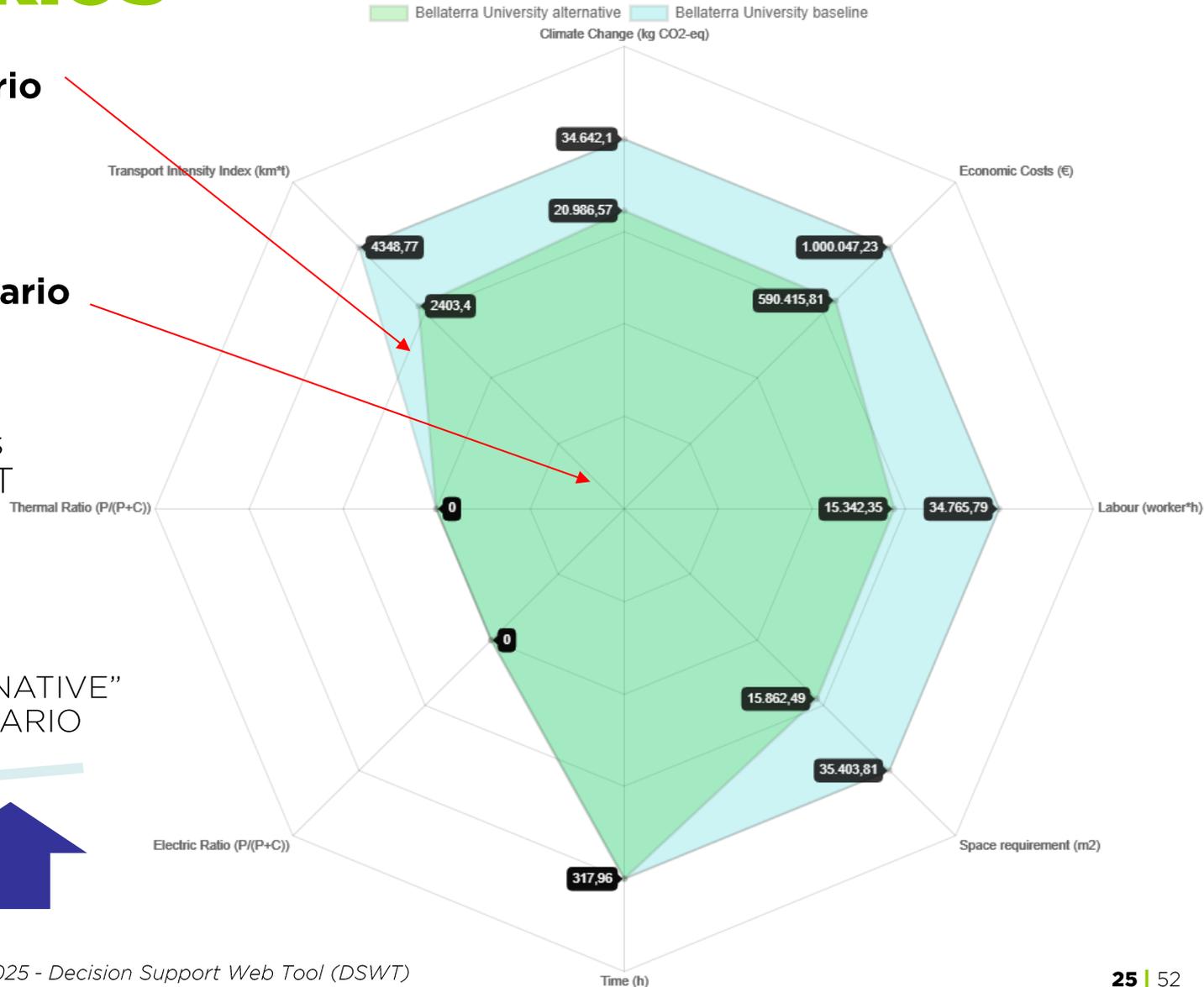
- Landfill
- Incineration
- Waste water treatment plant

COMPARING DIFFERENT SCENARIOS

Baseline scenario

Alternative scenario

The radars diagrams show how the DSWT works when comparing two different scenarios



Questions and comments



PART II - BLOCK 1

Building the simulation for biowaste management in a theoretical MedCity

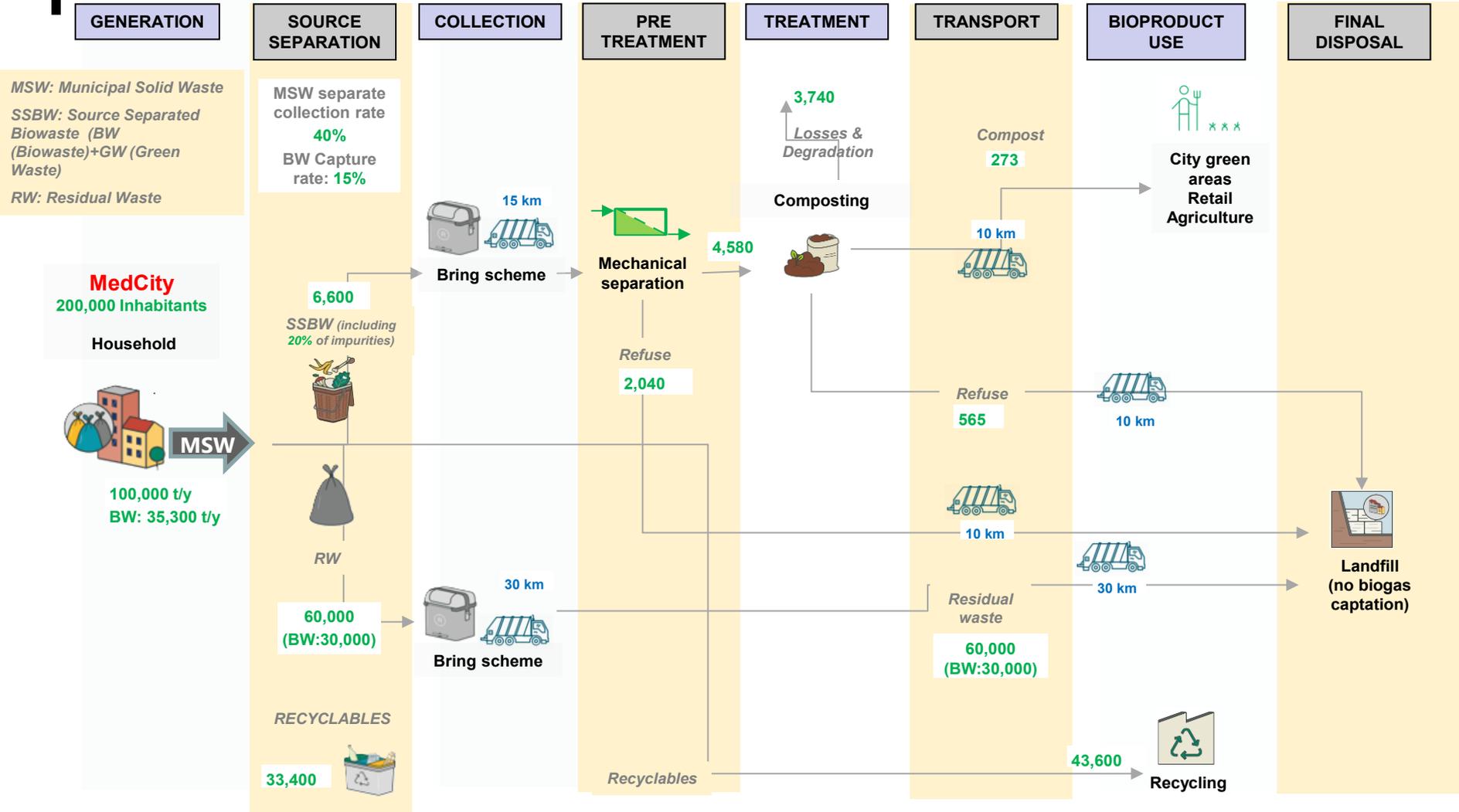


SIMULATION CASE

Case study: Theoretical Mediterranean City

- 200,000 Inhabitants;
- **Generation:** 100,000t/year of MSW (including 35,300t/year of BW)
- **Source Separation:** total recycling rate: 40% and BW capture rate: 15%. (SSBW(7%) + RW(60%) + other waste recyclables (plastic, paper, glass...) (33%));
- **Collection:** Street containers+ truck 18m³ for SSBW+RW
- **Pre-treatment:**
 - RW: No pretreatment
 - SSBW: Shredding + manual and mechanical sorting before composting
- **Treatment:**
 - RW: No treatment
 - SSBW : Composting outdoor
- **Final disposal:** *Landfill (without Biogas captation)* for RW and refuse from pretreatment and treatment

WASTE MANAGEMENT CURRENT SCENARIO



Scenario baseline



Data for Generation

Waste Management Phase

Generation

Waste type

Municipal Solid Waste

Generation Unit

Person

Type of source

Households & Food services

Time reference

2025

Location

MedCity

Source Name

Household & Commercial_MedCity

Mass Flow Parameters

Source size

1

Biowaste generation (t/unit)

0.1765

Composition Biowaste (%)

Food waste

61.19

Garden waste

38.81

Food Waste Composition

Avoidable (%)

22

Unavoidable (%)

78



Data for Source Separation

Waste Management Phase: Source Separation

Waste type (input): Municipal Solid Waste

Type of Biowaste Generation Source: Households & Food services

Type of collection: Bring-scheme

Time reference: 2025

Location: MedCity

Waste Outputs:

- Source Separated Biowaste (SSBW) *
- Residual Waste (RW) *

Waste Outputs:

- SSBW
- RW

% Macro-impurities (total) in SSBW

20

Macro-impurities Composition (%)

3.37	13.51	52.93
Metal	Other	
4.75	25.44	

Mass Flow Parameters

Mass Distribution of the input Food Waste between the Waste Outputs

Food waste in SSBW	Food waste in RW
22.0625	77.9375

Mass Distribution of the input Garden Waste between the Waste Outputs of the Source Separation Process(%)

Garden Waste in SSBW	Garden Waste in RW
3.865	96.135

Mass distribution of the FW, GW in SSBW and RW

Material inputs

Amount (unit/t)	Unit	Item name
0.034	Bin	
8.93	Bag	Plastic Bag, 10l
0.0007	Container	Plastic Container, Biowaste, 2200l
19.68	Bag	Plastic Bag, 40l
0.27	Bucket	Plastic Bucket, 40l
0.0052	container	Plastic Container, Residual, 2200l

Consumption of Bags, Buckets, Containers

Socio-economic aspects

Public and private space occupation, Private generator time

Amount (unit/t)	Unit	Item name
0.0011	m2	Private generator space
0.0180	m2	Private generator space
654	h	Private generator time
0.0049	m2	Public urban space



Data for Collection

Waste Management Phase:

Waste type (input):

Type of Source:

Type of Collection:

Time reference:

Location:

Material and energy inputs

Amount (unit/t*km)	Unit	Item name
<input type="text" value="0.00000204"/>	<input type="text" value="Truck"/>	<input type="text" value="Truck 18m3"/>
<input type="text" value="0.09"/>	<input type="text" value="Liter"/>	<input type="text" value="Diesel, Spain"/>

Consumption of:
Trucks
Diesel

Socio-economic aspects

Amount (unit/t*km)	Unit	Item name
<input type="text" value="2.44"/>	<input type="text" value="Person*Hour"/>	<input type="text" value="Worker, Spain"/>
<input type="text" value="0.00004964"/>	<input type="text" value="m2"/>	<input type="text" value="Public urban space"/>

Worker
Public space

Inventories per tonne*km

the unit impacts of such inventories are later multiplied by the tonnes of waste times the distance along which the waste is transferred.

Scenario baseline



Data for Pre-treatment

Waste Management Phase

Pre-treatment

Waste type (input)

Source separated biowaste

Type of pre-treatment

Shredding + manual and mechanical sorting

Waste Outputs

Biomass Output (BM_O) ✕

Refuse Output (RF_O) ✕

Time reference

2025

Location

MedCity

Plant Name

(Pretreatment) Composting unit

Waste Outputs:

Biomass output
Refuse output

Mass Flow Parameters

distribution of the input biowaste sub-fractions

Food Waste (input)

Garden Waste (input)

BM_O

RF_O

90

10

BM_O

RF_O

30

70

Glass - Macroimpurity

BM_O

RF_O

10

90

Paper & Cardboard - Macroimpurity

BM_O

RF_O

10

90

Plastic - Macroimpurity

BM_O

RF_O

10

90

Metal - Macroimpurity

BM_O

RF_O

10

90

Other - Macroimpurity

BM_O

RF_O

10

90

distribution of macro-impurities between two waste outputs



Data for Treatment 1/2

Composting

Type of treatment

Outdoor composting

Material and energy outputs

Methane Yield (% CH4 potential) Gas Output (% CH4) Gas Output (% CO2) Gas Output (% N2)

Biogas generated (none in this case)
Methane yield (%CH4)
Gas Composition

Material Outputs

Index	Name Output	% Input (dry weight)	C (% input C)	N (% input N)	P (% input P)	K (% input K)	As (% input Cu)	Cu (% input Cu)	Pb (% input Pb)	Zn (% input Zn)	Cd (% input Cd)	Ni (% input Ni)	Hg (% input Hg)	Cr (% input Cr)
MO_2	Compost	12	9.03	10.28	51.4	12.61	As (% input)	100	100	100				
MO_1	Solid Residue	29	5.74	6.85	28.04	0	As (% input)	0	0	0				

Material Outputs:
Distribution of nutrients in Compost and solid refuse

Energy Outputs

Amount	Parameter	Item name	Unit
0	BMP	Electricity Mix Catalonia	kWh
0	BMP	Heat, Catalonia	MJ

Energy outputs:
Electricity and heat generated

Direct Emissions

Amount	Emission
0.251	N2O
4.37	CH4
8.63	NH3

Direct emissions
N2O, CH4, NH3

Scenario baseline



Data for Treatment 2/2

Composting

Material and energy inputs

Consumption
Water
Electricity

Amount	Parameter	Item name	Unit
0.14	None	Water, Croatia	m3
0.0160	None	Electricity Mix Croatia	kWh

Socio-economic aspects

Worker
Public space

Amount	Item name	Unit
0.24	Worker, Croatia	Person*Hour
1.25	Industrial Space	m2

Capital goods

Annual Capacity
Lifetime facility
Investment cost

Annual Capacity (t/year)	Life time facility (y)	Investment Cost (€)
30000	20	4000000

1

Generation

2

Source separation

3

Collection

4

Pre-treatment

5

Transport

6

Treatment

7

Transport

8

Bio-based Product Use

8

Final Disposal

Data for Transport

waste management phase

Transport

waste type

Other

Size (tonne)

14

Type of truck

Truck of 14 t and velocity: 59 km/h

Velocity (km/h)

59

Time Reference

2025

Location

MedCity

Material and energy inputs

Amount (unit/t*km)

0.000000714

Item name

Truck 14t, rigid

Unit

Truck

Amount of trucks/t*km
Diesel consumption

0.0131

Diesel, Spain

Liter

Socio-economic aspects

Amount (unit/t*km)

0.00121

Item name

Worker, Spain

Unit

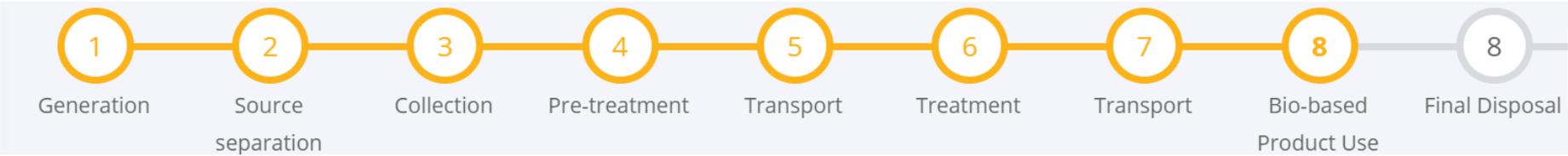
Person*Hour

Worker
Public space

0.0000125

Public urban space

m2



Data for Bio-based Product use

Use of Compost as fertilizer

Waste Management Phase: Bioproducts Use
 Product Type: Compost
 Type of Use: As soil
 Time Reference: 2009
 Location: Europe

Socio-economic aspects

Amount	Parameter	Item name	Unit
58823.529	Non	Agricultural land	m2

Direct emissions

Amount	Emission	Parameter
0.035	N2O	Nin
0.29	CO2 bind	Cin

Agricultural land

Material and energy inputs

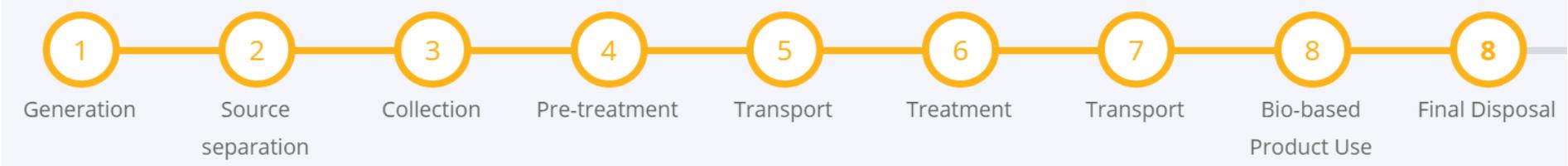
Amount	Parameter	Item name	Unit
71	Non	Diesel, Spain	Liter

Diesel consumption

N, P, K mineral fertilizer

Material and energy outputs

Amount	Parameter	Item name	Unit
-0.4	Nin	N mineral fertilizer, Europ	Tonne
-0.95	Pin	P mineral fertilizer, Europ	Tonne
-1	Kin	K mineral fertilizer, Europ	Tonne



Data for Final Disposal

Material and energy outputs

Direct emissions (kg/tonnes input)
 CO₂, CH₄, SO₂, CO, NO_x, HCl, HF, Pb, Hg, Dioxins, Cd, PCB, PAH, Chlorobenzene

Amount	Emission
0.0774	SO ₂
0.0329	HCl
51.7123	CH ₄
0.1096	CO
215.7534	CO ₂
0.0168	NO _x
0.0031	HF
0.000000379	Pb
0.00000000240	Cd

Annual Capacity
 Lifetime facility
 Investment cost

Capital goods

Annual Capacity (t/year)	Life time facility (y)	Investment Cost (€)
180000	40	4000000

Landfill (no biogas captation)

Residue outputs
wastewater

Amount	Item name	Unit
8.70	WW treatment, Europe	m ³

Energy outputs:
Electricity generated

Material and energy inputs
Diesel and electricity consumption

Amount	Item name	Unit
0.000963	Electricity Mix Croatia	kWh
0.734	Diesel, Croatia	Liter
0.004	Water, Croatia	m ³

Socio-economic aspects
Worker
Public space

Amount	Item name	Unit
0.029333	Worker, Croatia	Person*Hour
0.16444	Industrial Space	m ²

INTRODUCTION OF THE DISTANCES

Average distances among the processes origin and process of destination need to be introduced as last step of scenarios building

MedCities_ MedCity · Scenario

Scenarios

Please, add the Scenario to be assessed using the "Add new Scenario" Option. The aim of this step is defining all the technological pathway that the biowaste generated in each WMZ follows. The definition of the scenario is the "sum" of the definition of each waste management stage (generation, source separation, collection, pre-treatment, treatment, transportation, final disposal and bio-products use) for all the WMZs included in the Study Zone.

+ Add new Scenario

Scenarios

Code	Scenario Name	Actions	Results
00402	MedCity_current scenario		

Manual Entry of Collection and Transportation Distances

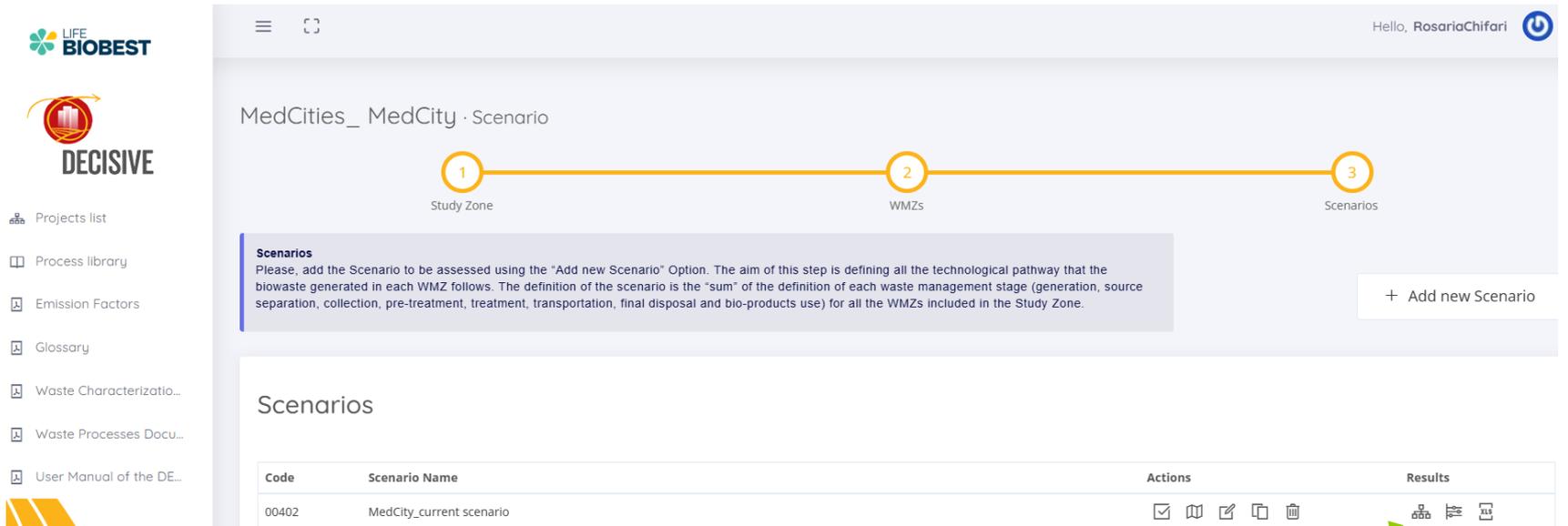
Collection & Transportation Process	Process of Origin	Process of Destination	Distance (km)
Household_Containers_SSBW_MedCity_Truck18m3	Household & Commercial_MedCity	Shredding + manual and mechanical sorting before composting_SS BW_MedCity	<input type="text" value="10"/>
Truck_Refuse composting &PT_14t_59km/h_MedCity	Shredding + manual and mechanical sorting before composting_SS BW_MedCity	Landfill_no Biogas captation_MedCity	<input type="text" value="10"/>
Truck_Compost_14t_59km/h_MedCity	Outdoor_composting_SSBW_MedCity	Compost_Fertilizer_EU_MedCity	<input type="text" value="10"/>
Household_Containers_RW_MedCity_Truck18m3	Household & Commercial_MedCity	No Treatment_RW_MedCity	<input type="text" value="30"/>
Truck_Refuse composting &PT_14t_59km/h_MedCity	Outdoor_composting_SSBW_MedCity	Landfill_no Biogas captation_MedCity	<input type="text" value="10"/>

PART II - BLOCK 2

Results of the simulation and comparing scenarios



FINAL ASSESSMENT



Scenarios
Please, add the Scenario to be assessed using the "Add new Scenario" Option. The aim of this step is defining all the technological pathway that the biowaste generated in each WMZ follows. The definition of the scenario is the "sum" of the definition of each waste management stage (generation, source separation, collection, pre-treatment, treatment, transportation, final disposal and bio-products use) for all the WMZs included in the Study Zone.

Code	Scenario Name	Actions	Results
00402	MedCity_current scenario	    	  

Biowaste flow diagram

Results of simulation (radar diagram)

Excel file with calculations and parameters

EXCEL FILE WITH CALCULATIONS



MedCities_MedCity-MedCity_current scenario... Saving...

File Home Insert Draw Page Layout Formulas Data Review View Automate Help Acrobat

Clipboard Font Alignment Number Styles Cells Editing Add-ins Adobe Acrobat

D3 BIOWASTE GENERATION

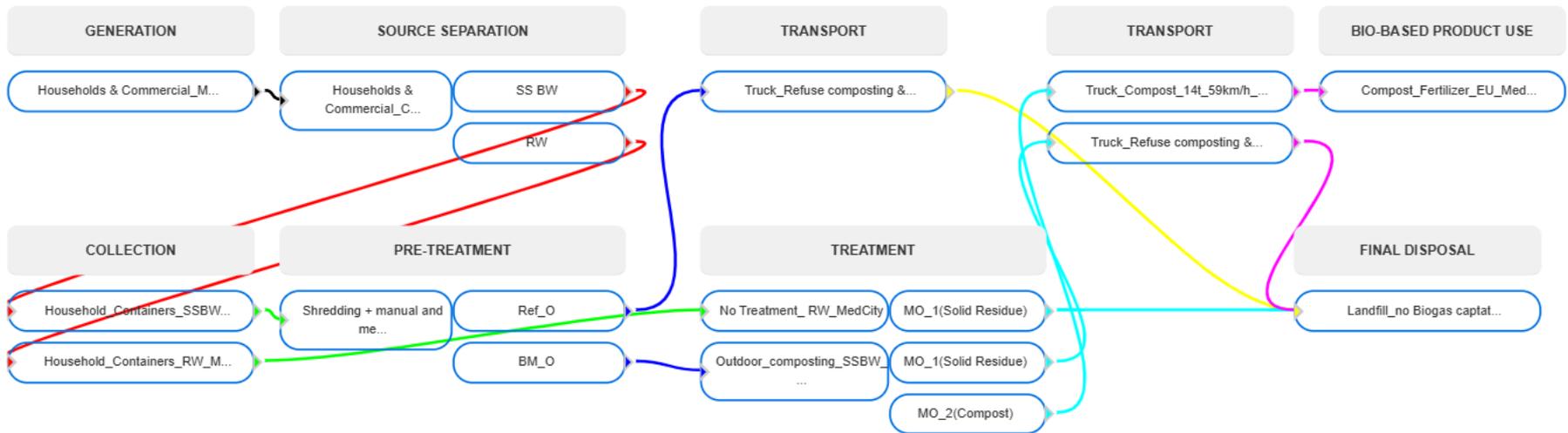
		BIOWASTE GENERATION		SOURCE SEPARATION			
Flows of biowaste sub-fractions, macro-impurities, Total solids (TS) & Chemical compounds		Household & Comme		Household & Commercial_MedCity			
				OUTPUT WASTE			
		Unit	INPUT WASTE	SS BW	RW	GW	
Food waste		t ww	21600.07	21600.07	4765.51544	16834.5546	0
Garden Waste		t ww	13699.93	13699.93	529.502295	13170.4277	2411.18768
Macro-impurities	Glass	t ww			44.6105244		
	Paper & Cardboard	t ww			178.839224		
	Plastic	t ww			700.663222		
	Metal	t ww			62.8783356		
	Other	t ww			336.763128		
Agregated amount (t ww)		t ww	35300	35300	6618.77217	30004.9823	2411.18768
TS		%	36.11673451	36.1167345	41.5159027	37.2856496	50.1851852
C		t	5685.910927	5685.91093	732.761398	4953.14953	504.563348
N		t	254.1068447	254.106845	42.2120739	211.894771	13.3954871
P		t	28.86423608	28.8642361	6.36817209	22.496064	0

Scenario Mass Balance Scenario Extensive Results KPIs Compliance

Biowaste composition; mass distribution

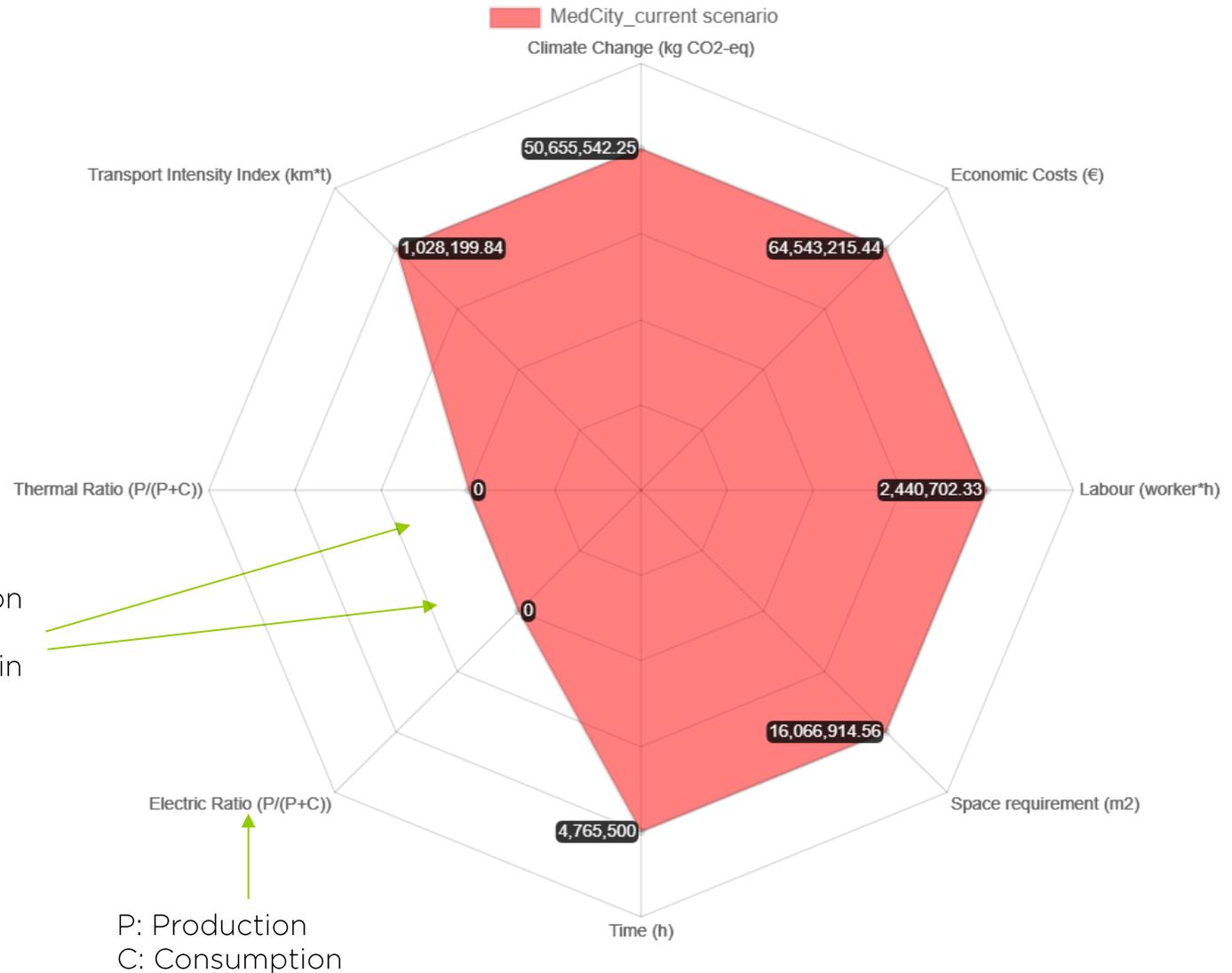
Check of compost and digestate compliance with different standards and regulation (i.e. heavy metals content)

BIOWASTE FLOW DIAGRAMM



Households & commercial
biowaste management
scheme in MedCity

RESULTS OF THE SIMULATION



- No electricity either thermal energy generation in composting plant
- No electricity generated in landfill (no biogas captation)

Comparing scenarios



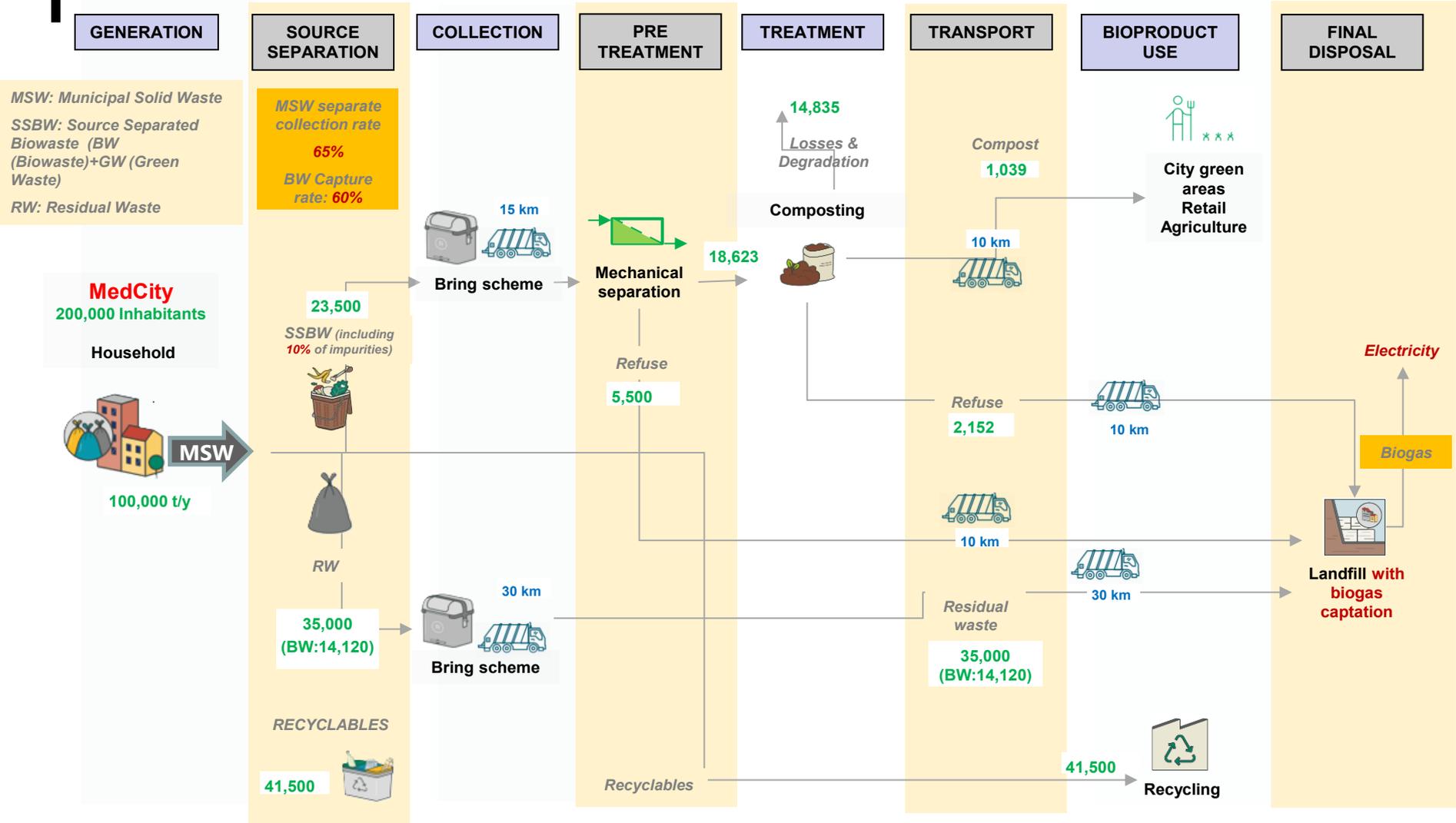
SIMULATION CASE

Alternative

Case study: Theoretical Mediterranean City (alternative)

- 200,000 Inhabitants;
- **Generation:** 100,000t/year of MSW (including 35,300t/year of BW)
- **Source Separation:** total recycling rate: **65%** and BW capture rate: **60%**. (SSBW(33%) + RW(42%) + other waste recyclables (plastic, paper, glass...) (25%)); **Collection:** Street containers+ truck 18m³ for SSBW+RW
- **Pre-treatment:**
 - RW: No pretreatment
 - SSBW: Shredding + manual and mechanical sorting before composting
- **Treatment:**
 - RW: No treatment
 - SSBW : Composting outdoor
- **Final disposal:** *Landfill (with Biogas captation)* for RW and refuse from pretreatment and treatment

WASTE MANAGEMENT ALTERNATIVE SCENARIO



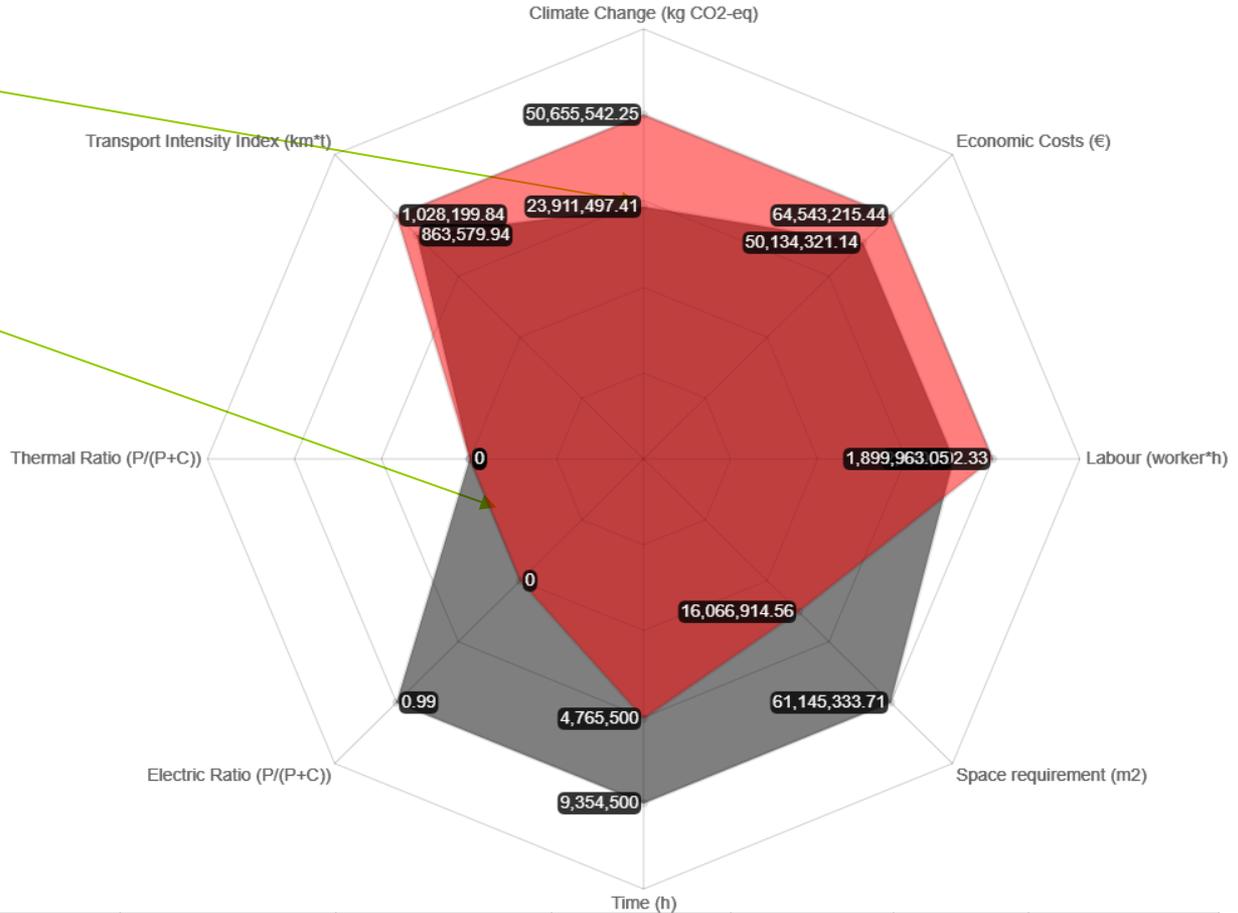
COMPARING SCENARIOS

MedCity_current scenario MedCity_alternative scenario

Current scenario

Alternative scenario

- Less expensive mainly for energy generation.
- Higher space requirement for larger composting area since SSBW increased
- Less emissions impact due to the reduction of BW amount going to landfill and because of saved emissions for using renewable electricity (biogas captation)



Scenario	Climate Change	Economic Costs	Labour	Space requirement	Time	Electric Ratio	Thermal Ratio	Transport Intensity Index
	kg CO2-eq	€	worker*h	m2	h	(P/(P+C))	(P/(P+C))	(km*t)
MedCity baseline	50,655,542	64,543,215	2,440,702	16,066,915	4,765,500	0	0	1,028,200
MedCity alternative	23,911,497	50,134,321	1,899,963	61,145,334	9,354,500	0.99	0	863,580

PART II - BLOCK 3

**Conclusions: strengths vs weakness of
the DSWT**

DSWT

Strengths and weaknesses

Strengths

- Multicriteria evaluations of existing and potential/alternative waste management systems by using different indicators are evaluated and can be visualized simultaneously.
- Libraries available related to existing facilities to build scenarios easily



Weaknesses

- Big amount of data are needed to create specific and new waste process inventories
- Further improvements could be included to make the DSWT more user friendly



CONCLUSIONS

1/2

The **DSWT** is a **systematic and automatic tool**, based on multicriteria analysis, **to simulate** scenarios of biowaste managements and **assess** their **performance** to support a decision-making when planning changes or evaluate the existing systems.

The tool can be used by local and regional authorities and for planning managers:

- to **visualize** the current biowaste management system and **identify deficits** that can be approached by using different alternative scenarios
- to have a **holistic view** about the performance of the current biowaste management systems and **comparing** it with **alternative scenarios**
- to **support the decision** when there are **many parameters** to consider
- to be **supported when defending proposed solutions**

CONCLUSIONS

2/2

- The **DSWT** offers an objective **first assessments** and **comparisons among scenarios**. However, the final decision needs experienced people/teams that can adequately interpret the results produced.
- **Data gathering process** to build new waste process libraries and the scenarios **is intense** in terms of time and effort (lack of standardized datasets that properly describe biowaste management systems at local scale).
- Results should be taken with **caution** in case of **uncertainties** and **poor quality of available data**. Data inserted in the tool impact directly the results.
- The possibility to **update/change** the data inventories of waste processes to build scenarios of biowaste management options **according to the local contexts** will make it possible to introduce more precise values and obtain **more accurate results**.

Questions and comments



FINAL COMMENTS

- The DSWT also supports simulations for scenarios where biowaste is not source-separated. In these cases, the tool models the fate of the organic fraction as part of the mixed residual waste stream.
- The DSWT enables the simulation of scenarios within the same city under varying contextual conditions, such as seasonal changes that may affect the generation of biowaste.
- The role of citizens is partially assessed through three parameters: the time required by individuals to separate biowaste, the space available in households for placing separate collection containers, and the labor involved, measured in person-hours, for all phases of the biowaste management process.



This project is funded
by the European Union



Rosaria Chifari
r.chifari@ent.cat

www.ent.cat



**Thanks for
your attention**