Terra Preta Packaging System. A new “blue” waste management.

APPENDIX

APPENDIX A – COST ESTIMATIONS (BUSINESS MODEL)

REVENUES	
BIOCHAR sale	**UOM**
Daily production of biochar	
1000	kg/day
Sale price	
€ 6.00	€/kg
Daily potential Revenue	
€ 6,000.00	€/day
Annual potential Revenue	
€ 2,190,000.00	€/year
Annual actual Revenue	
€ 2,190,000.00	**€/year**

Tab.A-1: Biochar sale revenues

COSTS					
Toilet	**UOM**	**Pyrolyzer**	UOM	**Pyrolyzer Maintenance**	UOM
Total inhabitants		Power to install (kW)		€ 50,000.00	€/y per operat
20000	inhab	150	kW	Maintenance operator	
Mean value of distributed toilet		Cost €/KW		2	operators
8333	toilet	2500	€/kW	**Total Cost of Pyrolyzer Maintenance €/year**	
Toilet Cost		**Pyrolyzer Cost**		**€ 100,000.00**	**€/year**
151.84	€/toilet	**€ 375,000.00**	**€**		
Total Cost of distributed toilet		Years of Depreciation			
€ 1,265,333.33	**€**	11			
Years of Depreciaton		**Pyrolyzer Depreciation€/year**			
5		**€ 34,090.91**	**€/year**		
Toilet Depreciation €/year					
€ 253,066.67	**€/year**				

Marketing	UOM	**Sale Agents**	UOM	**Pyrolyzer Insurance**	UOM	**Handling**	UOM
Percentage of total revenues		€ 30,000.00	€/y per agent	Percentage of Pyrolyzer Total Cost		**Total Handling Cost €/year**	
40.0%		Number of agents		10.0%		**€ 90,315.35**	**€/year**
Total MKTG investement		2	agents	**Total Cost of Insurance €/year**		**Vehicle Cost**	
€ 876,000.00	**€/year**	**Total Cost of sale agents €/year**		**€ 37,500.00**	**€/year**	**€ 40,000.00**	**€**
		€ 60,000.00	**€/year**			Year of Depreciation	
						8	year
						Vehicle Depreciation €/year	
						€ 5,000.00	**€/year**

Tab.A-2: General costs

INCOME STATEMENT (20,000 inhabitants)	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
REVENUES						
Biochar sale	€ -	€ 2,190,000.00	€ 2,233,800.00	€ 2,278,476.00	€ 2,324,045.52	€ 2,370,526.43
TOTALE REVENUES	**€ -**	**€ 2,190,000.00**	**€ 2,233,800.00**	**€ 2,278,476.00**	**€ 2,324,045.52**	**€ 2,370,526.43**
COSTS						
Toilet Cost	€ 1,265,333.33	€ -	€ -	€ -	€ -	€ -
Toilet Depreciation	€ -	€ 253,066.67	€ 253,066.67	€ 253,066.67	€ 253,066.67	€ 253,066.67
Pyrolyzer Cost (150 kW)	€ 375,000.00	€ -	€ -	€ -	€ -	€ -
Pyrolyzer Depreciation	€ -	€ 34,090.91	€ 34,090.91	€ 34,090.91	€ 34,090.91	€ 34,090.91
Maintenance Operator Cost	€ -	€ 100,000.00	€ 102,000.00	€ 104,040.00	€ 106,120.80	€ 108,243.22
Marketing Cost	€ -	€ 876,000.00	€ 832,200.00	€ 790,590.00	€ 751,060.50	€ 713,507.48
Sale Agent Cost	€ -	€ 60,000.00	€ 61,200.00	€ 62,424.00	€ 63,672.48	€ 64,945.93
Pyrolyzer Insurance	€ -	€ 37,500.00	€ 38,250.00	€ 39,015.00	€ 39,795.30	€ 40,591.21
Handling Cost	0	€ 90,315.35	€ 92,121.66	€ 93,964.09	€ 95,843.37	€ 97,760.24
Vehicle Cost	€ 40,000.00	€ -	€ -	€ -	€ -	€ -
Vehicle Depreciation	€ -	€ 5,000.00	€ 5,000.00	€ 5,000.00	€ 5,000.00	€ 5,000.00
TOTAL COSTS	**€ 1,680,333.33**	**€ 1,455,972.93**	**€ 1,417,929.23**	**€ 1,382,190.67**	**€ 1,348,650.03**	**€ 1,317,205.64**
INCOME BEFORE TAXES	**-€ 1,680,333.33**	**€ 734,027.07**	**€ 815,870.77**	**€ 896,285.33**	**€ 975,395.49**	**€ 1,053,320.79**
Taxes (40%)	€ -	€ 293,610.83	€ 326,348.31	€ 358,514.13	€ 390,158.20	€ 421,328.31
NET INCOME	€ -	**€ 440,416.24**	**€ 489,522.46**	**€ 537,771.20**	**€ 585,237.29**	**€ 631,992.47**

CASH FLOW ANALYSIS	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
NET INCOME	€ -	€ 440,416.24	€ 489,522.46	€ 537,771.20	€ 585,237.29	€ 631,992.47
Operating Activities (Depreciation)	€ -	€ 292,157.58	€ 292,157.58	€ 292,157.58	€ 292,157.58	€ 292,157.58
(-) Increase of stock		-€ 36,500.00	-€ 730.00	-€ 744.60	-€ 759.49	€ -
(+) Decrease of stock		€ -	€ -	€ -	€ -	€ 39,508.77
(-) Increase trade receivable		-€ 547,500.00	-€ 10,950.00	-€ 11,169.00	-€ 11,392.38	€ -
(+) Decrese of trade receivable		€ -	€ -	€ -	€ -	€ 592,631.61
(-) Decrease of debt		€ -		€ -	€ -	€ -
(+) IIncrease of debt			€ -	€ -	€ -	€ -
Financing Activities	€ -	-€ 584,000.00	-€ 11,680.00	-€ 11,913.60	-€ 12,151.87	€ 632,140.38
Purchases of property, plant and equipment	-€ 1,680,333.33	€ -	€ -	€ -	€ -	€ -
Cash Flow for Investing Activities	-€ 1,680,333.33	€ -	€ -	€ -	€ -	€ -
Operating Cash Flow	-€ 1,680,333.33	€ 148,573.82	€ 770,000.04	€ 818,015.18	€ 865,243.00	€ 1,556,290.43

WACC
5%

NPV	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
	-€ 1,680,333.33	**€ 141,498.88**	**€ 698,412.73**	**€ 706,632.26**	**€ 711,837.56**	**€ 1,219,394.27**

SUM OF ACTUALIZED CASH FLOW	€ 1,797,442.37	>	0

Tab.A-3: Net Present Value

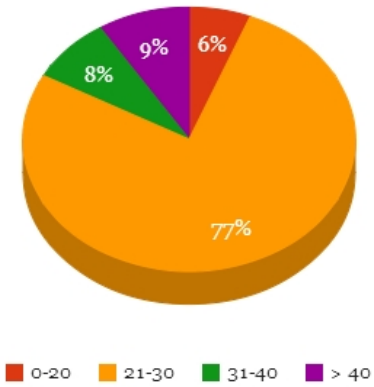
APPENDIX B – QUESTIONNAIRE

I SECTION: OVERWIEV

The following tables show the AGE/ GENDER /JOB, the number of peoples who answered (ANSWER) and the percentage of it (%).

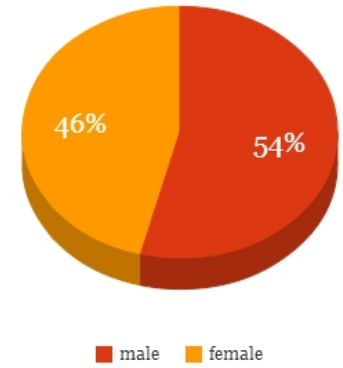
- AGE:

AGE	*ANSWER*	*%*
0-20	10	6%
21-30	137	77%
31-40	14	8%
> 40	16	9%



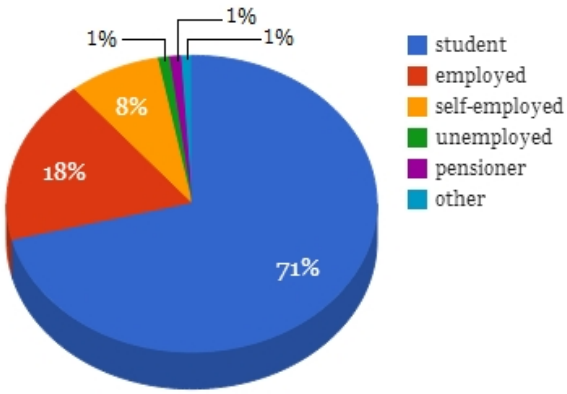
- GENDER

GENDER	*ANSWER*	*%*
Male	96	54%
Female	81	46%



- CURRENT JOB

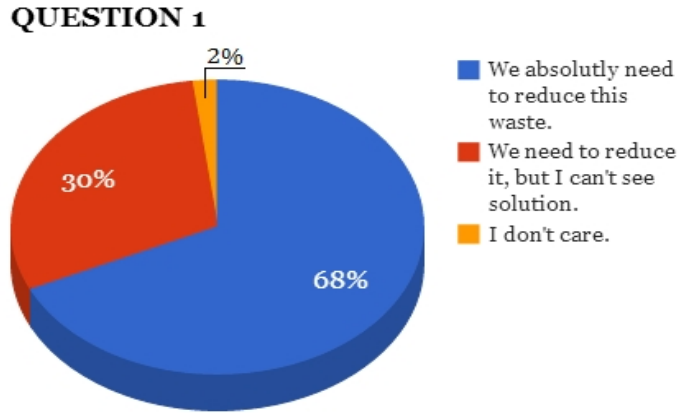
JOB	*ANSWER*	*%*
Student	126	71%
Employed	32	18%
Self-employed	14	8%
Unemployed	2	1%
Pensioner	1	1%
Other	2	1%



II SECTION: ENVIROMENTAL SUSTAINABILITY

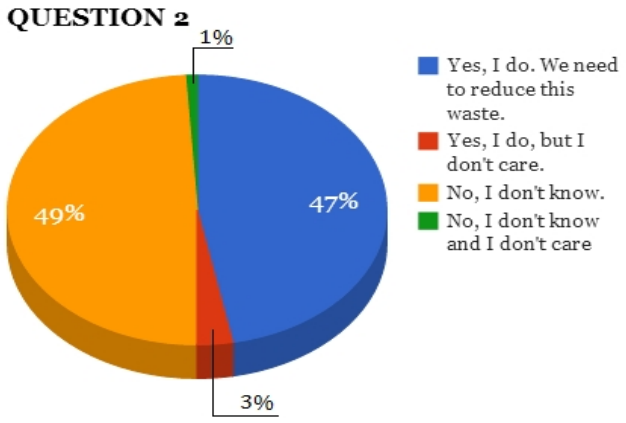
❖ QUESTION 1: *If I told you that about 40% of your bill are due to the water used to flush the toilet, what would it be your reaction?*

POSSIBLE ANSWERS	*ANSWER*	*%*
We absolutely need to reduce this waste.	116	68%
We need to reduce it, but I can not see solutions.	51	30%
I don't care.	3	2%



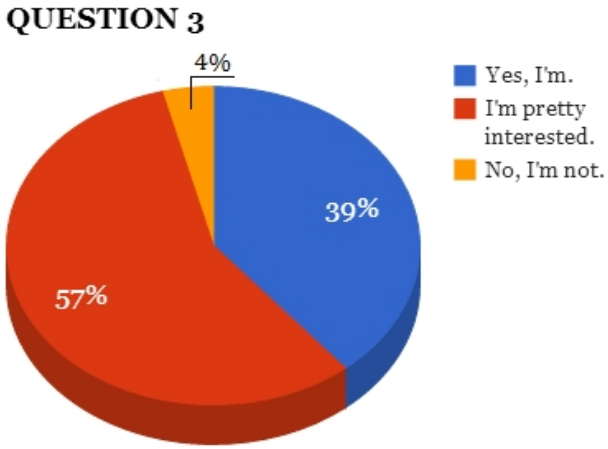
❖ QUESTION 2: *Do you know that every time you flush the toilet, you use about 7 litres of drinking water?*

POSSIBLE ANSWERS	*ANSWER*	*%*
Yes, I do. We need to reduce this waste.	79	47%
Yes, I do, but I don't care.	5	3%
No, I didn't know.	83	49%
No, I didn't know and I don't care	2	1%



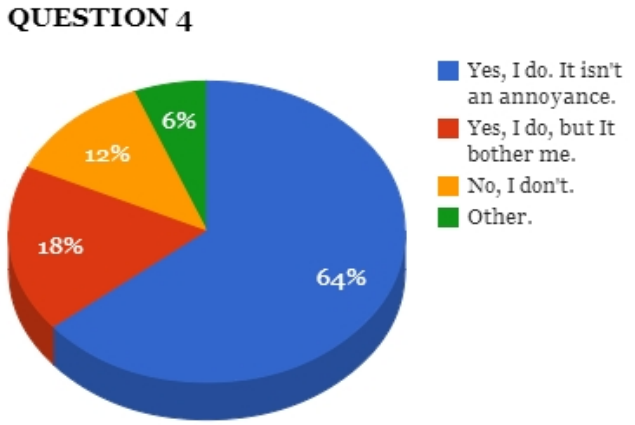
❖ QUESTION 3: *Are you interested in ecological and environmental sustainability?*

POSSIBLE ANSWERS	*ANSWER*	*%*
Yes, I am.	66	39%
I am pretty interested.	97	57%
No, I am not.	7	4%



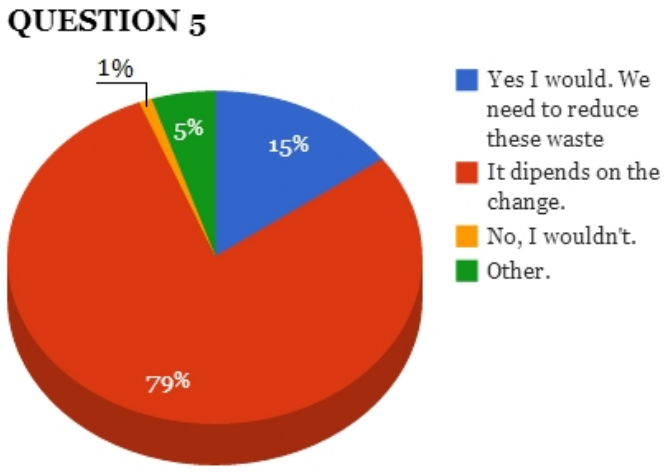
❖ QUESTION 4: *Are you segregating the waste in your country? Is this annoying you?*

POSSIBLE ANSWERS	*ANSWER*	*%*
Yes, I do. It is not an annoyance.	114	64%
Yes, I do, but it bother me.	31	18%
No, I don't.	22	12%
Other.	10	6%



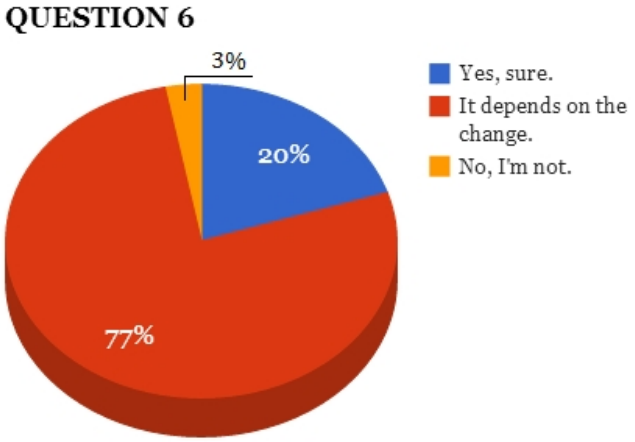
❖ QUESTION 5: *If there was a new system of toilets to reduce this environmental and economic waste, would you be willing to change significantly your daily habits?*

POSSIBLE ANSWERS	*ANSWER*	*%*
Yes I would. We need to reduce these wastes.	27	15%
It depends on change.	140	79%
No, I wouldn't.	2	1%
Other.	8	5%



❖ QUESTION 6: *Are you willing to make an investment to replace your toilet to reducing these wastes?*

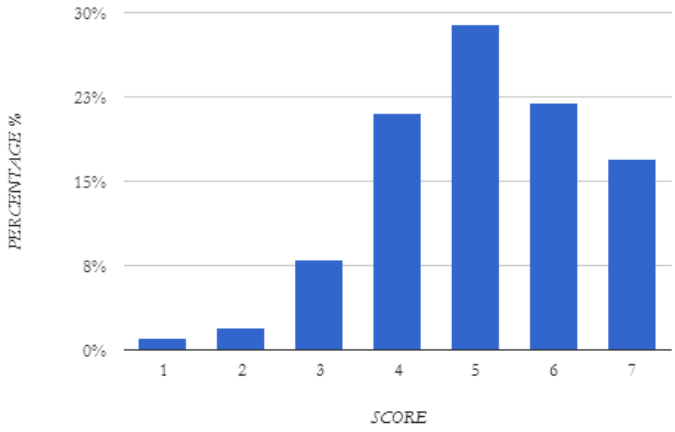
POSSIBLE ANSWERS	*ANSWER*	*%*
Yes, sure.	34	20%
It depends on the change.	131	77%
No, I'm not.	5	3%



III SECTION: TOILET FACILITIES

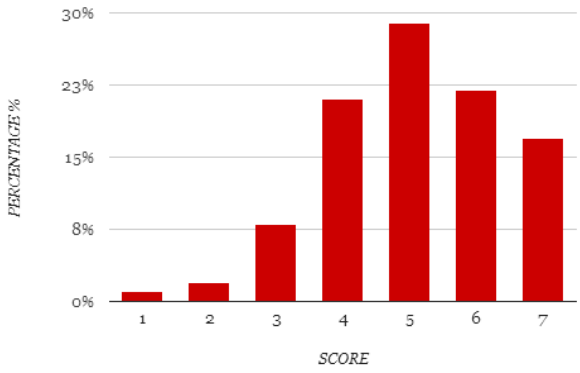
- CHEAPNESS

SCORE	ANSWER	0%
1	2	1%
2	3	2%
3	14	8%
4	38	21%
5	51	29%
6	39	22%
7	30	17%



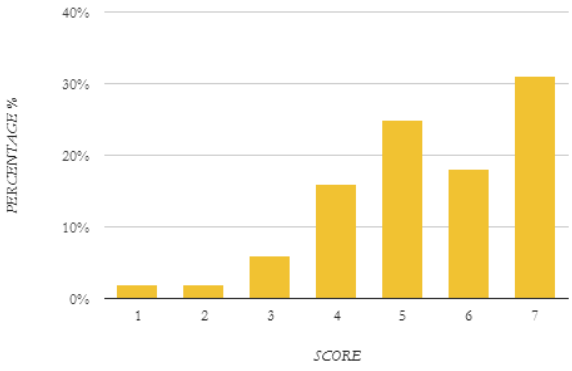
- ENVIROMENTAL IMPACT

SCORE	ANSWER	%
1	2	1%
2	3	2%
3	14	8%
4	38	21%
5	51	29%
6	39	22%
7	30	17%



- USE RESISTANCE

SCORE	ANSWER	0%
1	3	2%
2	3	2%
3	11	6%
4	28	16%
5	45	25%
6	32	18%
7	55	31%



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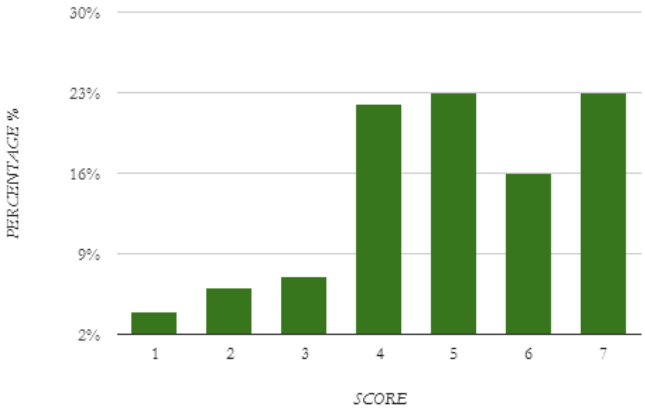
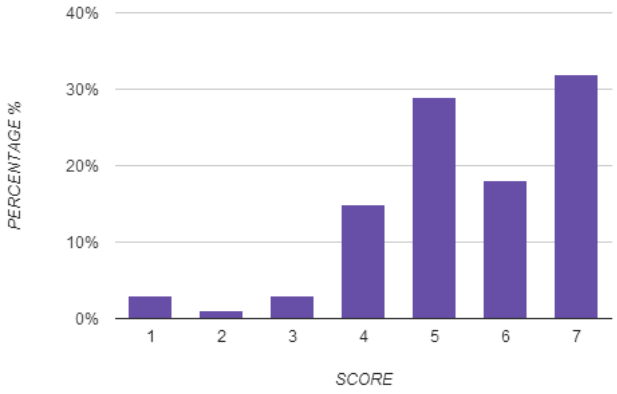
❖ SIMPLE TO USE

SCORE	ANSWER	0%
1	7	4%
2	10	6%
3	13	7%
4	39	22%
5	40	23%
6	28	16%
7	40	23%



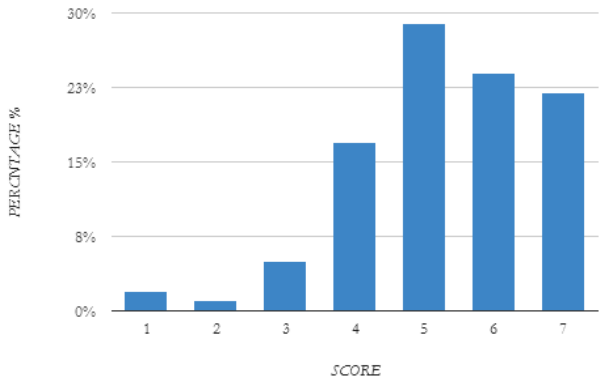
❖ EASY TO CLEAN

SCORE	ANSWER	0%
1	5	3%
2	2	1%
3	6	3%
4	26	15%
5	51	29%
6	31	18%
7	56	32%



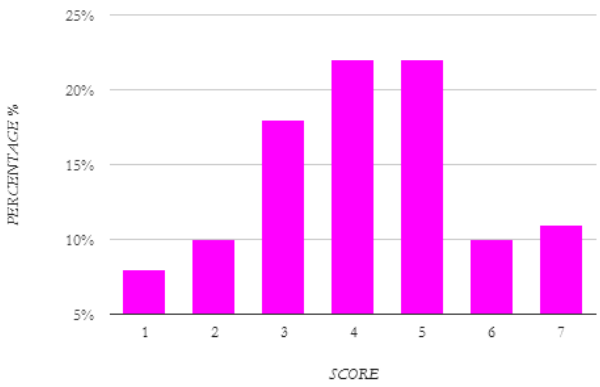
❖ EASY MAINTENANCE

SCORE	ANSWER	0%
1	3	2%
2	1	1%
3	9	5%
4	30	17%
5	52	29%
6	43	24%
7	39	22%

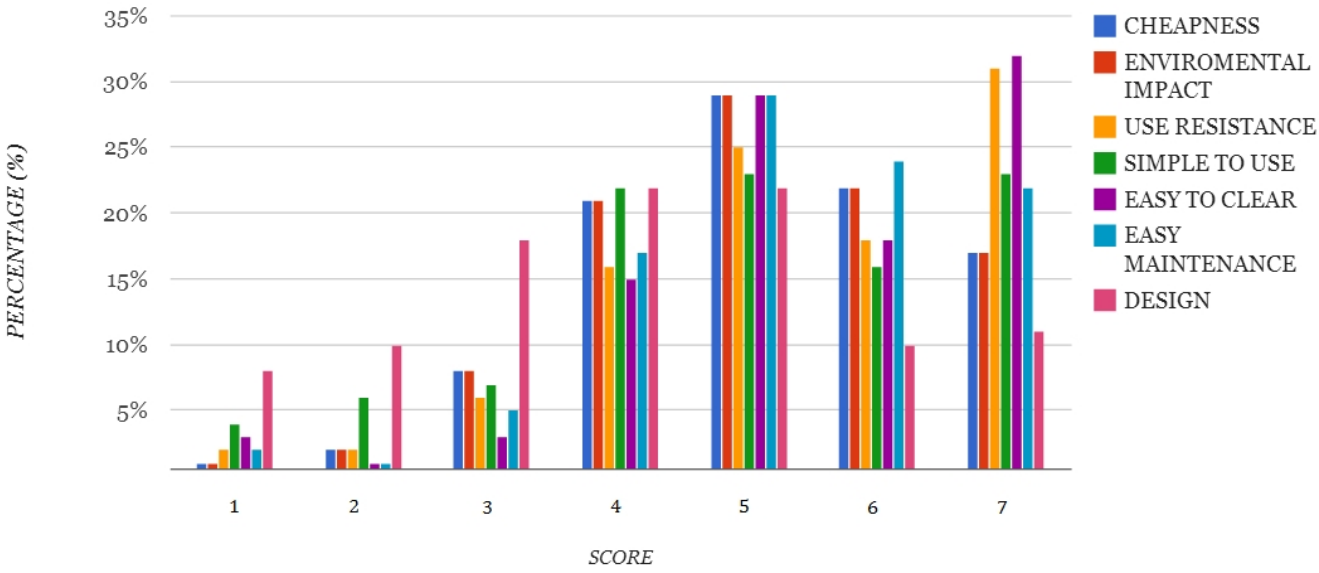


❖ DESIGN

SCORE	ANSWER	0%
1	14	8%
2	17	10%
3	31	18%
4	39	22%
5	39	22%
6	18	10%
7	19	11%



❖ FACILITIES SUMMARY



APPENDIX C – TECHNICAL DESCRIPTION

APPENDIX C.1 - THE PACKAGING TOILET SYSTEM

	Scatola Meccanismi	Mechanism Box			
1	Base inf	Lower Base		1	PVC
2	Case Pedali	Pedal Case		1	PVC
3	Pedale Scivolo Ergonomico	Ramp Pedal		1	PVC
4	Pedale Sigillatrice Ergonomico	Sealer Pedal		1	PVC
5	Sigillatrice	Sealer		2	PVC + Stainless Steel
6	Barra Movimento Sigillatrice	Sealer Orizontal Bar		1	PVC
7	Braccio AZ Sigillatrice	Sealer Side Bar		2	PVC
8	Scivolo Scarico	Ramp		1	PVC
9	Leva Azionamento Scivolo	Ramp Connecting Rod		1	PVC
10	Sportello Chiusura	Shutter		1	PVC
11	Base Superiore	Upper Base		1	PVC
12	Sportello 1	Left Side Windows		1	PVC
			tot	14	

	Involucro Toilet	Toilet Shell			
13	Ceramica	Ceramic Body		1	Ceramic/ Cement
14	Diveriting	Diverting (Urine Separator)		1	Sainless Steel
	Tavoletta Copri	Seat/Lid Group		1	
15	Cerniera Tavoletta	Mounting Bolts		2	Stainless Steel
16	Attacco Cerniera Tavoletta	Seat Hinges		2	Stainless Steel
17	Tavoletta	Toilet Seat		1	PP
18	Attacco Cerniera Copri	Lid Hinges		2	Stainless Steel
19	Copritazza 2	Toilet Lid		1	PP
			tot	10	

	Assieme Colonna (4)	Recharge Column Group			
	Gruppo Pista	Track Group		1	
20	Pista Afferraggi	Track		1	PVC
21	Coperchio Leva 2	Track Case		1	PVC
	Meccanismo Posizionamento Sacchetti	Bag Positioning Mechanism		1	
22	Movente	Slider		1	PVC
23	Guida Leva	Lever Support		2	PVC
24	Leva Togli Sacchetti	Bags Lever		2	PVC
25	Perno Leva	Pivot		2	PVC
	ASM Colonna	Column Assembly		1	
26	Colonna	Column		1	PVC
27	Vetro Colonnina	Side Windows		2	PVC
28	Sacchetto Ovale	Bags		2	PLA
29	Coperchio Colonna	Bag Positioner		1	PVC
30	Tappo	Column Top		1	PVC
	Braccio Sacchetti	Bag Holder Group		1	
31	Braccio Base	Holder Base		1	PVC
32	Esterno Afferraggio	External Holder		2	PVC
33	Interno Afferraggio	Inner Holder		2	PVC
34	Rotella	Castor Wheel		2	PVC
			tot	23	

	Guida Posteriore	**Rear Guide**			
35	Guida Movimento Carica	Recharge Guide Body		1	PVC
36	Sportello Chiusura Corsa	Recharge Guide Shutter		1	PVC
			tot	2	

	Mobile		**Base Cabinet**			
37	Mobiletto		Case Cabinet		1	PP/ plywood
	ASM Giunto		Door Cabinet Hinges		4	
38		Giunzione		Case Hinge	1	Stainless Steel
39		Giunzione 2		Door Hinge	1	Stainless Steel
40	Anta		Door		2	PP
				tot	11	
				tot	60	

Tab.C.1-1: Bill of Materials

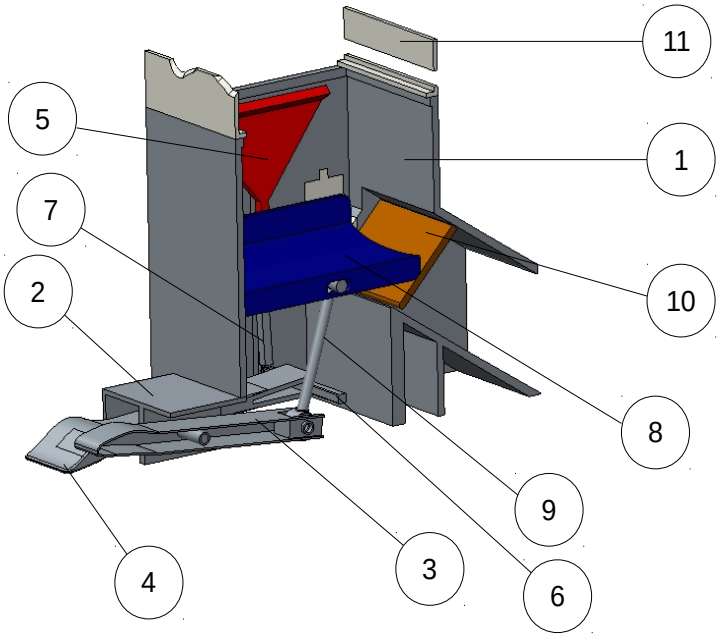


FIG.C.1-1: The Mechanism Box

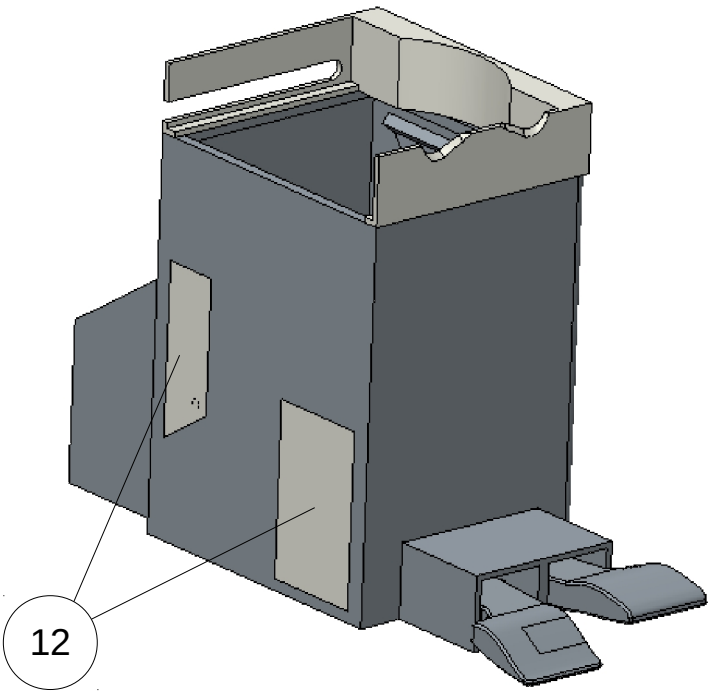


FIG.C.1-2: The Mechanism Box

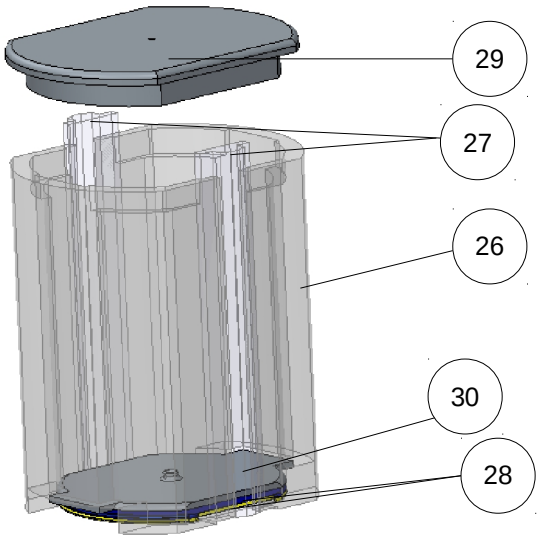


FIG.C.1-3: The Column Assembly

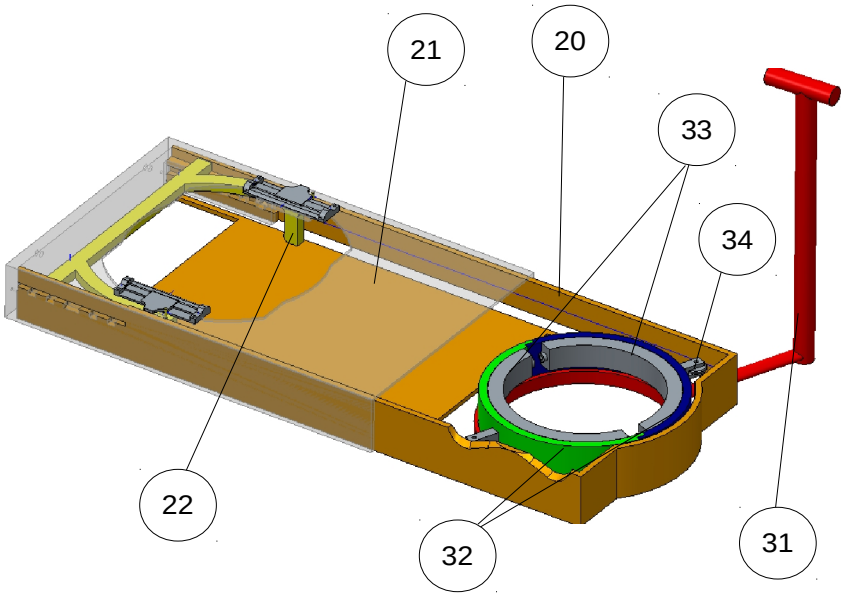


FIG.C.1-4: The Track Group, the Bag Positioning Mechanism and the Bag Holder Group

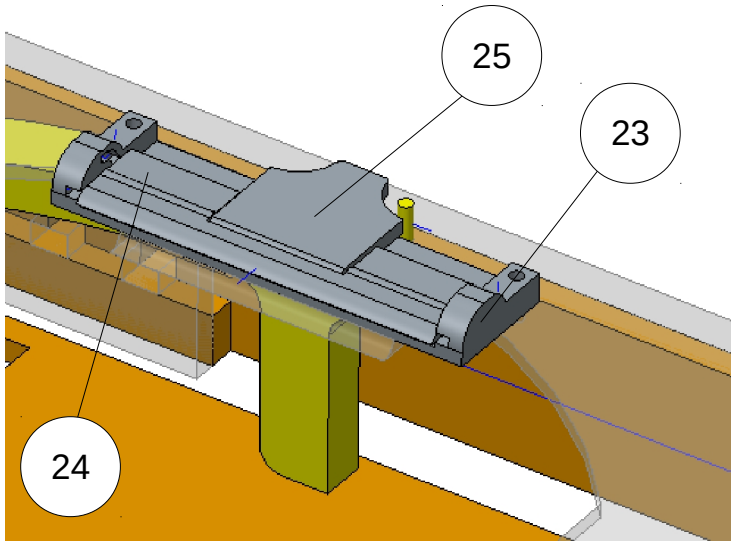


FIG.C.1-5: The Bag positioning system: detail

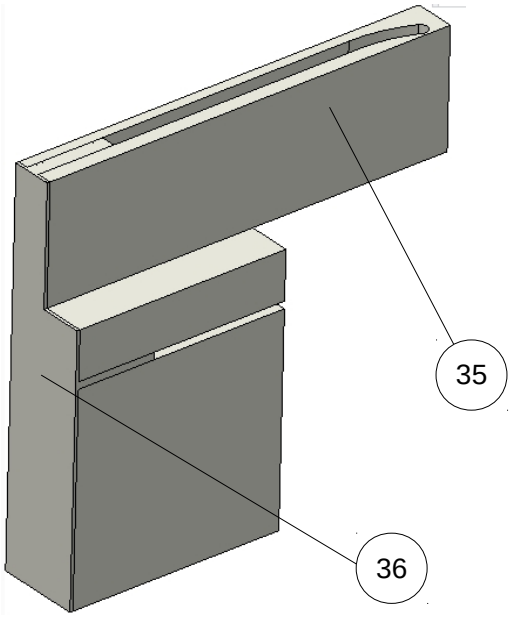


FIG.C.1-6: The Rear Guide

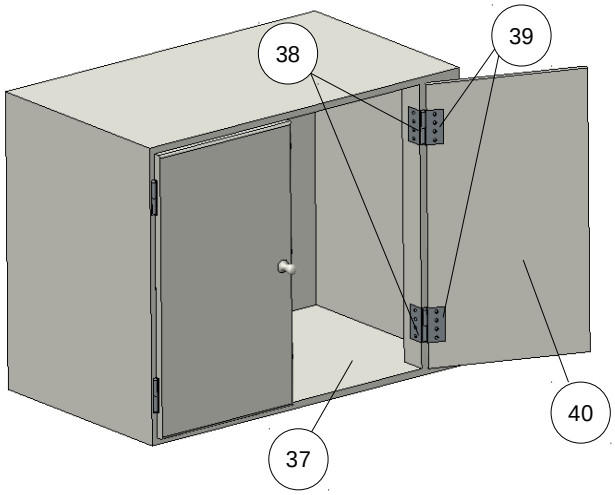


FIG.C.1-7: The Base Cabinet

QUANTITY	DESCRIPTION	UNIT PRICE
1	Lower Base	$13,47
1	Pedal Case	$1,09
1	Ramp Pedal	$1,94
1	Sealer Pedal	$1,17
2	Sealer	$1,22
1	Sealer Orizontal Bar	$1,08
2	Sealer Side Bar	$0,92
1	Ramp	$4,82
1	Shutter	$0,17
1	Upper Base	$3,08
1	Left Side Windows	$2,05
1	Ceramic Body	$12,50
1	Diverting	$19,50
1	Seat/Lid Group	$3,89
1	Track	$4,60
1	Track Case	$2,45
1	Slider	$1,83
2	Lever Support	$0,10
2	Bags Lever	$0,10
2	Pivot	$0,03
1	Column	$5,20
2	Side Windows	$3,00
2	Bags	$3,00
1	Bag Positioner	$1,83
1	Column Top	$3,89
1	Holder Base	$1,52
2	External Holder	$1,44
2	Inner Holder	$1,21
2	Castor Wheel	$0,02
1	Recharge Guide body	$4,82
1	Recharge Guide Shutter	$5,74
1	Case Cabinet	$10,00
4	Casde Hinge	$0,20
4	Door Hinge	$0,20
2	Door	$5,00
SUBTOTAL		$123,08
EURO		€94,68

Tab.C.1-2: Cost of toilet

THE TANK UNIT

The Tank Unit is composed by three main elements: the Waste Stack (A), the Bag Container (B) and the Urine Container (C). The Bags that come from the Composting Toilet go through to the waste stack to the Bag Container while the urine, separated by the toilet, goes to the urine container through a second tube.

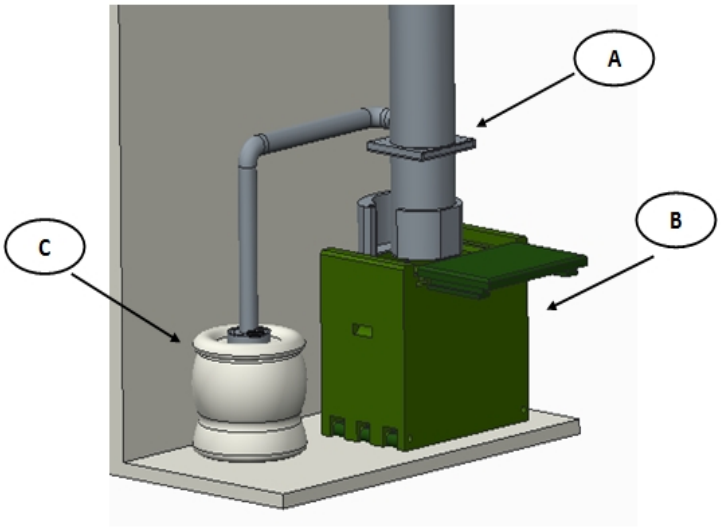


FIG.C.1- 8: The Tank Unit

The Waste Stack Group

The Waste Stack, crossed by the Urine Tube (2), is composed by six elements. A Waste Security System (4) is positioned in the final part of the Waste Stack (1): the Waste Security System has the purpose of closing the Waste Stack when the Bag Container is removed. This is possible thanks to the Bottom Closing (7) and to the Bottom Closing Stopper (6). When the bag container is not in position the first one is closed and the second one blocks its movement.

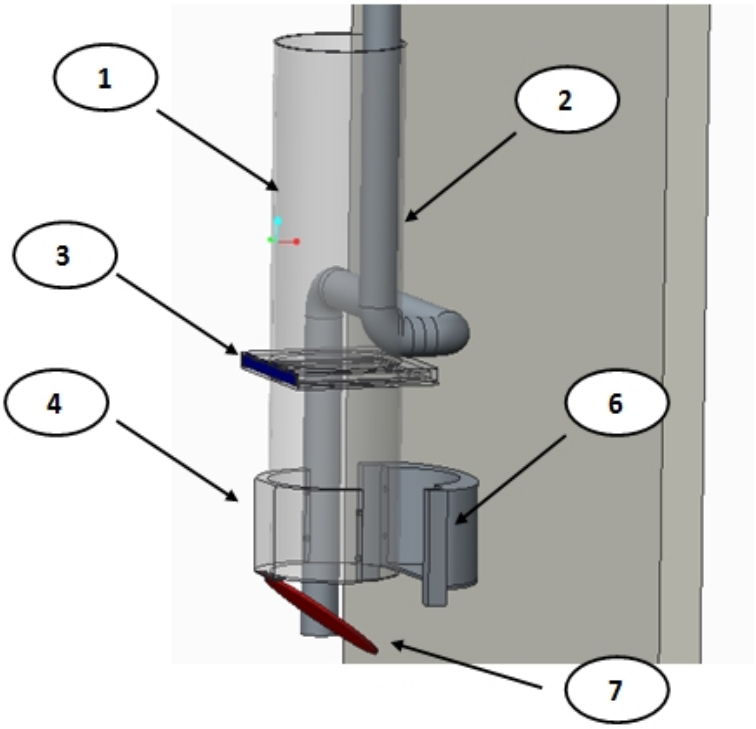


FIG.C.1- 9: The Waste Stack Group

If the Waste Security System needs to be replaced the Closing Sheet (8) can be inserted in the Lateral Cover (3) opening.

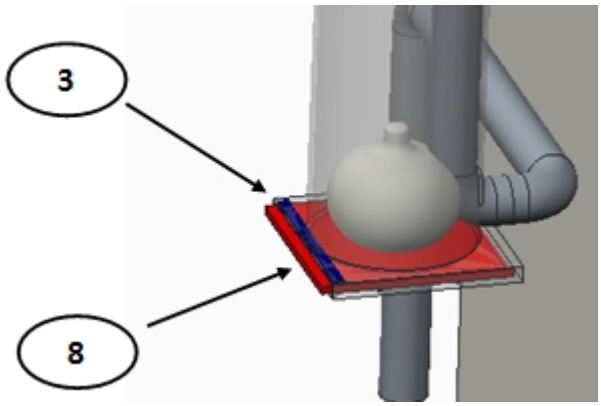


FIG.C.1- 10: The Closing Sheet: detail

The Bags Container

The Bags Container is composed by six elements. It is closed by an Upper Sliding Cover (9): the Upper Sliding Cover opens when the Bags Case arrives in its “work position”, under the Waste Stack. In fact the Bag Case continues to slide while the Upper Sliding Cover stops against the Waste Stack. Later on, the Bag Case opens the Bottom Closing Stopper pushing it forward.

The Bag Container has two Bottom Closing (10 and 11), a Bottom Stopper (12) and two Rotating Stopper (13).The Bottom Closings create the bottom of the container. The Bottom Stopper blocks these two Bottom Closing elements and the Rotating Stoppers blocks the Bottom Stopper.
When the container needs to be emptied, a guide (15) moves the Bottom Stopper and the Bottom Closings opens, so the bags are free to fall.

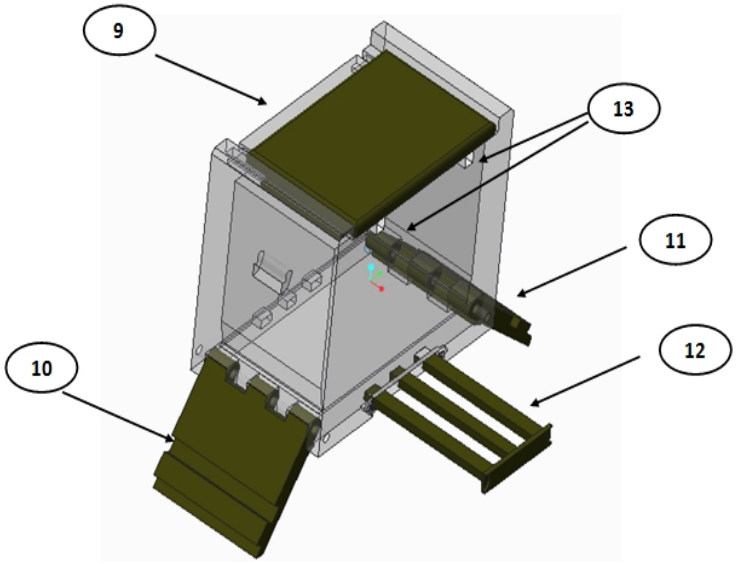


FIG.C.1- 11: The Bag Container

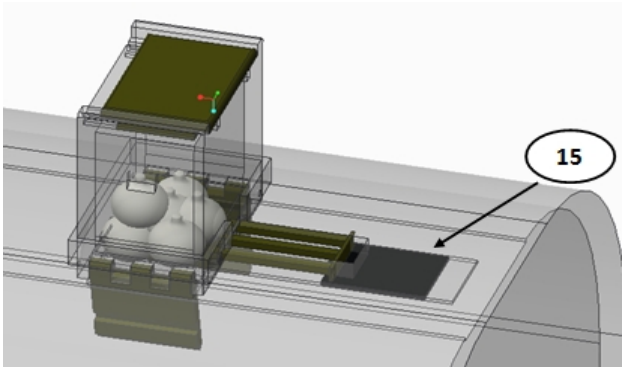


FIG.C.1- 12: The Guide: detail

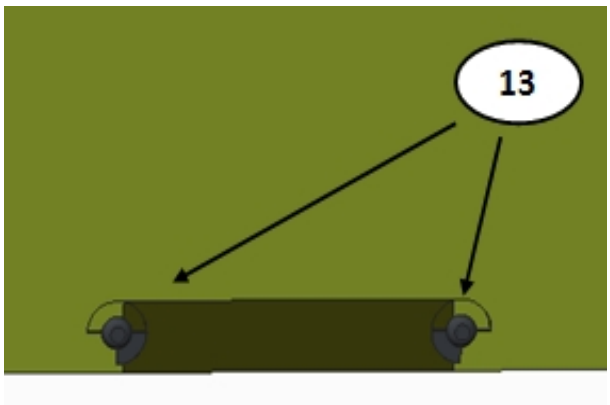


FIG.C.1-13: The Rotating Stoppers

The Urine container

The Urine Container is a simple container (16) with a pierced cap (17) where the tube for the urine enters. A closing cap shuts the container when it is out of the “work position”.

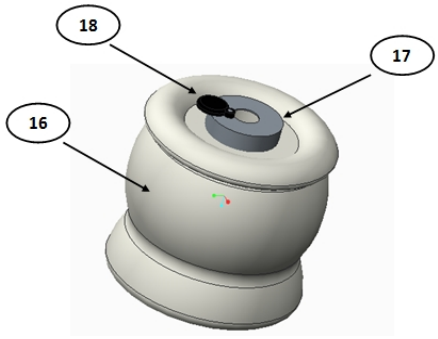


FIG.C.1- 14: The Urine Container

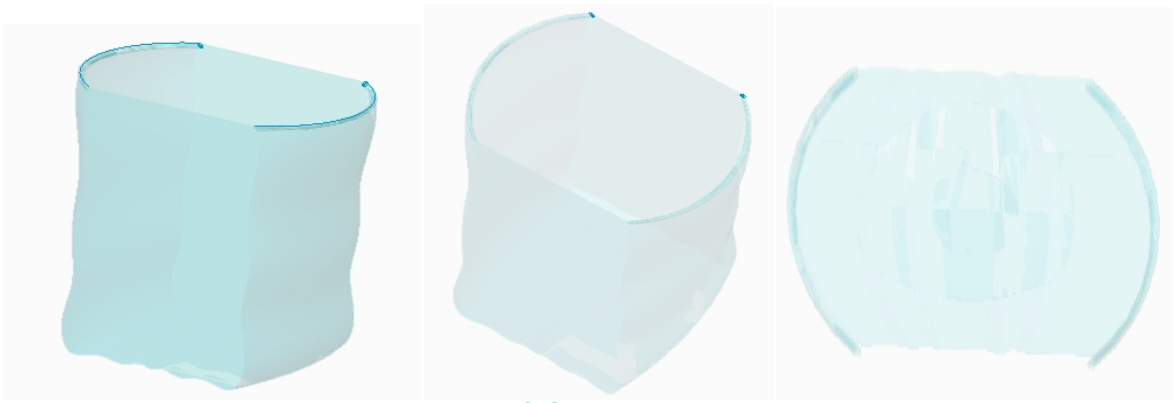


FIG.C.1- 15: PLA Bag

APPENDIX C.2 – THE PYROLYSIS REACTOR

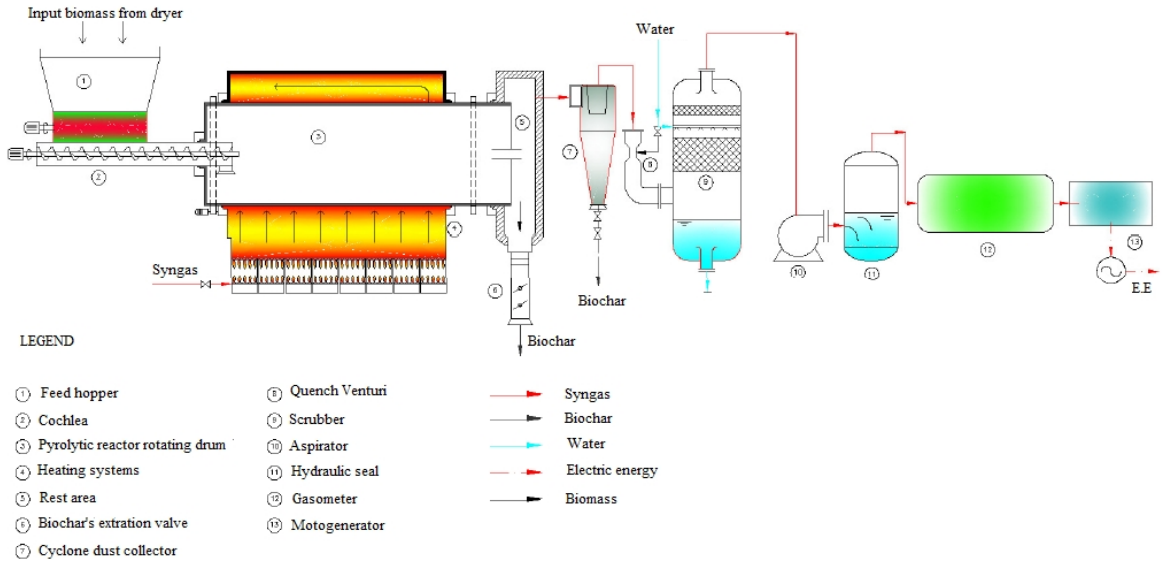


FIG.C.2- 1: The plan of the pyrolysis reactor

APPENDIX C.3 – THE HANDLING SERVICE

VRP:

Vehicle Routing Problem (VRP) is a combinatorial optimization and integer-programming problem seeking to service a number of customers with a fleet of vehicles. Generally the context is characterised by the distribution of goods between depots and final users (customers) but as said by Paolo Toth and Daniele Vigo, in "The vehicle routing problem"(2002), it can be used effectively not only for the solution of problems concerning the delivery or collection of goods, but for the solution of different real-world applications arising in transportation system as well.

VRP MODEL:

INDICES:

CP (customer): i = 0,...,n;

Vehicles: k = 1,...,m;

Pyrolysis Reactors: j = 1,...,q;

PARAMETERS:

V_i = Volume to be taken from each CP_i (m^3/CP)

M_k = Capacity of vehicle k (m^3/vehicles)

$dist_{i-i1}$ = Distance between CP_i and CP_{i1} (m)

VARIABLES:

$$F_{i-i_1}^{k} = \begin{cases} 1 \text{ if vehicle k covers route } i\text{-}i_1 \\ 0 \text{ instead} \end{cases}$$

$$Z_i^k = \begin{cases} 1 \text{ if } CP_i \text{ is served by vehicle k} \\ 0 \text{ instead} \end{cases}$$

OBJECTIVE FUNCTION:

$$\min \sum_k \sum_i \sum_{i_1} dist_{i-i_1} \times F_{i-i_1}^{k}$$

SUBJECT TO:

$$\sum_k \sum_{i_1} F_{i-i_1}^{k} = 1 \qquad \forall i \in CP/\{0\} \tag{1}$$

$$\sum_i F_{0-i}^{k} = 1 \qquad \forall k \tag{2}$$

$$\sum_i F_{i-.0}^{k} = 1 \qquad \forall k \tag{3}$$

$$\sum_i V_i \times Z_i \le M_k \qquad \forall k \tag{4}$$

$$\sum_k Z_i^{k} = 1 \qquad \forall i \in CP/\{0\} \tag{5}$$

$$\sum_i F_{i-i_1}^{k} = \sum_i F_{i_1-i}^{k} \qquad \forall k, i_1 \in CP/\{0\} \tag{6}$$

$$\sum_{i_1 \notin S} F_{i-i_1}^{k} \geq Z_i^k \qquad \forall k, S \subseteq CP/\{0\}, i \in S \tag{7}$$

$$F_{i-i_1}^{k} \leq Z_i^k \qquad \forall k, i \in CP/\{0\}, i_1 \in CP \tag{8}$$

$$F_{i_1-i}^{k} \leq Z_i^k \qquad \forall k, i \in CP/\{0\}, i_1 \in CP \tag{9}$$

$$F_{i-i}^{k} = 0 \qquad \forall k, i \in CP \tag{10}$$

Subject to (7) eliminates the problem of subtours.

NEIGHBOURHOOD:

In (FIG.C.3-1) is showed the neighbourhood and in particular the colours represent the different routes that must be driven by vehicles. The coloured circle represents CP.

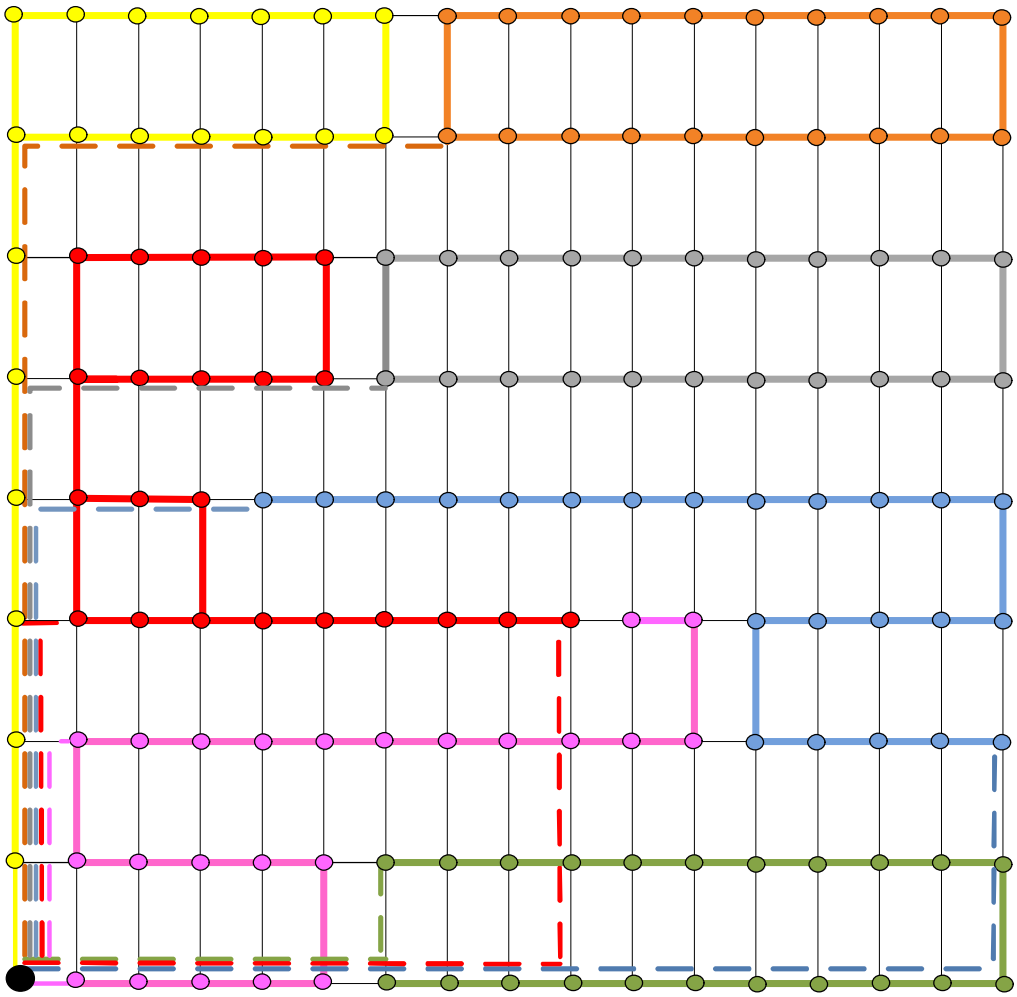


FIG.C.3- 1: The neighbourhood plant

Side of Neighbourhood (m)	Distance between the streets on the x-axis (m)	Distance between the streets on the y-axis (m)	Number of vertical streets	Number of horizontal streets	Number of Rectangle per Neighbourhood
1,600	200	100	8	16	128

Distance between residence (m)	Num of residences in a Rectangle	Num of residence in neighbourhood	Num of CP in Neighbourhood
100	6	768	153

People in a Unit	Units in "THREE-FAMILY HOUSE"	People in "THREE-FAMILY HOUSE"	Percentage of type of Residence	Num of Residences per type	Total people in Neighbourhood
2.6	3	7.8	33.3	256	20,613
	Units in "CONDOMINIUM"	People in "CONDOMINIUM"	33.3	256	
	8	20.8			
	Units in "SKYSCRAPER"	People in "SKYSCRAPER"	33.3	256	
	20	52			

Num of Rectangle per km^2	Num of Residences per km^2	Type of Residences	Num of Residences per type per km^2	People per km^2
50	300	THREE-FAMILY HOUSE	100	8,052
		CONDOMINIUM	100	
		SKYSCRAPER	100	

TAB.C.2-1: Dimensions of Neighbourhood

APPENDIX D – LEGISLATION

LACK OF LEGISLATION

Addressing a new approach to sanitation system

Packaging toilet is a great innovation for the future of international sanitation system way of thinking. Its implementation requires to change the approaches from habitual domestic users to institutions that must work out a new system of laws about this vision of sanitation. Current Italian legislation demonstrates incompleteness and unsuitability of developed countries in the direction, not only of more ecological wastewaters treatment, but primary of realizing "Blue" solutions in human waste management. This is a problem common at EU level because a new building must be connected to drainage.

Anyway, a State must ensure many functions about protection by wastewater or sludge:

- enacting a legislative package of laws that is aimed to any kind of exhaust system, public or private, direct or indirect, in any sorts of groundwater and surface water, river and maritime waters, both public or private, and sewers.
- orientation, promotion, counseling and coordination of public and private activities linked to the previous law.
- developing general criteria to right utilization and discharging of polluted waters about human settlement and location of industry.
- organization of public services (aqueduct, drainage system, purification system) and setting up rules for installation
- definition of methods to establish characteristics of water bodies
- guideline on the correct and rational use of water to industrial, civil and irrigation system by using standards of expenditures in order to prevent waste and facilitate recovery processes
- planning a strategy for cleaning up water, according with regional public administrations
- appointing a legal entity in charge with respect of law
- technical regulation about disposal of slurry in the soil for agricultural use
- technical regulation about disposal of sewage sludge and residual of treatment and clean-up

These indications are included in an Italian ministerial decree (April 16, 1976 –Regulation of discharges into maritime waters) and are clear representation of an old point of view of wastewaters management. Today technological development (an example can be *pyrolysis*) propose many solutions to restrict or to cancel pollutant emissions. Carbone cycle can be closed, characteristics of water bodies can improve and finally the problem of illegal dumps can be resolve. A new sludge processing system obliges developed countries to a re-examination of current laws but in the same moment becomes a great opportunity to developing countries that can revolutionize their hygienic condition and their environment approach from scratch through a sustainable strategy.

Every day in USA 10,000 billion liters of water are used. It is a quantity 8 times greater than river flow of Mississippi. The majority is used to generate hydroelectric power and 1200 liters remaining change their quality for worse as a result of use in industries, irrigation of plant stock, public services, domestic water supplies. This important quantity of wastewater can receive 3 different treatments to purify water and eliminate suspended solid and BOD, in order:

1. PRIMARY TREATMENT PROCESS:

Preliminary treatment that consists in the separation between water and solid materials. This process eliminates about 30% of BOD. For that reason is not sufficient to reduce concentrations of pollutants considerably and is necessary a supplementary treatment. Primary treatment can be divided in:

a) *Passage across grids or use of "comminutor"*
b) *Sand removal with sedimentation*

c) *Settleable solid removal in a settling tank and removing of primary sludge*
d) *Addition of chlorine to eliminate pathogenic bacteria*

2. SECOUNDARY TREATMENT PROCESS

More than 40% of world population's wastewater receives a secondary treatment that can reduce BOD rate between 75% and 90%. Two different treatments are available:

a) *Percolating filter*
b) *Process with activated sludge*

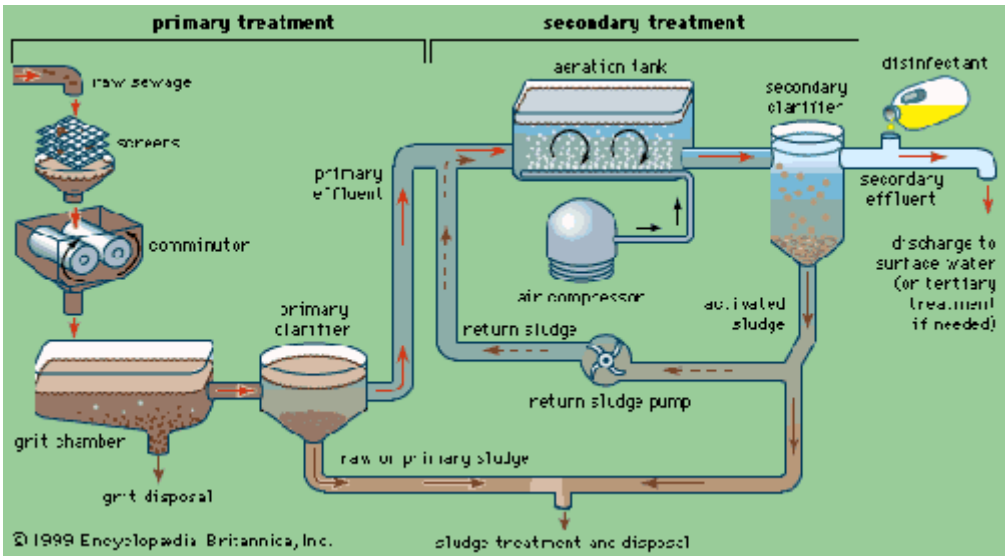


FIG.D – 1: Treatment of wastewater

3. TERTIARY TREATMENT PROCESS

Advanced techniques thinking to eliminate nutrients based on nitrogen and phosphorus, techniques of physic-chemical separation, like:

a) *Precipitation*
b) *Adsorption*
c) *Electrodialysis*
d) *Distillation*
e) *Reverse osmosis*

An important problem of wastewater treatment centers is disposal of sludge. There are two methods to face this theme: disposal into soil and disposal on the top of soil. The second solution is the more efficient because semi-liquid sludge that come out from purification system aren't safe for their hygiene condition. *Biostabilization* with organic waste and *composting* are more expended solutions actually. *Compost* has good fertilizing characteristics similar to other natural products.

Characteristics	Composting %	Peat %	Manure %
water	40 - 50	30	75 - 80
organic substances	20 -40	60	17
nitrogen	0,3 - 0,9	0,5 - 1	0,5
phosphorus	0,3 - 0,9	-	0,3
potassium	0,3 - 0,6	-	0,6
magnesium	0,3 - 0,9	-	-
calcium	0,6 - 6	-	-

TAB.D-1: Characteristics of Composting, Peat and Manure

Today, there is a strictly and precise legislation about features, proveniences and qualities of any type of composts. Classifications and prices are available simply. This said, new technologies have proposed a new kind of natural fertilizer: Biochar. It is a highly porous charcoal that helps extraordinary soils retain nutrients and water and it is produced by pyrolysis of biomasses. In this months European Union is working to give a clear classification to this type of product. When countries will have a complete legislation about matter of Biochar, it will be easier to integrate it with a new sanitation and wastewater management system.
This is an explanation of a classic configuration of system of sludge treatment. It is a long way to give a new life to wastewater. Even if these methods are difficult and incomplete, a great percentage of nutrients drop in the loop, especially precious element like carbon that can feed and increase productivity of soils. So, the idea of the UB Team for Sanitation System can represent a solution to a easier management of waste, reducing transformation processes and creating new opportunities of grown.

REFERENCES

- H.S.Stoker, S.L.Seager. Air and water pollution
- Biochar Group Meeting – Richland – May 21-22, 2009. The economics of Biochar production
- V.Nanni. Modern technique of drainages
- Training of environmental engineering – Milan - Febbruary 26, 1996. Recent trends in depuration of wastewaters
- Italian ministerial decree - April 16, 1976 –Regulation of discharges into maritime waters