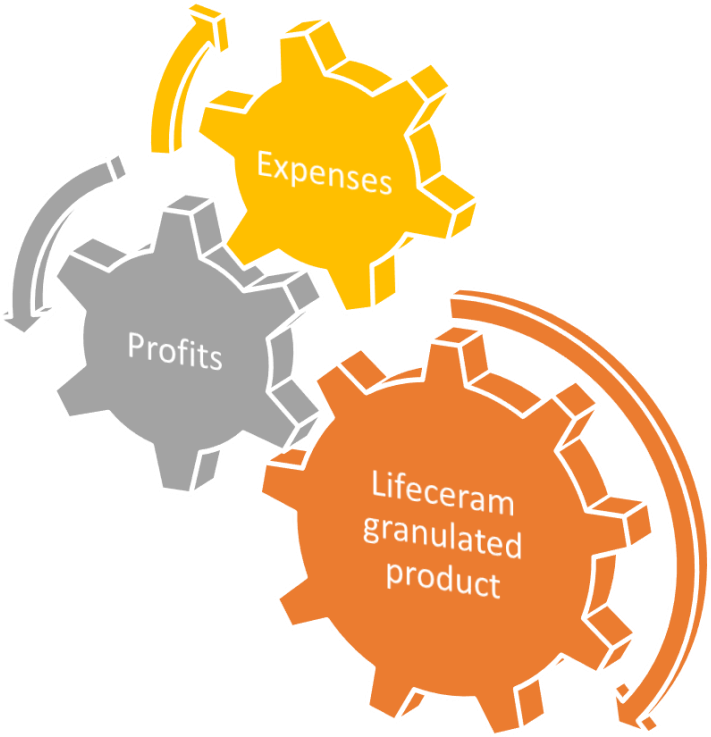
LIFE Project Number: **LIFE12 ENV/ES/00230**

LIFECERAM - Zero waste in ceramic tile manufacture



Business model. New company to collect and pre-treat the wastes to serve a revalued product ready to manufacture the Lifeceram product for urban flooring.

After-LIFE Communication Plan

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1. Background

The work described in this report is included in the project management tasks, specifically in Action E3- After-LIFE + communication plan. The deliverable DE3-1 included the realization of a business model for the creation of a new waste management company, dedicated to collect wastes from ceramic companies, pre-treat these wastes and serve them as revalued products to the tile companies, being ready to manufacture the Lifeceram product for urban flooring.

The business model has been made for a new company that produces granulated powder from ceramic wastes. This study was carried out at the end of the Lifeceram project, using the results obtained in the project; However, some data had changed slightly from those presented in the deliverables of the project, since they have been updated to adapt them to the current situation. In this way, both the composition of the product and the production method have varied slightly with respect to the deliverable DB5-3 and the "Final report"; on the other hand, the prices used in the realization of the business model have been updated to the data of February 2018.

2. Manufacture of the granulated product

2.1. Final composition of the granulated product

Considering the amounts in which every residue is obtained in the ceramic tile manufacture process, the composition of the granulated product has been calculated and it is included in Table 1, together with the water content of the different wastes. This composition was validated previously in ITC.

Table 1. Final composition of the granulated product.

Wastes	Composition (wt. %)	Water content (wt. %)
Fired scrap	45.0	0.5
Green scrap	45.0	2.0
Enamel sludge	7.5	60.0
Grinding and polishing sludges	2.0	25.0
Dry grinding waste	0.4	0.5
Inkjet ink waste	0.1	--

2.2. Design requirements

The design requirements allow to adequately size the equipment and facilities of the plant to be built; the most important are:

- Production of granulated powder and included stock
- Production rate
- Composition of granulated powder
- Moisture of wastes

The production has been estimated from the data of the potential market of the final product, namely, the current Spanish production of urban paving tiles. According to ASCER[1] data, in 2016 a total of 492 million square meters were sold, of which 25% was allocated to the national market and 75% to export. Of the national sales, 2.5% were allocated to urban paving and only 1% to exports. In this way, the number of total meters allocated to urban paving (sum of national and international) is 6.8 million square meters.

To be able to size the plant, it is necessary to know the amount of granulated product used per square meter of manufactured tiles. Taking into account the bulk density of the product, its shrinkage and its water content, it has been calculated that a 15 mm thick piece uses 36.3 kg of wet granulated powder/m^2. The plant has been designed to manufacture 100,000 t/year of wet granulated powder, so it will be able to manufacture granulated product to produce **between 35 and 40% of the current urban pavement production**.

Although the arrival of raw materials is considered constant, a 10-day security stock of every waste should be stored, to ensure a constant production against any external or internal disturbances. The production rate will be 16 h/day (two shifts), from Monday to Friday, with 30 days of vacation per year (230 effective days of work). From these values, a production of 27 t/h of granulated product is estimated. Considering the percentages of each waste in the final composition and the water content of each waste (Table 1), Table 2 shows the flow rates of each residue, considering the water content of different wastes when reaching the plant.

Table 2. Fluxes of the wet wastes used.

Wastes	Mass flow rate (kg/h)	Volumetric flow (m^3/h)
Fired scrap	11420.0	-
Green scrap	11590.0	-
Enamel sludge	-	4735.0
Grinding and polishing sludges	101.5	-
Dry grinding	520.0	-

[1] www.ascer.es

2.3. Flowchart and design of the facilities

According with the design requirements and considering the characteristics of the wastes, Figure 1 shows a representative flow chart of the facility where the most important operations appear: crushing, grinding, magnetic separation, granulation, and drying and the connections between the different elements of the facility.

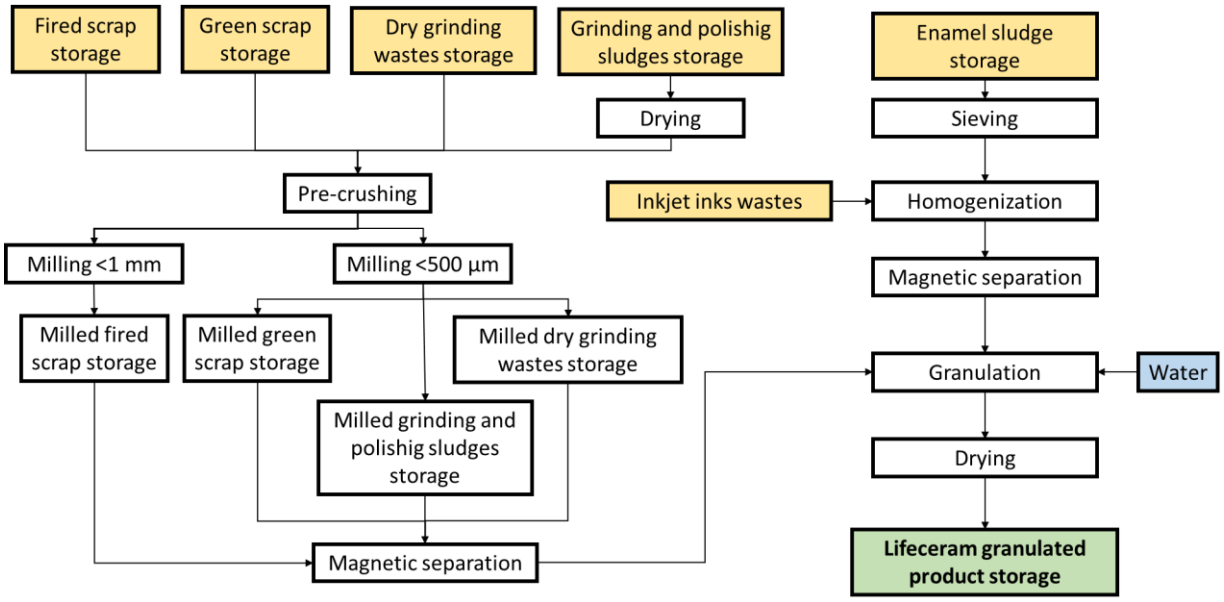

Figure 1. Flowchart of the facility.

The plant is divided into two differentiated parts: those in which scrap and grinding and polishing wastes are processed and that in which the enamel sludge and inkjet inks are processed. Both parts will converge on the granulator.

Table 3 shows the final size needed for each area of the plant, and the total area required:

Table 3. Occupied area of each area

Element	Area (m^2)
Production line	3,479
Laboratory, changing room and offices	290
Exterior area	1,100
Enamel sludges pond	113
Grinding and polishing sludges pond	610
Barns	570
Total	6,162

3. Investments

In this section the capital needed to build the plant and provide it with the equipment necessary for its operation will be calculated, which is called the budget for implementation of contractual engineering work. This budget includes the material execution budget, general expenses, industrial profit and VAT.

To calculate the material execution budget, it is necessary to know the cost of the equipment of the plant, the civil works and other expenses, which include: the costs of carrying out the initial tests of operation, licenses and permits and other generic elements of the plant, (shovel loader, pipes, office furniture, laboratory, etc.).

3.1. Calculation of the material execution

Table 4 lists the equipment necessary to complete the industrial facilities, according to the previous studies carried out in this project and the prices provided by the provider (Ch&T).

Table 4. Budget for equipment.

Equipment	Units	Unit price (€)	Total cost (€)
Disintegrator	1	56,000	56,000
Hammer mill	2	55,000	110,000
Magnetic separator for solids	1	3,610	3,610
Magnetic separator for suspensions	1	10,410	10,410
Granulator	1	350,000	350,000
Dryer	1	300,000	300,000
Centrifugal pump	4	2,782	11,128
Sieve	1	5,300	5,300
Storages silos	32	35,000	1,100,000
Conveyor belts	7	43,000	300,000
Total (€)			

The second budget consists of the civil works, which include the price of the purchase of the plot and the price of building the plant with all the necessary facilities (electrical system, plumbing, etc.); these costs are summarized in Table 5. The price of the plot is determined € 70 per m^2, corresponding to the value of the local industrial site where the plant is going to be installed. The price of civil works is calculated € 352 per m^2, including electrical installation, plumbing, etc.

Table 5. Civil Works budget.

Element	Area (m^2)	Cost (€)
Plot	6,932	485,240
Civil works	4,678	1,644,784
Total (€)		**2,130,024**

For other expenses (item "Others"), a total cost of € 50,000 has been considered, which corresponds to 1% of the sum of the rest of the items. The material execution budget is listed in Table 6.

Table 6. Material execution Budget.

Item	Cost (€)
Item 1: Equipments	2,246,448
Item 2: Civil works	2,130,024
Item 3: Others	50,000
Total	**4,426,472**

3.2. Calculation of Budget for implementation of contractual engineering work

To elaborate this budget, it has been considered: the general expenses are 13%, the industrial benefit is 6% and the VAT is 21%:

Table 7. Budget for implementation of contractual engineering work.

Element	Cost (€)
Material execution Budget	4,426,472
Overheads	575,441
Industrial profit	265,588
VAT	1,118,671
Total	**6,386,173**

4. Expenses

The operating budget details the expected annual expenses and includes direct expenses, indirect expenses and depreciation of the plant.

4.1. Direct costs

Direct costs depend on production. In this study, the cost of raw materials, electricity, fuel (natural gas), shipping of the final product and personnel cost have been considered.

4.1.1. Raw Materials

The Lifeceram granulated product is obtained exclusively from ceramic wastes, so the cost should be very low, except for the green scrap, since it can be easily recovered in ceramic companies, so it cost will be slightly higher. In conclusion, for the calculations it has been considered that the cost of the green scrap is € 5 per ton and the cost of other wastes is € 2 per ton, assuming the transport costs from the origin of the wastes to the designed plant. Table 8 shows the cost of raw materials according to their expected consumption per year.

Table 8. Wastes used in the facilities.

Material	Demand (t/year)	Price (€/t)	Total (€/year)
Fired scrap	45,000	2	90,000
Green scrap	45,000	5	225,000
Dry grinding	500	2	1,000
Grinding and polishing sludges	2,000	2	4,000
Enamel sludges	7,500	2	15,000
Total (€/year)	**335,000**		

4.1.2. Electric consumption

The electric consumption of the different equipment of the designed plant has been calculated considering the total electric power consumed by them, as well as the annual work hours of the plant. The cost of electricity has been taken as € 0.084 per kWh.

Table 9. Electric consumption of the facilities.

Equipment	Power (kW)	Consumption (kWh/year)	Cost (€/year)
Disintegrator	20.5	75,440	6,337
Hammer mills	75	552,000	46,368
Magnetic separator	0.8	5,888	494.6
Pumps	2.2	24,288	2,040
Sieve	0.73	2,686	225
Granulator	150.5	553,840	46,522
Dryer	2.6	9,568	803
Total (€/year)	**102,792**		

4.1.3. Fuel consumption

The dryer is the only equipment in the facility that requires fuel (natural gas). To perform the calculations, a value of 11 Nm^3/t was taken, value provided by the manufacturer to obtain a humidity of 6.5% from an initial humidity of 13%. Considering

the production of the installation, the HCV (higher calorific value) and the price of natural gas (€ 0.0494 per kWh), a total cost of **€ 57,417 per year** is obtained.

4.1.4. Personnel

Table 10. Personnel of the company.

Personnel	Units	Annual salary per person (€)	Total (€)
Operator	8	28,000	120,000
Administrative staff	2	29,000	50,000
Marketing staff	1	33,000	60,000
Production manager	1	55,000	50,000
CEO	1	65,000	60,000
Total (€/year)			**435,000**

4.1.5. Total direct costs

Table 11. Direct costs.

Direct costs	Cost (€/year)
Raw materials	335,000
Electricity consumption	102,792
Fuel consumption	57,417
Personnel	435,000
Shipping	200,000
Total	**1,130,209**

4.2. Indirect costs

Table 12. Indirect costs.

Element	Cost (€/year)
Lighting	12,365
Vehicles	15,000
Maintenance services	40,000
Insurance policies	3,000
Others	12,000
Total	**82,365**

4.3. Depreciation

Table 13. Depreciation costs.

Initial investment	Euros (€)	Depreciation percentage (%)	Depreciation (€)
Equipment	2,246,448	12	269,574
Civil Works	2,130,025	3	49,344
Others	50,000	15	7,500
Overheads	575,442	15	86,316
Industrial profit	265,588	15	39,838
Total	6,386,173		**452,572**

4.4. Total costs

Table 14. Total costs.

Expenses	€/year
Direct costs	1,130,209
Indirect costs	82,365
Depreciation	452,572
Total	**1,665,146**

5. Profit

The selling price of the Lifeceram granulated product has been fixed at **€ 24.7 per ton**, considering the expenses balance detailed in this document, as well as the profits. When compared with the selling price of red spray-dried powder (which is around € 38 per ton), it is observed that it is a competitive price.

6. Financial viability

To analyse the economic viability of the plant, the Profit and Loss Forecast and the cash flow from years 0 to 6, the NPV and the IRR will be calculated. For the calculation of these parameters it is necessary to fix others previously.

During the first two years, it is estimated that the maximum of the total production of the plant will not be reached, but the production will increase as the plant begins to operate, due to the novelty of the product. During the first two years 50,000 and 70,000 t/year will be produced, reaching during the third year to the nominal production of the plant (100,000 t/year), which is maintained during the following years.

To carry out the calculations carried out, a consumer price index (CPI) of 2.5% was considered.

To obtain the financing of the investment, it has been considered that the bank grants a loan of 70% of the initial investment, with an interest of 3% and that the debt must be paid in the first 6 years (for which the projection has been made, including here the year 0 where the start-up of the installation will take place). Thus, Table 15 shows the

initial capital of each year and the total amount to be paid annually to the banc (detailing interest and amortization).

Table 15. Annual quote to be paid to the banc

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Initial capital	4,470,321	3,779,221	3,067,387	2,334,199	1,579,015	801,175
Quote	-825,210	-825,210	-825,210	-825,210	-825,210	-825,210
Interest	-134,110	-113,377	-92,022	-70,026	-47,370	-24,035
Amortization	-691,101	-711,834	-733,189	-755,184	-777,840	-801,175
Final capital	**3,779,221**	**3,067,387**	**2,334,199**	**1,579,015**	**801,175**	**0**

6.1. Income statement

Table 16 shows the income statements from year 0 to 6. There, gross margin, EBITDA, pre-tax profit (PBT) and after-tax profit (PAT) have been calculated. For the calculation of profits, it has been considered that the corporate income tax is 25%. As can be concluded from said table, the company would produce benefits from the fifth year.

Table 16. Income statements.

Income statements	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Sales	-	1235000	1772225	2595044	2659920	2726418	2794578
Supplies	-	-167500	-240363	-351959	-360758	-369777	-379022
Gross margin	-	1067500	1531863	2243084	2299161	2356641	2415557
Direct costs	-	-347604	-498812	-730403	-748664	-767380	-786565
Fixed costs	-	-82847	-84918	-87041	-89217	-91447	-93734
Personnel costs	-	-435000	-445875	-457022	-468447	-480159	-492163
EBITDA	**-**	**202049**	**502257**	**968618**	**992834**	**1017654**	**1043096**
Depreciation	-	-452572	-452572	-452572	-452572	-452572	-452572
Operating results	-	-250523	49686	516046	540262	565083	590524
Financial results	-134110	-113377	92022	-70026	-47370	-24035	-
PBT	**-134110**	**-363899**	**-42336**	**446020**	**492891**	**541047**	**590524**
Corporate income tax	33527	90975	10584	-111505	-123223	-135262	-147631
PAT	**-100582**	**-272925**	**-31752**	**334515**	**369669**	**405786**	**442893**

6.2. Cash flow (CF)

Cash flow (CF) refers to the economic flows of entry and exit in a certain period in a company. To define this parameter, it is necessary to describe in advance the "Working Capital", which refers to all the costs associated with the final product, that is, costs of the raw material, direct costs and personnel costs that are linked to the production:

Table 17.Working Capital.

Working Capital	
Raw materials	3.4 €/t
Direct costs	7 €/t
Personnel costs	3.2 €/t
Total	**13.5 €/t**

Next, the following concepts are defined:

- rotation: 30 days
- average collection period (ACP): 90 days
- average payment period (APP): 60 days

Applying the above data, the price that costs to maintain the final product generated but not yet sold, the amount of the accounts pending to be payed to suppliers and the amount receivable from customers is calculated annually. Considering the tax refunds of the first year and the CAPEX, investors must make an investment of 3 million euros to avoid obtaining the financial year 0 a negative cash.

Thus, the sixth year, after paying the debt to the bank and selling all production, a cash flow of € 561,740 is obtained. This value will be the same for the following years, if the process works in the same conditions. Table 18 shows all the calculated data for each projected year.

Table 18. Calculation of the annual cash flow.

Cash Flow	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
EBITDA	-	202049	502257	968618	992834	1017654	1043096
Working Capital	-	813648	-137499	-210102	-13541	-13880	-14227
Stock	-	-55488	-22195	-33293	-	-	-
Customers	-	-368470	-160284	-245493	-19356	-19840	-20336
Suppliers	-	118935	44980	68684	5815	5960	6109
VAT	-	1118671	-	-	-	-	-
CAPEX	-6386173	-113143	-150857	-226286	-452572	-452572	-452572
Investment by shareholders	3000000	-	-	-	-	-	-
Debt cash flow	-3386173	902554	213901	532230	526721	551203	576297
Payments / financing arrangement	3779221	-711834	-733189	-755184	-777840	-801175	-
Finance expenses	-134110	-113377	-92022	-70026	-47370	-24035	-
Full year cash flow	**258938**	**77344**	**-611309**	**-292980**	**-298490**	**-274007**	**576297**
Initial cash flow	-	258938	336281	-275028	-568008	-866497	-1140504
Cumulative cash flow	258938	336281	-275028	-568008	-866497	-1140504	-564207

6.3. Net Present Value (NPV) and Internal Rate of Return (IRR)

For the calculation of the NPV, a discount rate of 8% is applied, according to the National Commission on Markets and Competition. Finally, the values of the NPV and IRR obtained are calculated.

Table 19. NPV and IRR obtained for the investment.

Investment (€)	NPV (€)	IRR (%)
3,000,000	**3,733,597**	**8.9%**

7. Conclusions

Analysing the results obtained for the financial viability study and the two main economic indicators (NPV and IRR), it can be concluded that the project is totally viable, because the value of the NPV is higher than the investment by the shareholders. In addition, the IRR is 8.9%, and, after studying the current situation of the real estate market and its current profitability (7%), it is concluded that undertaking this project will be profitable for the shareholders.