

Update on Life Cycle Costing (LCC) project

Ugo Pretato – Elia Rillo
Studio Fieschi & soci S.r.l.
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STUDIO FIESCHI
& SOCI



Scuola Superiore
Sant'Anna
di Studi Universitari e di Perfezionamento

Summary

- Introduction
- Project timeline
- Methodology
 - ❖ *Direct costs*
 - ❖ *Externalities*
- Results from the pilot phase
- Tool structure and features
- User's Guide
- Changes to be implemented in the tool
- Next steps



Introduction

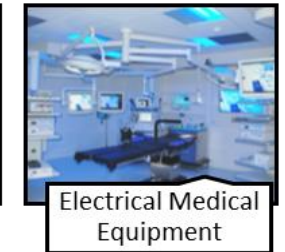
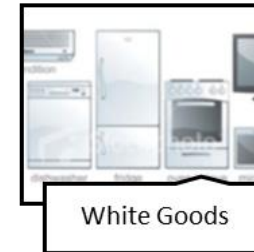
Project goal

Develop an electronic tool that will help the user to calculate the life cycle costs for goods where a substantial part of the overall costs comes from electricity use.

The tool may be used as part of a tendering process, as a contribution to developing a business case, or to analyse the current situation in view of a potential need of further purchases.

The tool is focused on five product categories:

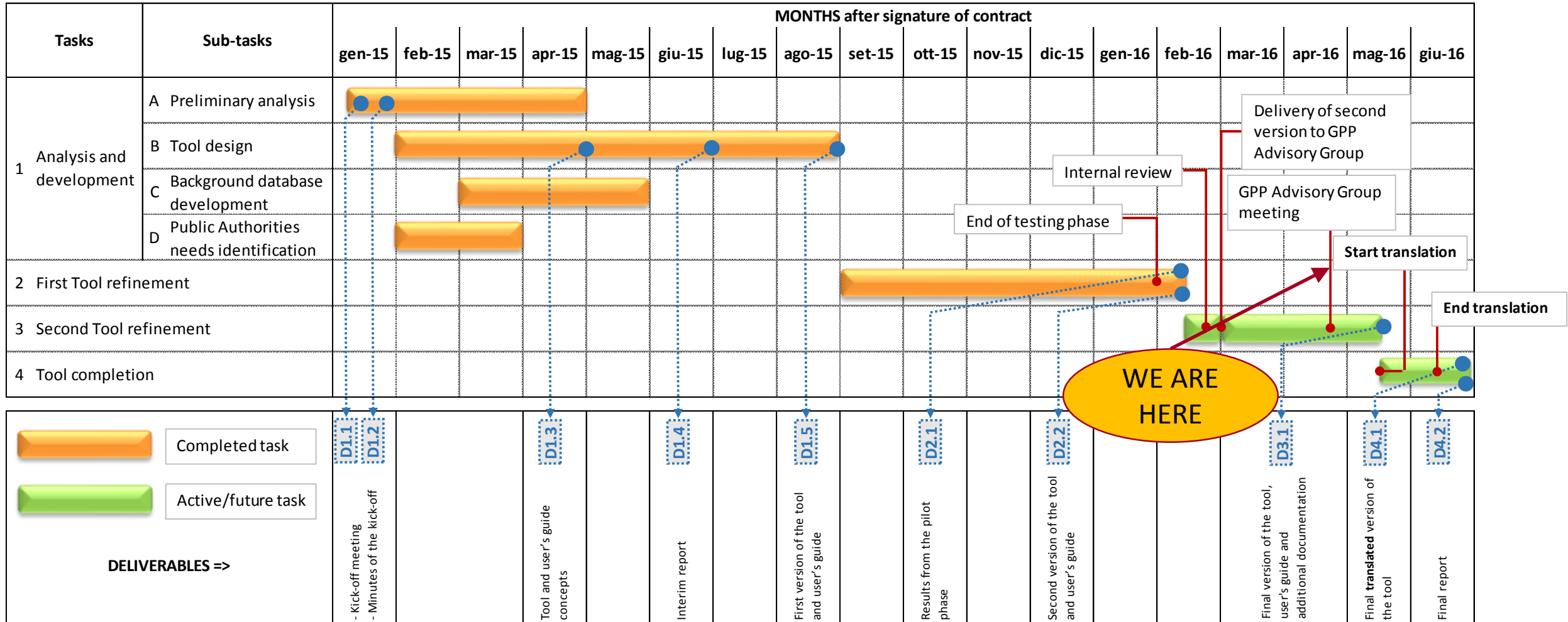
- Office IT equipment
- Office & street lighting
- White goods
- Vending machines
- Electrical medical equipment



Project team:

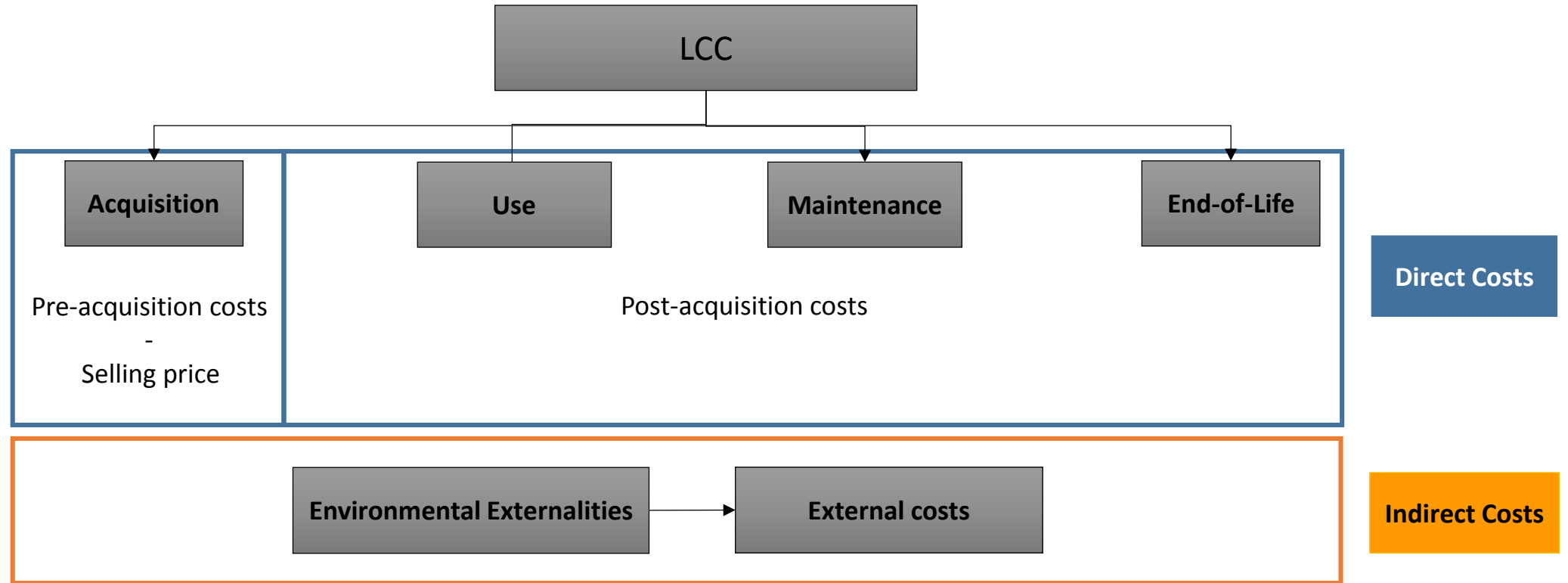
- Studio Fieschi & soci
- Scuola Superiore Sant'Anna di Pisa (SSSUP)

Project timeline



Methodology

Life-Cycle Costing is a methodology where costs of a given asset are considered throughout its life-cycle (2014/24/EU - Art. 67)



Costs imputed to environmental externalities linked to the product, service or works during its life-cycle, provided their monetary value can be determined and verified. (2014/24/EU - Art. 68)



Direct costs

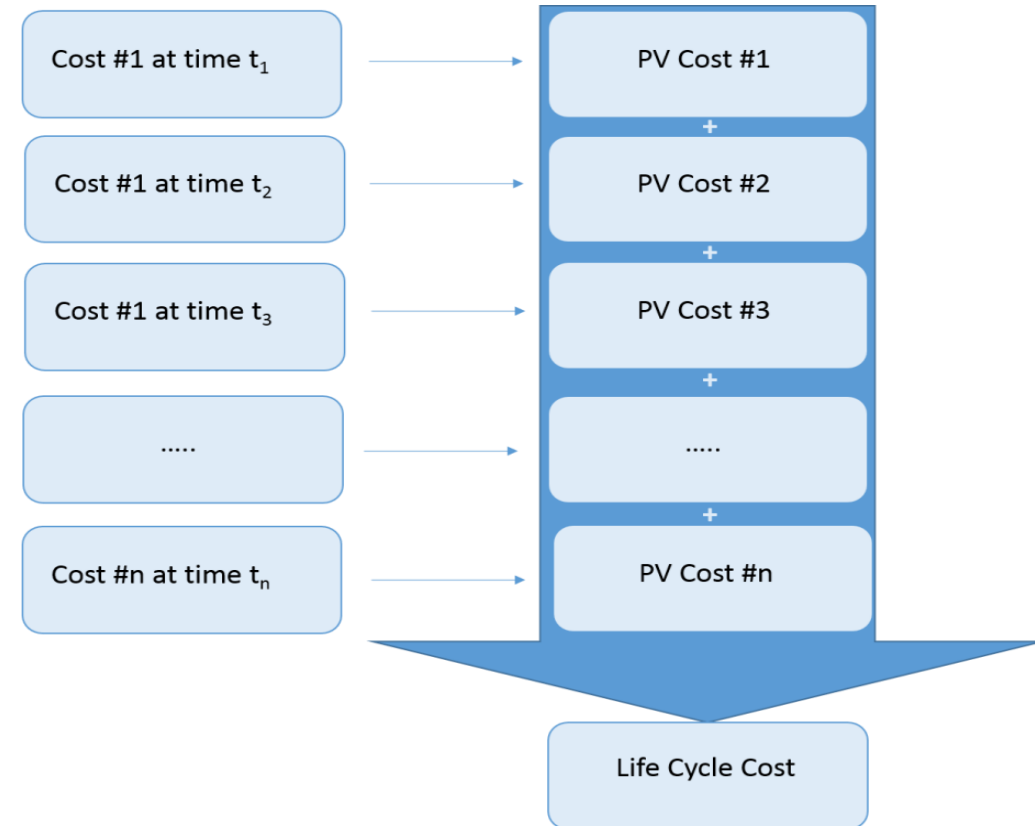
Direct costs are costs paid by the Public Administration along the life cycle of a product:

- Purchasing cost
- Distribution costs
- Installation costs
- Costs of functioning during the use phase (e.g. energy, water, consumables, etc.)
- Repair and maintenance costs
- Disposal, recycling costs

The LCC approach identifies all future costs and reduces them to their present value by the use of discounting techniques.

Steps in the calculation of LCC:

- Identifying and calculating the cost items
- Discounting all costs to the baseline period
- Summing up discounted costs to establish the present value



Externalities

During the development of the tool, the following externalities have been assessed:

- **Climate Change**
- **Human Health**
- **Ecosystems**
- **Resources Availability**

It was evaluated and agreed with the Commission that the available methods for the evaluation and monetization of externalities for Human Health, Ecosystems and Resources Availability are currently not robust enough to meet the requirements of Art. 68 of Directive 2014/24/EU.

Therefore, **the tool performs calculations only for the impact category Climate Change and only related to the use phase of products.**

Since more robust methods could become available in future, the tool is structured to allow an easy upgrade including calculations for the other impact categories.

CALCULATION PROCEDURE

The equation exemplifies the calculation procedure for externalities, referred to the impact category Climate Change, for 1 kWh of electricity (EU 27 mix).

$$1 [kWh] * 0.569 \left[\frac{kgCO_2 eq}{kWh} \right] * 0.04 \left[\frac{€}{kgCO_2 eq} \right] = 0.023 €$$

EXTERNALITY	IMPACT FACTOR FOR 1 kWh OF ELECTRICITY (EU 27 PRODUCTION MIX)	MONETIZATION FACTOR (DIRECTIVE 2009/33/EC)	MONETARY VALUE FOR 1 kWh OF ELECTRICITY (EU 27)
Climate change	0.569	0.04	0.023 €



Results from the pilot phase (1/2)

Purpose of the testing phase was to **collect feedback on the LCC tool usability** by a sample of public administrations involved in procurement activities, which represent the main target of the LCC tool project.

The tool test obtained an overall positive feedback. All participants were able to use the tool in various exercises and to explore the whole range of capabilities.

Only few and minor errors were reported. All of them were investigated and resolved.

The participants expressed interest for instruments such as the LCC tool as support for decision-making, especially regarding the assessment of direct costs. Two participants declared doubts regarding the use of externalities in Public Procurement procedures.

Participants (name of organization)	Country
ARPA Piemonte	Italy
City of Rotterdam	The Netherlands
Technical Office of the Undersecretary of the Ministry of Agriculture, Food and Environment	Spain
Regionservice Medicinsk teknik Region Örebro län	Sweden



Results from the pilot phase (2/2)

MAIN COMMENTS

- All participants were able to use the tool
- All participants found the tool friendly and easy to use
- A few difficulties interacting with the tool were reported, in most cases related to non-fully compatible versions of MS-Office
- Two participants suggested to skip externalities evaluation since it may generate uncertainty in the tender awarding process
- One participant suggested to include more explanations on how to use the tool for tender evaluation
- One participant pointed out that using such tool for centralized acquisition may result in an excessive workload for the PA. In addition, it would increase the risk of errors

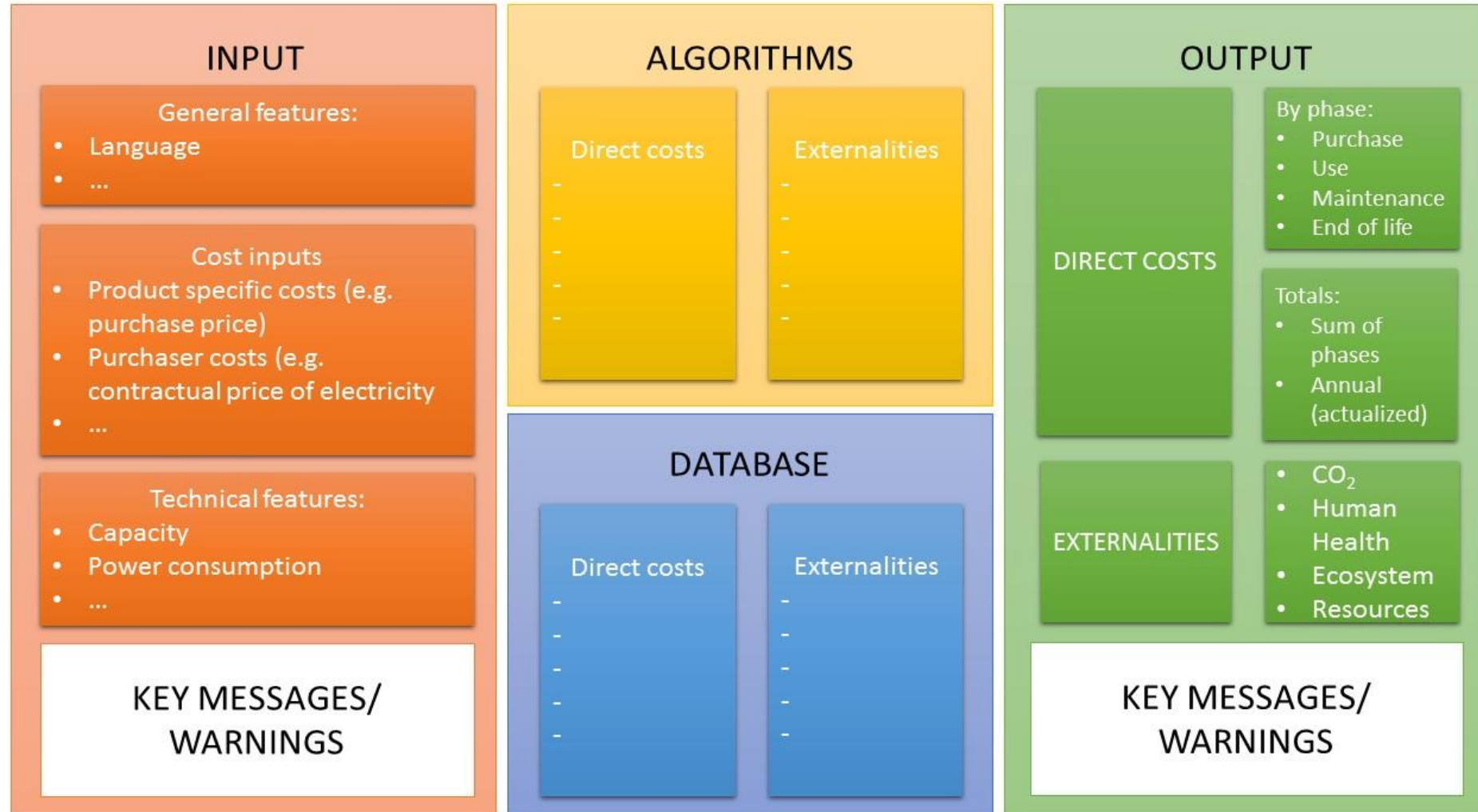


Tool: structure & features

LCC CALCULATION TOOL

Calculation tool developed to meet the requirements of EU Directive 24/2014 regarding the implementation of life cycle perspective in public procurement.

The tool has been developed with Ms-Office 2013, for MS-Windows based computers. The tool has been tested also on Office 2010.




WELCOME (section)

WELCOME PAGE

This page includes:

- General instructions (1)
- The complete list of sheets available in the tool (2)

To browse the tool, the user shall use the provided navigation buttons (3)

"Life Cycle Costing (LCC) calculation Tool"	Developed by: STUDIOFIESCHI & SOCI  Scuola Superiore Sant'Anna <small>di Studi Universitari e di Perfezionamento</small>
v.0.8 30/03/2016	

Warning

Please note: this Tool has been developed and tested with Excel 2013 and 2010. In order to use it, macros have to be activated. To enable macros, go to File => Options => Trust center => Trust Center Settings => Macro settings and select "Disable all Macros with notification". In the yellow banner, select "Enable content" to activate the macros.

Introduction

This is an electronic tool designed to perform life cycle costing (LCC) for a specific range of products commonly featured in public tenders.

The tool, distributed by the European Commission, derives from provisions made in the new Directive 2014/24/EU, which significantly innovates the tender evaluation and award process through placing considerable importance on LCC.

1

INSTRUCTIONS	
•	Use coloured buttons to access the forms to fill in data
•	Use grey buttons to browse the tool
•	The table below includes a complete list of the available sheets.
•	Detailed instructions are included in the User's Guide

2

Sheet name		Content		
•	MAIN	Select the general settings (e.g. tool language, currency, exchange rate).		
		Product category	Reference product	Available actions
•	IT_PC	Office IT equipment	Computer	Insert, edit or delete products.
•	IT_DS	Office IT equipment	Computer Display	Insert, edit or delete products.
•	IT_IE	Office IT equipment	Imaging equipment	Insert, edit or delete products.
•	LT_GL	Office & street lighting	Generic luminaire	Insert, edit or delete products.

3

GO TO MAIN
GO TO REFERENCES



MAIN (section)

MAIN CONTROL PANEL

With the control panel, the user has access to the general settings:

- Language
- Currency
- Product category and product
- User details
- Comments

MAIN CONTROL PANEL	
Tool language	English
Currency	[EUR] euro
Exchange rate	1 EUR = 1 EUR
Exchange rate reference date	31/08/2015
Product category	White goods
Product	Washing machine
User name	John
User information (e.g. office/branch)	Doe
Comments	

PRODUCT SHEETS (section)

PRODUCT SHEET

The tool includes 22 sheets to assess the various products included in the tool scope.

All data are saved in the reference sheet where the user may edit and/or delete them.

Each sheet can store data for up to ten products.

Product category		White goods						
Product		Washing machine						
GENERAL DATA								
N°	INPUT NAME		UNIT	VALUE				
1	Discount rate		%	2,50%				
2	Amortization coefficient		%	10,00%				
3	Electricity price		EUR/kWh	0,15				
4	Country		-	EU				
5	Economic period considered		Years	10				
PRODUCT SPECIFIC DATA								
N°	LIFE CYCLE PHASE	INPUT NAME	UNIT	Supplier_1 - Prod_1	Supplier_1 - Prod_2	Supplier_2 - Prod_3	Supplier_3 - Prod_4	
1	Purchase	Purchasing cost	EUR	500	600	400		
2		Delivery expenses	EUR	0	20	0		
3		Installation cost	EUR	0	0	0		
4	Use & end-of-life	Number of cycles per year	Cycles/year		150			
5		Annual electricity consumption	kWh/year	350		357		
6		Electricity consumption per cycle	kWh/cycle		1,8			
7		Cycle duration	min/cycle		120			
8		Power consumption in left on-mode	W		15			
9		Power consumption in off-mode	W		5			
10		Annual thermal energy consumption	MJ/year	750	500	800		
11		Thermal energy consumption per cycle	MJ/cycle					
12		Thermal energy source	-	Light fuel oil	Wood pellets	Natural gas		
13		Energy price for thermal energy production	EUR/MJ	0,04	0,04	0,04		
14		Annual water consumption	Liters/year	3000	2800	3000		
15		Water consumption per cycle	Liters/cycle					
16		Water price	EUR/m3	2	2	2		
17		Annual detergent consumption	kg/year	70	70	70		
18	Detergent consumption per cycle	kg/cycle						
19	Cost of detergent	EUR/kg	2	2	2			
20	Annual softener consumption	kg/year	15	15	15			
21	Softener consumption per cycle	kg/cycle						
22	Cost of softener	EUR/kg	2	2	2			
23	Annual rinsing agent consumption	kg/year	10	10	10			
24	Rinsing agent consumption per cycle	kg/cycle						
25	Cost of rinsing agent	EUR/kg	2	2	2			
26	Warranty	Years	2	2	2			
27	Maintenance/service contract costs	EUR/year	40	50	60			
28	Estimated maintenance costs	%						
29	Expected product lifetime	Years	10	8	8			
30	Cost of disposal	EUR	10	10	10			
31	Rated capacity	kg	5	6	5			
32	Rated capacity	kg/h						



PRODUCT SHEETS: user form

GENERAL DATA

Data are filled using a form, designed to guide the user through the entire process.

The first set of information is related to general data, i.e. valid for all products modeled in the selected sheet (1).

The voice 'Country' will allow the regionalization of externalities in future versions (2). In the current version European Union is set by default.

Product category	White goods
Product	Washing machine

GENERAL DATA	
N°	
1	Discount rate
2	Amortization coefficient
3	Electricity price
4	Country
5	Economic period con

PRODUCT SPECIFIC	
N°	LIFE CYCLE PH
1	
2	Purchase
3	
4	
5	
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18	Use & end-of-l
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32	

White goods | Washing machine

GENERAL DATA

General data - To be used for all products inside this product family

Discount rate	2.5	%
Amortization coefficient	10	%
Electricity price	0.15	EUR/kWh
Economic period considered	10	Years
Country	[EU] European Union	

SAVE DATA AND ADVANCE TO PAGE 1 >>

PRODUCT SHEETS: user form

PRODUCT DATA MANAGEMENT

In the second page product specific data can be managed. Available actions are:

- Create a new product (1)
- Edit existing products (2)
- Delete existing products (3)

The screenshot displays a software interface for product data management. The main window shows a table with columns for 'Product category' and 'Product'. A modal window titled 'White goods | Washing machine' is open, displaying 'PRODUCT SPECIFIC DATA'. The modal has three main actions: 'Create new product' (circled in red and labeled '1'), 'Edit existing product' (boxed in red and labeled '2'), and 'Delete existing product(s)' (boxed in red and labeled '2'). A green button labeled 'CONFIRM AND CREATE NEW PRODUCT' is also visible. The background table shows various product details like 'Discount rate', 'Amortization coefficient', 'Electricity price', 'Country', and 'Economic period'.

PRODUCT SHEETS: user form

PRODUCT SPECIFIC INPUTS

All product specific inputs are organized following a life cycle perspective, therefore a distinction between life stages is established. The first inputs are related to the purchase phase.

Product category	White goods
Product	Washing machine

GENERAL DATA	
N°	
1	Discount rate
2	Amortization coefficient
3	Electricity price
4	Country
5	Economic period con

PRODUCT SPECIFIC	
N°	LIFE CYCLE PH
1	Purchase
2	
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White goods | Washing machine

Purchase

Purchasing cost: 500 EUR

Delivery expenses: 0 EUR

Installation cost: 0 EUR

ADVANCE TO NEXT PAGE >>

Supplier 1 - Prod 1

	EUR	1U	1U	1U
Cost or disposal				
Rated capacity	kg	5	6	5
Rated capacity	kg/h			

PRODUCT SHEETS: user form

PRODUCT SPECIFIC INPUTS

The second set of data refers to use & end-of-life stages. In this section data such as energy and water consumption, **product lifetime** and cost of disposal are filled in.

For some inputs the user may select an **alternative option**, set to facilitate data collection.

Points where changes are planned
See slides 26-27

Product category		White goods			
Product		Washing machine			
GENERAL DATA					
N°		White goods Washing machine			
1	Discount rate				
2	Amortization coefficient				
3	Electricity price				
4	Country				
5	Economic period con				
PRODUCT SPECIFIC					
N°	LIFE CYCLE PH	Use & end-of-life			
1		Thermal energy source			
2	Purchase	Energy price for thermal energy production	0,04	EUR/MJ	<input type="checkbox"/> Alternative data
3		Annual water consumption	3000	Liters/year	<input type="checkbox"/> Alternative data
4		<i>Water consumption per cycle</i>		Liters/cycle	
5		Water price	2	EUR/m3	<input type="checkbox"/> Alternative data
6		Annual detergent consumption	70	kg/year	<input type="checkbox"/> Alternative data
7		<i>Detergent consumption per cycle</i>		kg/cycle	
8		Cost of detergent	2	EUR/kg	<input type="checkbox"/> Alternative data
9		Annual softener consumption	15	kg/year	<input type="checkbox"/> Alternative data
10		<i>Softener consumption per cycle</i>		kg/cycle	
11		Cost of softener	2	EUR/kg	<input type="checkbox"/> Alternative data
12	Annual rising agent consumption	10	kg/year	<input type="checkbox"/> Alternative data	
13	<i>Rinsing agent consumption per cycle</i>		kg/cycle		
14	Cost of rinsing agent	2	EUR/kg	<input type="checkbox"/> Alternative data	
15	Warranty	2	Years	<input type="checkbox"/> Alternative data	
16	Maintenance/service contract costs	40	EUR/year	<input type="checkbox"/> Alternative data	
17	<i>Estimated maintenance costs</i>	0	%		
18	Use & end-of-l	Expected product lifetime	10	Years	
19		Cost of disposal	10	EUR	
20		Rated capacity	5	kg	<input type="checkbox"/> Alternative data
21		<i>Rated capacity</i>		kg/h	
22		<input type="button" value=" << GO BACK"/> <input type="button" value=" CONFIRM AND SAVE DATA"/>			
23		Supplier 1 - Prod 1			
30	Cost of disposal	EUR	10	10	10
31	Rated capacity	kg	5	6	5
32	Rated capacity	kg/h			

PRODUCT SHEETS: Help

HELP

For each input, the orange button with the question mark displays the help window.

Help windows provide information regarding the selected input (definition, WARNING, DEFAULT VALUES).

The screenshot displays a software interface for a product sheet. The main window is titled 'White goods | Washing machine' and contains a table with columns for 'GENERAL DATA' and 'PRODUCT SPECIFIC'. The 'GENERAL DATA' section includes fields for 'Discount rate', 'Amortization coefficient', 'Electricity price', 'Country', and 'Economic period coefficient'. The 'PRODUCT SPECIFIC' section includes a 'LIFE CYCLE PHASE' table with rows for 'Purchase' and 'Use & end-of-life'. An orange button with a question mark is visible next to the 'Use & end-of-life' input field.

A help window is open, titled 'Maintenance/service contract costs'. It contains the following text:

NAME
Maintenance/service contract costs

DETAILS
This cost includes all the costs sustained by the final user during the useful lifetime of the appliance that cover all the actions which have the objective of retaining or restoring an item in or to a state in which it can perform its required function. The actions include the combination of all technical and corresponding administrative, managerial, and supervision actions. Examples of included costs are: cost of personnel for maintenance and repair of the appliance, cost of spare parts, cost of upgrading.

WARNING: if the product is subject to service contract, the fee must be inputted here. Cost of functioning (e.g. energy, water..) are computed separately.

An orange 'OK' button is located at the bottom right of the help window.



OUTPUT (section)

GENERAL INFORMATION

The first page of the OUTPUT sheet displays the products under assessment (incomplete data are marked by a red '!').

In addition, this page features general remarks about the interpretation of results.

GENERAL INFORMATION

ANALYSIS DETAILS

PRODUCT CATEGORY	White goods	WG
PRODUCT	Washing machine	WM

PRODUCT NAMES LEGEND

CODE	PRODUCT NAME
WG_WM-1	Supplier_1 - Prod_1
WG_WM-2	Supplier_1 - Prod_2
WG_WM-3	Supplier_2 - Prod_3
WG_WM-4	Supplier_3 - Prod_4

DETAILS ON THE INTERPRETATION OF RESULTS:

Contents available:

- General information
- Life Cycle Costing results - Direct costs
- Cost distribution over time
- Externalities - Climate Change
- Externalities - Human health (disabled)
- Externalities - Ecosystem (disabled)
- Externalities - Resources availability (disabled)
- Overall Life Cycle Costing results - Direct costs and externalities

WARNING: The tool shows results only for those products where all necessary data to perform the calculations have been filled in. Incomplete products are marked with an "!" in the legend and are greyed out in the results tables.

WARNING: externalities results for the impact categories Human Health, Ecosystems and Resources availability are disabled in this version of the tool. For details, see the Technical Specifications, Annex II.

DETAILS ON THE INTERPRETATION OF RESULTS:



OUTPUT: direct costs

LIFE CYCLE COSTING RESULTS – DIRECT COSTS

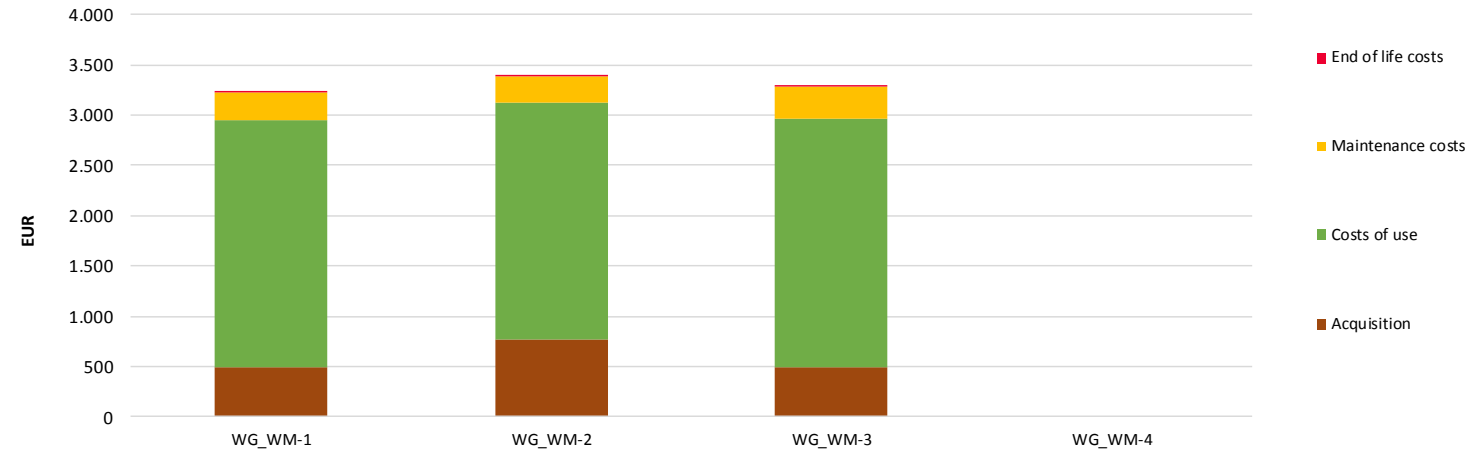
The first set of results displays the life cycle cost of the products (direct costs), subdivided in the cost categories listed in art. 68 of EU Directive 24/2014, expressed for **one single product**.

Results are displayed both in graphical and table form.

The resume table features also the **'Per function result'**, an additional result that may be used for advanced comparisons.

Points where changes are planned
See slides 26-27

LIFE CYCLE COSTING RESULTS - DIRECT COSTS



COST CATEGORY	UNIT	WG_WM-1	WG_WM-2	WG_WM-3	WG_WM-4
Acquisition	EUR	500,00	763,90	487,65	
Costs of use	EUR	2446,93	2365,55	2473,73	
Maintenance costs	EUR	272,61	262,97	315,56	
End of life costs	EUR	7,66	8,13	8,13	
Total	EUR	3227,20	3400,55	3285,07	
<i>Per function result</i>	<i>EUR/[kg]</i>	<i>645,44</i>	<i>566,76</i>	<i>657,01</i>	
	<i>EUR/[kg/h]</i>	<i>0,00</i>	<i>0,00</i>	<i>0,00</i>	

For details on the consultation and interpretation of LCC results see the User Guide, chapter 2.2.4.

OUTPUT: direct costs

COSTS DISTRIBUTION OVER TIME

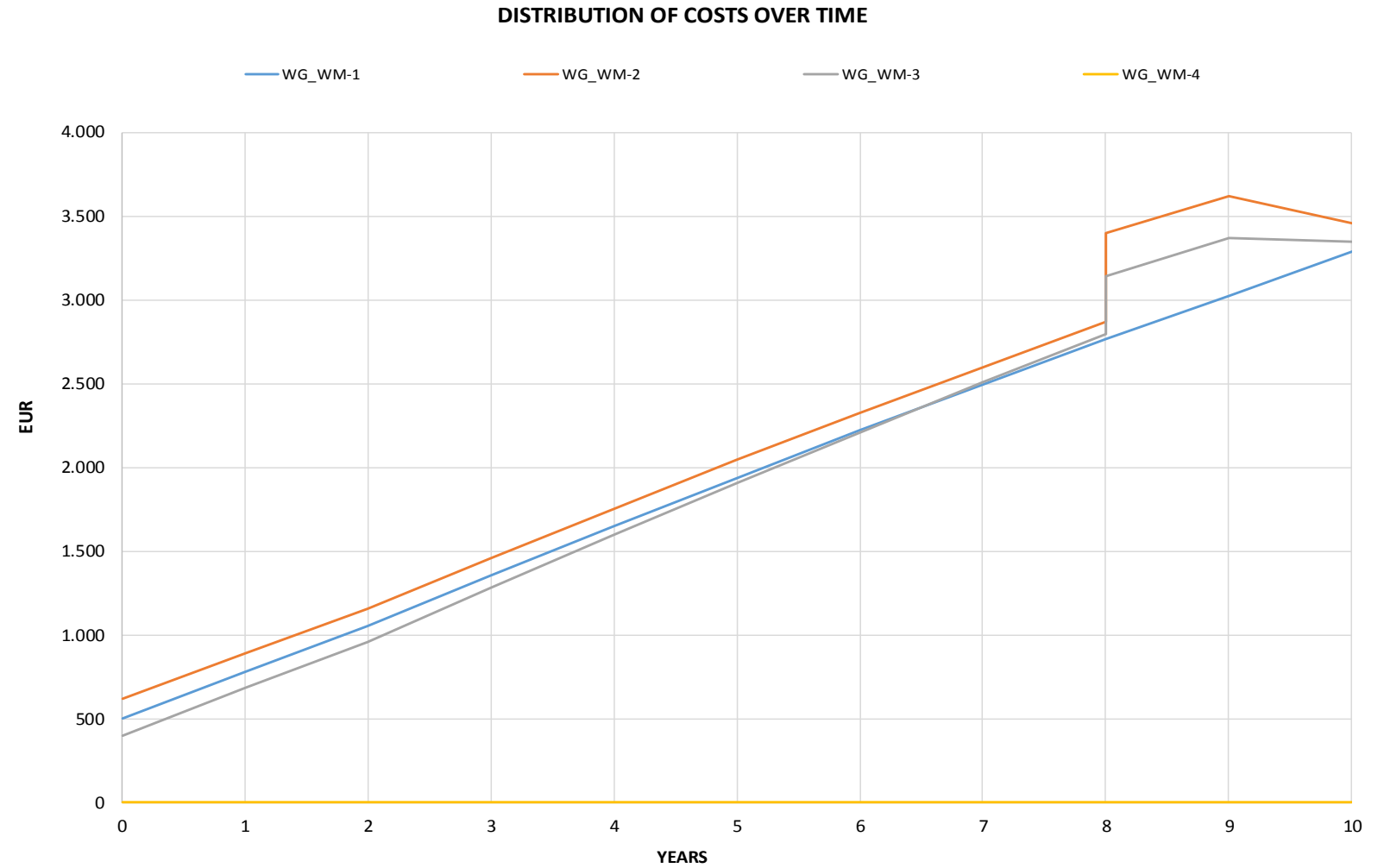
Costs distribution over time shows the evolution of the cumulative costs year by year.

Year 0 marks the purchase of the products.

Vertical steps represent products substitutions.

The final year marks the products life cycle cost (direct costs).

Changes in the slope during the last year are due to the evaluation of the residual value of substituted products.



For details on the consultation and interpretation of cost distribution over time see the User Guide, chapter 2.2.4.



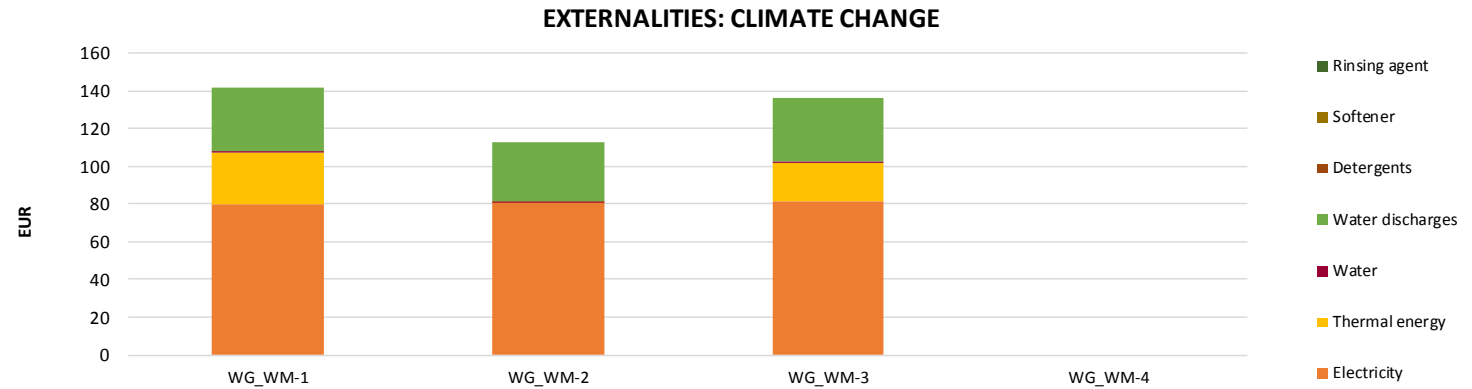
OUTPUT: externalities

EXTERNALITIES

Externalities are calculated only for the impact category Climate Change and only related to the use phase.

Externalities are reported per externality item.

Externalities related to manufacturing are disabled.



UNIT: EUR		WG_WM-1	WG_WM-2	WG_WM-3	WG_WM-4
LIFE CYCLE PHASE	EXTERNALITY ITEM	1	2	3	4
MANUFACTURING	-				
USE	Electricity	79,69	80,74	81,29	
USE	Thermal energy	27,89	0,08	20,92	
USE	Water	0,73	0,68	0,73	
USE	Water discharges	33,49	31,26	33,49	
USE	Detergents	0,00	0,00	0,00	
USE	Softener	0,00	0,00	0,00	
USE	Rinsing agent	0,00	0,00	0,00	

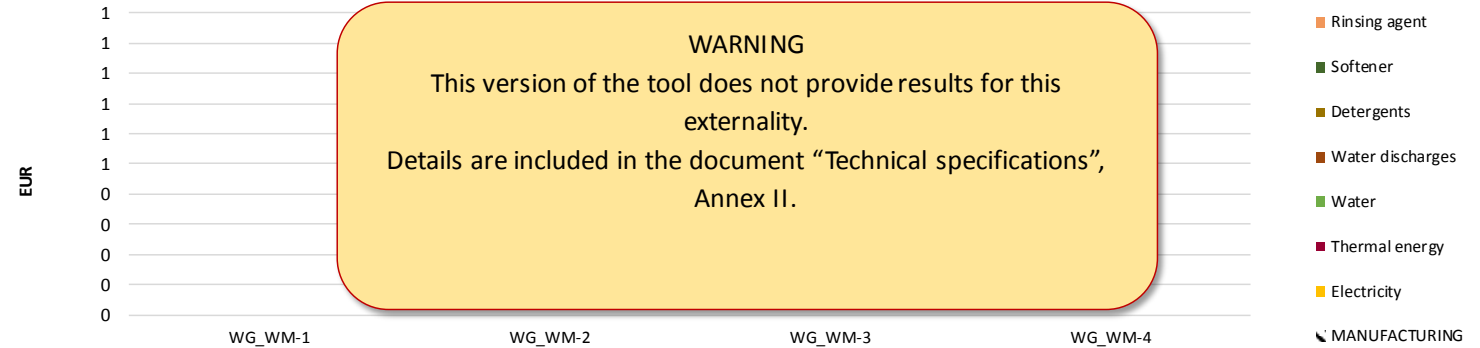
For details on the consultation and interpretation of Climate Change results see the User's Guide, chapter 2.2.4.

OUTPUT: externalities

EXTERNALITIES

In the current version of the tool, externalities related to Human Health, Ecosystems and Resources Availability impact categories are disabled, but the tool is ready to be updated as soon as reliable methods for their evaluation and monetization become available.

EXTERNALITIES: HUMAN HEALTH



UNIT: EUR		WG_WM-1	WG_WM-2	WG_WM-3	WG_WM-4
LIFE CYCLE PHASE	EXTERNALITY ITEM	1	2	3	4
MANUFACTURING	-				
USE	Electricity				
USE	Thermal energy				
USE	Water				
USE	Water discharges				
USE	Detergents				
USE	Softener				
USE	Rinsing agent				

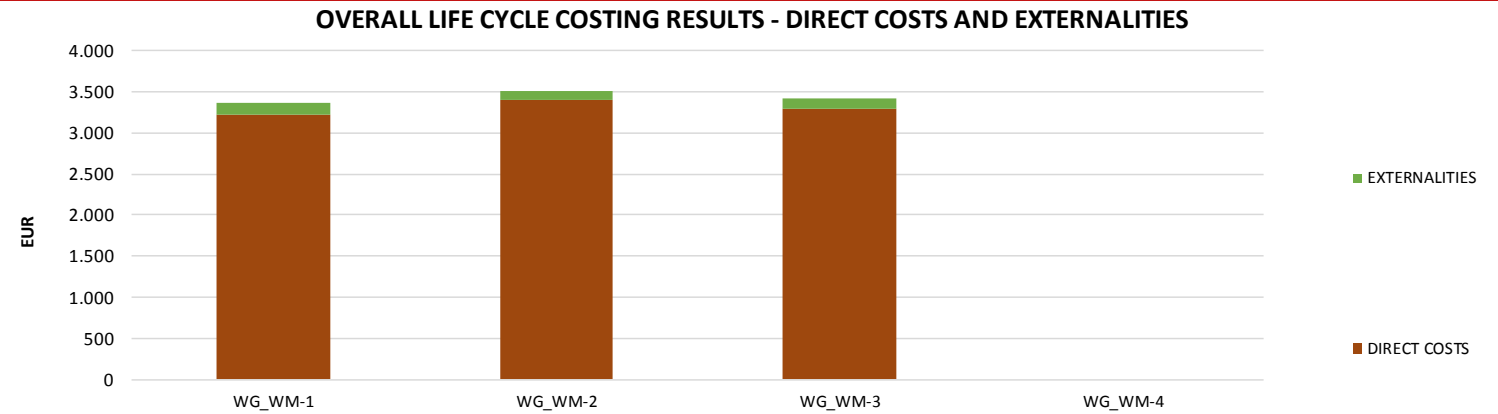
For details on the consultation and interpretation of Human Health results see the User's Guide, chapter 2.2.4.

OUTPUT: direct costs and externalities

LIFE CYCLE COSTING RESULTS – DIRECT COSTS AND EXTERNALITIES

The tool allows the user to display the sum of direct costs and externalities.

This output can be enabled/disabled through a dedicated button in the OUTPUT section.



COST CATEGORY	UNIT	WG_WM-1	WG_WM-2	WG_WM-3	WG_WM-4
DIRECT COSTS	EUR	3227,20	3400,55	3285,07	
EXTERNALITIES	EUR	141,80	112,76	136,43	
TOTAL	EUR	3369,01	3513,31	3421,50	

For details about consultation and interpretation about the overall Life Cycle Costing results see the User's Guide, chapter 2.2.4

USER'S GUIDE

USER'S GUIDE

- 1) **Introduction:** description of the project;
- 2) **operational instructions:** divided in two sections:
 - *Preparatory stage:* introductory information regarding the use of the tool
 - *Evaluation stage:* step by step instructions
- 3) **Annexes.** These include additional information, e.g. details on how to calculate maintenance costs

Summary

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Key changes to be implemented in the tool (1/2)

Alternative inputs

Current situation: The user has the possibility to fill in data using alternative inputs. For example, in the case of washing machines the user may: a) fill in the measured electricity consumption or b) estimate it using the number of cycles per year and the electricity consumption per cycle.

The user selects alternative data for each product.

After the change: In case of a tender procedure, the user will select at the beginning of the assessment mode a) or b) and the same model will be used for all the analyzed products.

Maintenance costs (related to the point above “Alternative inputs”)

Current situation: the tool allows the user to input maintenance costs in two modes: expressed directly as maintenance costs per year or estimated as a percentage of the purchase price.

After the change: In case of a tender procedure, the estimated percentage option will not be available.



Key changes to be implemented in the tool (2/2)

Use profile for IT equipment (related to the point above “Alternative inputs”)

Current situation: for IT equipment, the operating hours defining the use profile are default values.

After the change: the user will be able to fill in specific hours of use and the consumption per different modes.

Expected product lifetime

Current situation: The tool requires to fill in for each analyzed product an expected product lifetime (expressed in years).

After the change: In case of a tender procedure, the user will fix at the beginning of the assessment the same lifetime for all the analyzed products.

Results for total purchased amount

Current situation: results are provided with reference to buying only one single item. The tool does not provide results for the total purchased amount of each item.

After the change: results will be provided both for one product and for the total purchased amount.

Next steps

TASK 3: second tool refinement

- GPP AG feedback (before May 4th)
- All suggestions, comments and proposed changes will be evaluated and discussed with DG Environment. All agreed changes will be included in the final version of the tool. The user's guide and all other documents will be modified accordingly
- All text elements of the tool and the user's guide will be provided in editable formats to the EC for translation purposes
- An additional technical document for the EC will describe the methods, technologies and coding architecture utilised, in order to allow a smooth hand over to future contractors for further tool maintenance

TASK 4: tool completion

- The EC will provide the translation of all text elements of the tool and the user's guide contents. All these texts will be used to update both the tool and the user's guide

Expected project conclusion and delivery of the tool: June 2016



THANKS FOR YOUR ATTENTION

QUESTIONS ?

Contacts

Studio Fieschi & soci Srl
Via Cesare Lombroso, 25
10125 Torino – Italia
Tel: +39 011 65 99 677
fieschi@studiofieschi.it
pretato@studiofieschi.it
www.studiofieschi.it