



# BIOCHAR PILOT PROJECT

---

Small scale production and practice of Biochar in the North of Portugal preparing the operating conditions of an industrial unit.

Paço de Lanheses

## WHAT IS BIOCHAR ?

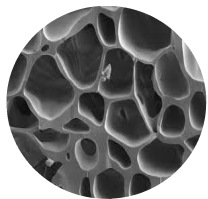
Biochar is made from biomass via Pyrolysis\*. It is used as a soil amendment for soil and atmospheric benefits like carbon sequestration. Biochar is a stable solid, rich in carbon, and can endure in soil for thousands of years.

\***Pyrolysis** is the thermal decomposition of organic materials at elevated temperatures in the absence of oxygen.

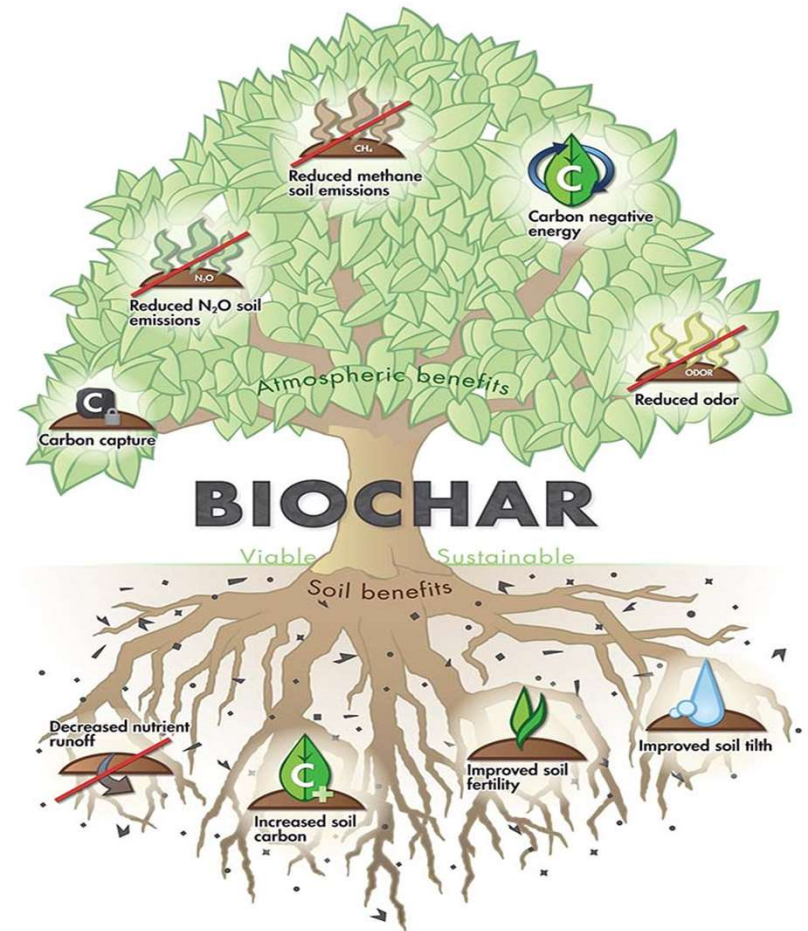
## BIOCHAR IS A VALUABLE SOIL AMENDMENT

This 2,000 years old practice converts agricultural waste into a soil enhancer that can hold carbon, boost food security, increase soil biodiversity, and discourage deforestation. The process creates a fine-grained, highly porous biochar that helps soils retain nutrients and water, increasing soil fertility.

Biochar also improves water quality and quantity by increasing soil retention of nutrients and agrochemicals for plant and crop utilization. More nutrients stay in the soil instead of leaching into groundwater and causing pollution.



Microscopic view of biochar, showing the alveolar network housing micro-organisms, nutrients and water.



## IMPLEMENTATION OF THE PILOT UNIT (PHASE 1) ABLE TO:

### Test before Industrialization of biochar production for:

- Agriculture, Horticulture, Arboriculture and pastures amendment (water and nutrient retention, soil aeration and enhancement of micro-organisms activity, improvement of soil fertility and crops yield)
- Soils remediation (revegetation of former industrial areas)
- Welfare of animal farming (Feed additive/ Supplement, litter additive)
- Mitigation of climate change (carbon credit registration)
- Creation of new carbo-industries for various other uses (water treatment, building insulation material...)

## MAIN KEY BENEFITS

### SOCIAL

- Developing carbon farming as a priority .
- Increase in arable land.
- Improving diet.
- Achieving Food security.

### ECONOMIC

- Better agricultural and livestock productivity.
- Water and fertilizer saving.
- Industrialization of new products and wealth creation.
- Food price stability.

### ENVIRONMENTAL

- Net reduction of CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub> in the atmosphere with permanent sequestration of carbon.
- Better soil resistance to drought and erosion, forest fire risk reduction.
- Development of organic and conservative agriculture.

## BIOCHAR PRODUCTION EQUIPMENT



The kiln works as a dryer and pyrolyser.

It is possible to pyrolyze all sort of biomass, including straws and green wood.

Thanks to the cone form, continual vortex streaming develops, ensuring very clean burn with low smoke emissions.

Average production capacity: 4,6 tons per month of biochar from 21 tons of biomass

Biochar produced by this kiln fulfills all conditions for the premium European Biochar Certificate.

Paço de Lanheses

## LEGAL STRUCTURE

TO BE IMPLEMENTED AS A PRIORITY

**Main partner:** Paço de Lanheses

**Other possible partners:** .....( OMondoSomosNos ?,Quinta ecológica de Peneda ? Parque Nacional Peneda-Gerês.?)

## INSTITUTIONAL PARTNERS

- Escola Superior Agrária de Ponte de Lima
- Universidade do Minho
- Universidade de Aveiro

Ministério do Ambiente e da Ação Climática  
CESAM (Biovalchar)

International Biochar Initiative.  
Ithaka Institute.  
Carbon-standards AG.

Paço de Lanheses

## IMPLEMENTATION SEQUENCES

- **LEGAL STRUCTURE, ORGANIZATION, FINANCING, INVESTMENT, RECRUITMENT, TRAINING**

Economic Interest Grouping (ACE in Portugal) or non-profit association? Small scale process amortized over 3 years, followed by the industrial one ? Local or European grant? 2 employees will be sufficient for this first phase.

- **CERTIFICATION AND CARBON CREDIT REGISTRATION**

Realized in collaboration with Ithaka institute and Carbon Standards AG, to possibly export part of the production and benefit from the carbon offset market.

- **TESTS AND ADAPTATION FOR SOIL AMENDMENT, LIVESTOCK FARMING, FILTRATION, BUILDING MATERIAL**

Testing will take place at Paço de Lanheses and partners farms, and with the companies concerned, for filtration and building material. One half of production will be used for testing, the other half for sale in 5 L boxes for horticultural market.

- **MARKET PROSPECTING (In the perspective of phase 2)**

Part of biochar production will be used in production (Filtration, Building material) and sold at retail, for local consumption and export. That will allow to partially subsidize the other part used for agriculture, horticulture, arboriculture and breeding in the country. Partners, organic farms and livestock breeding will be privileged customers.

- **FEASIBILITY STUDY AND BUSINESS PLAN OF INDUSTRIAL UNIT (PHASE 2)**

Test results and verified expectations of potential markets will confirm the industrialization phase and specify its size and profitability.

## BIOCHAR PILOT PROJECT - ACTION PLAN - Starting period (5 months) + Year 1

Activities	Starting Period														Actors, Supervisors	EXPECTED RESULTS		
1. Legal and social organization.															P de L/CZ	1-Non-profit ACE or association.		
2. Business Plan.															CZ	2-Allowing the granting of european funds		
3. Sensibilisation Private and Public partners.															P de L/CZ/GV	3-To prepare for financing and acting.		
4. Funding.															P de L/CZ/GV	4-European grant +small partner particip...		
5. Land leveling, access, development.															CZ/Subcontr.	5-With phase 2 in mind.		
6. Staff recruitment,1 technician, 2 operators.															CZ	6-Looking for dedicated persons.		
7. Purchase of the carbonizer and accessories.															CZ	7-With a simple heat recovery device.		
8. Purchase of tools and control utensils.															CZ	8-To create a small laboratory.		
9. Biomass identification, collection and storage.															P de L/CZ	9-Collection policy / type of biomass.		
10. Training and first batch of biochar.															CZ	10-Submission of a sample for certification.		
11. Certification and launch of production.															CZ/Partner	11-Target: 3,8 t of biochar per month.		
12. Trials in agriculture and forestry.															CZ/Partners	12-13-14-15-Designation of partners and		
13. Trials for cattle and poultry breeding.															CZ/Partners	locations. Monitoring of test specifications.		
14. Filtration and water treatment tests.															CZ/Partners	16-Edition of documents certifying test		
15. Wall coating and insulating panels to be tested															CZ/Partners	procedures and results.		
16. Trials documentation and report.															CZ/Partners	17-Confirm with Carbon-Standards the		
17. First marketing and environmental conclusions.															CZ/GV/Partner	validity of the process and the use of		
18. Draft of Business Plan phase 2															CZ	biochar for the allocation of carbon credits.		
	24	2025										26		18-Use this first experience to build the				
	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	basis of the phase 2 Business Plan.

## MARKETING OF BIOCHAR

	PRODUCT	MARKET	CLIENT	INSTITUTIONAL PARTNERS	ADVANTAGES	RESULTS
<b>A</b>	Soil Amendment	Agriculture/ Agroforestry	Public/Private farmers Family and community gardens/ Specialized NGO and environmental associations	Ministerio da Agricultura Escola superior agraria de Ponte de Lima. Universidade do Minho Universidade de Aveiro CESAM	Yield increase/ Water saving/ Fertilizer saving/ Improved soil quality/ Nutrient retention/ Long term carbon sink/ Soil decontamination	Increasing food security/ Stabilising food prices/ developing sustainable agriculture/ Facilitating resettlement/ Mitigation of climate change/
<b>B</b>	Animal manure, bedding Feed supplement.	Animal husbandry	Cattle breeders/ Poultry farms	Ministerio da Agricultura e Pescas (DGAV) Universidade do Minho	Improve health and Appearance. increase milk, fat, protein Reduce diarrhea. Reduce manure odor. Decline in mortality rate.	Improve animal health and productivity. Pre-loading the biochar on the litter, making it a rich soil supplement after pyrolysis.
<b>C</b>	Filtration	Air & water treatment	Specialised companies/ Municipalities/ Individuals	Ministerio do Ambiente e Transição Energetica (ERSAR)	Stormwater management Biochar can be used alone or mixed for any type of filters.	Contaminant removal particularly metals and organics.
<b>D</b>	Building material	Plasrering Insulating panels	House, warehouse & roads builders/ Concrete, bricks & panels manufacturers.	Ministerio Infraestrutura e Habitação	Thermal insulation and regulation of humidity. Efficient absorption of electromagnetic radiations.	Optimization of indoor climate for preservation of health and energy saving
<p><u>Comments:</u> Production and marketing of Biochar in Portugal will use best international technology and know-how, to protect the climate and promote employment and productivity in the country. This will allow the development of a new and profit-making carbon farming and carbon industry, essential for future generations.</p>						

## ESTIMATED BUDGET

Equipment	Quantity	Unit cost (EUR)	Total (EUR)
Carbonizer and accessories	1	6 000	6 000
Tools	1	3 000	3 000
Biomass supply unit	1	5 000	5 000
Storage and packaging equipment	1	6 000	6 000
Building, land leveling and access	1	15 000	15 000
Vehicle	1	10 000	10 000
Office and laboratory equipment	1	5 000	5 000
Transport, Insurance, Installation	1	2 000	2 000
		<b>Sub-Total</b>	<b>52 000</b>
Services / Starting costs			
Ithaka assistance	1	2 000	2 000
Local experts/academics	1	3 000	3 000
Carbon-Standards, product certification,	1	4 000	4 000
Accounting, Lawyer	1	2 000	2 000
		<b>Total</b>	<b>63 000</b>

Paço de Lanheses

## PROFIT & LOSS ACCOUNT

Machine: 1Kon Tiki 1000			
Parameter	Quantity	U.P.	Unit
<b>Production</b>			
Biochar production rate	0,7		M3/J
Biochar production	202		M3 / year
Biomass input	230		tonnes / year
Annual time in activity	11		months / year
Total utilisation period of the equipment	3		years
<b>Revenues</b>			
Biochar in 5 L boxes selling price		1750,00	EUR / M3
<b>Carbon credits</b>			
Carbon credits per tonne of biochar	3,0		
Carbon credit selling price		100	EUR/ tonne
Annual CO <sub>2</sub> reduction (carbon credits)	151		tonnes CO <sub>2</sub> e / year
<b>Tax</b>			
Tax rate		20%	
<b>Costs</b>			
<b>Staff</b>			
Manager	0	36 000	EUR / year
Foreman	0	30 000	EUR / year
Technician	0	24 000	EUR / year
Operator	2	18 000	EUR / year
Secretary	0	18 000	EUR / year
<b>Energy</b>			
Water consumption	500		M3 / year
Water cost		1	EUR/ M3
Electricity consumption	5 000		kWh / year
Electricity cost		0,17	EUR / kWh
<b>Production</b>			
Biomass supply		50,00	EUR/ tonne
Packaging		500,00	EUR/ M3
Maintenance		2 000	EUR/ year

Profit & Loss Account (EUR) 1 Kon Tiki 1000			
Annual production: 50 tonnes / 200 Cubic meters of biochar			
From: 230 total tonnes of biomass			
<b>Annual sales biochar</b>	<b>117 600</b>	<b>176 400</b>	<b>176 400</b>
<b>Carbon credits income</b>	<b>0</b>	<b>15 120</b>	<b>15 120</b>
<b>Costs</b>			
Manager (0)	/	/	/
Foreman (0)	/	/	/
Operator (2)	36 000	36 000	36 000
Secretary (0)	/	/	/
Water	500	500	500
Electricity	850	850	850
Biomass supply	7 667	11 500	11 500
Packaging	33 600	50 400	50 400
General expenses	24 000	24 000	24 000
Maintenance	2 000	2 000	2 000
<b>Total</b>	<b>104 617</b>	<b>125 250</b>	<b>125 250</b>
<b>Depreciation</b>	<b>21 000</b>	<b>21 000</b>	<b>21 000</b>
<b>Profit before tax</b>	<b>-8 017</b>	<b>45 270</b>	<b>45 270</b>
<b>Profit after tax</b>	<b>-8 017</b>	<b>36 216</b>	<b>36 216</b>
<b>Cash flow</b>	<b>-50 017</b>	<b>57 216</b>	<b>57 216</b>
<b>Cumulated cash flow</b>	<b>-50 017</b>	<b>7 199</b>	<b>64 415</b>
<b>Investment cost:</b>	<b>63 000</b>		
<b>Internal rate of return</b>	<b>78%</b>		

Paço de Lanheses

**CARBON-FARMING, A STRATEGY ABLE TO DEVELOP PORTUGUESE ECONOMY  
WHILE MITIGATING CLIMATE CHANGE,  
AND RESTORING INTEGRITY OF THE NOURISHING EARTH.**

Paço de Lanheses