ABC Animal Bone bioChar: recovered organic phosphate fertilizer for the agriculture

**SHORT DESCRIPTION**

Animal Bone bioChar (ABC) is a recovered organic phosphorus fertiliser produced from food grade animal bones with advanced zero emission environmental performance. The current investment project is aimed at the implementation of an ABC processing plant hardware installation (replication model) and the global market uptake of ABC biochar technology.

**Funding requirement**

EUR 5 M

<table>
<thead>
<tr>
<th>Sector</th>
<th>Agriculture, Horticulture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project owner</td>
<td>Terra Humana Ltd.</td>
</tr>
<tr>
<td>Location</td>
<td>Kajászó, Hungary</td>
</tr>
<tr>
<td>Implementation period</td>
<td>2016-2017</td>
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<tr>
<td>Overall Budget of the Project</td>
<td>EUR 7 million</td>
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</table>

### PROJECT BACKGROUND

#### Project Owner

Terra Humana Ltd. is a technology-intensive company playing a leading role in zero emission pyrolysis technology engineering, phosphorus recovery and biochar industrial production. Since 2002, Terra Humana Ltd. has coordinated multiple international research and development programs in the specific field of carbon refinery and phosphorus recovery.

Terra Humana Ltd is the original source and inventor of the “3R” Recycle-Reduce-Reuse zero emission advanced pyrolysis technology. The 3R development has been financed by the company until 2002. From 2002, the European Commission selected the technology and co-funded the further developments through its research and development programmes. By the end of 2015, the R&D stages were successfully completed, finalized and the technology was made ready for market uptake. During the past years, Terra Humana has built up a wide network of stakeholders in both the scientific and industrial sector.
The flagship project of the company is recovering phosphorus and other nutrients from bio-waste via pyrolysis technology and biochar biotechnological formulation. Terra Humana Ltd. is the only biochar vendor in Europe with an official and accredited Authority permit\(^1\). Recently the company also received Authority permits for the full-scale industrial installation and operation of an organic phosphorus recovery plant in Kajászó, Hungary\(^2\).

The company has a staff of 12 people and a balance sheet with a total of EUR 3.3 million.

The owner and managing director of the company is Mr. Edward Someus, a Swedish-Hungarian senior environmental engineer and businessman with core competence and specialization in industrial pyrolysis, carbon product development, phosphorus recovery from animal by-products and marketing of related products in the agricultural and environmental industrial sectors as adsorbents. Mr. Someus is also involved in the European Commission standardization and harmonization of laws as a consultant for the revision of the EU Fertiliser Regulation in the field of expansion to innovative recovered fertilisers.

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1 Under the united EU and Member State regulation to use qualified and eco-safe biochar products in an open ecological soil environment (permit number 02.5/67/7/2009, CLP upgraded 04.2/102-2/2015
2 FES/01/0851-33/2015 uniting permits from ten different Authorities
Technology

Terra Humana Ltd. has developed an innovative technology for phosphorus recovery from animal by-products and biochar manufacturing through a series of research and development projects. The demonstrated and operating complex technology includes:

- ‘ABC’ Animal Bone bioChar, an innovative and recovered phosphorus fertilizer produced from food grade animal by-products in line with the EU bio nutrient circular phosphorus economy model,
- the comprehensive manufacturing process via “3R” pyrolysis technology,
- “3R” pyrolysis equipment and infrastructure,
- comprehensive field testing involving independent laboratories and national authorities under EU regulations,
- legal evaluations and industrial operations/product application Authority permits and
- economical planning, market investigation and end-product market uptake evaluation.

The goal of the current investment project is the implementation of an ABC processing plant hardware installation (replication model) and the global market uptake of ABC biochar technology.

Animal Bone bioChar (ABC) is a recovered organic phosphorus fertiliser produced from food grade, category 3 animal bones between 600 – 850°C reductive thermal processing and negative pressure conditions with advanced zero emission environmental performance (3R technology).

ABC has a 92% calcium-phosphate (30% P2O5) content which makes it a significant source of phosphorus and thus a significant alternative of the mineral phosphate fertilizers in current use. For farmers, the economic benefits of ABC is the use as organic and low-input fertilizer in the horticultural sector (fruit and vegetables); improving soil quality in physical, chemical and biological terms, such as strengthening the activity of the soil; restoration of the natural soil balance, and increasing its drought tolerance and productivity.
The main agricultural and environmental importance of ABC is that it contains no heavy metal contamination and toxic elements and adheres to even the strictest requirements of organic agriculture. (Traditional mineral source phosphate fertilizers contain cadmium and uranium as inevitable by-products of the production technology). ABC biochar is manufactured from food quality animal bones and renewable biomass resources, and is the by-product waste of the food industry available in large quantities.

In the EU, approximately 20 million tonnes of slaughter by-products are produced by the meat industry every year, including several million tonnes of food grade bones, which is far more sufficient to manufacture the targeted EU production of 250,000 t/y ABC before 2025. However, ABC processing requires high-end specialized technology for which Terra Humana Ltd. is the sole specialized vendor in Europe.

The 3R pyrolysis field demonstration equipment with a 2000 t/year throughput capacity is currently in operation in Polgardi, Hungary, with focus on applied research and development. For industrial scale production, a 20,800 t/h throughput capacity pyrolysis plant will be installed in Kajászó, Hungary, situated west of Budapest at an excellent logistics hub location.

The quality and safety of the ABC produced at the 3R field demonstration plant was investigated by an independent and accredited laboratory, WESSLING Hungary Ltd., based on both the European and Member State legislation (which is among the strictest in Europe). The measurements confirmed that the biochar produced by the technology of Terra Humana Ltd. is of an exceedingly high quality, meeting all EU, US and Australian industrial, environmental and safety requirements; its agronomic efficiency is high, it is free of heavy metal and toxic elements, and meets the requirements for higher standards of organic agricultural application. Furthermore the impact assessment confirmed the positive impact of the ABC material on crop yield, quality and food safety. In this context, ABC is a natural product with a high agronomic and economic application efficiency, whilst also significantly improving food and environmental safety.

**Property rights**

Edward Someus, owner of Terra Humana Ltd., solely owns all the necessary intellectual property rights to all the key elements of the ABC biochar manufacturing technology and its products. The technology exploitation objective is to enter the global market as a biochar manufacturer and also as a technology provider for licensed/franchised partners.
The 2016 Business Opportunity

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Phosphorus is economically available from two sources: from phosphate mines in mineral form and from animal bones. Currently, the agricultural sector mainly uses mineral forms for fertilization. However phosphate fertilizers delivered from mined rock phosphate cause significant problems for the sector. Firstly, rock phosphate raw material can contain high levels of cadmium and uranium. Secondly, the European Union is poor in phosphate reserves and imports approx. 95% of phosphate fertilizers from outside the European Union (from Morocco, Tunisia and Russia). This makes phosphate a listed (one of twenty) critical raw materials for the EU. Thirdly, in many cases only approx. 30% of the nutrient leached dissolved organic phosphorus is only utilized by the plants, while this ratio in the case of controlled release ABC natural substance more closely approximates full value.

The Terra Humana Ltd. 2016 business opportunity consists of four integrated elements which are together present in the right time and EU location, including:

a) The need: a strong and rapidly growing EU market demand for pure organic phosphorus in the organic horticultural sector and water treatment adsorbent industry.

b) The means to fulfil the need: the implementation in 2016 of a production franchise model project in a low-cost country such as Hungary at a logistical hub with a 12,500 t/y ABC output.

c) The method to apply the means to fulfil the need: coherently integrated EU marketing and sales distribution networking of ABC products.

d) The benefit method: franchise technology and sale of ABC products.

Beyond the proposed business opportunity in 2016, the ten year-period business opportunity in the EU includes the production of 250,000 tons of pure ABC per year before 2025 via 20 installed plants, which targets a EUR 500 million value business sector, yet still involves less than 10% substitution potential only for imported mineral P fertilizers. In the upcoming years, international ABC business opportunities are also planned in the USA and Australia.

Before the innovative technology of Terra Humana Ltd., there was no efficient and modern phosphorus recovery technology to produce high quality bone char from animal bones which adhere to the new, strict regulations of the EU. The solution allows to supply recovered organic phosphate fertilizer to the agricultural sector at a reasonable price. The global phosphate fertilizer demand is expected to grow until 2018 from 41.7 million nutrition tons (P2O5 content) to 46.6 million tons, which results in a global annual market size of approx. EUR 7.2 billion. The European market is estimated to be 8% of the global market.

Terra Humana Ltd. plans to enter the global market with its breakthrough technology and offer an innovative recovered organic phosphorus fertilizer as an alternative of the currently used mineral phosphate fertilizers. The organic horticultural and low-input agricultural sectors are significant and rapidly growing open markets for the ABC biochar.
The project is for the implementation of an ABC processing plant hardware installation (replication model) in Hungary, Kajászó.

- Year 1: infrastructural investments and installation of the plant.
- Year 2: basic capacity production. Throughput capacity: 6,500 t/y animal bone. Output production: 4,000 t/y ABC biochar.
- From year 3 onwards: full capacity production. Nominal throughput capacity: 20,800 t/y (or 2.6 t/h) animal bone. Output production: 12,500 t/y ABC biochar.

WHY INVEST?
- A strategic breakthrough in technology on a critical raw material market in the EU and globally as well.
- Provides an efficient, economical and safe product solution for the significant, increasing and predictable national, European and global markets with high food safety demands at an affordable cost.
- Fast payback period.
- The rapidly changing legal environment in the EU and the USA requires changes in technology and products, and encourages the production and market uptake of the innovative and recovered Phosphorus fertilizer at competitive market costs.

III. FINANCIAL INDICATORS

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<th>2016</th>
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<tbody>
<tr>
<td>Investment (EUR 1,000)</td>
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<tr>
<td>Operating costs (EUR 1,000)</td>
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<td>Sales quantity (tons)</td>
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<td>4000</td>
<td>12500</td>
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<td>Revenue (EUR 1,000) EXW</td>
<td>0</td>
<td>5000</td>
<td>15625</td>
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<tr>
<td>EBIT (EUR 1,000)</td>
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<td>4300</td>
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Quantitative and qualitative indicators

<table>
<thead>
<tr>
<th>QUANTITATIVE INDICATORS</th>
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<tbody>
<tr>
<td>Mid-term revenues / year expectation</td>
<td>EUR 15.6 million</td>
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<tr>
<td>Mid-term market penetration expected (%)</td>
<td>0.1%</td>
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IV. INVESTMENT OFFER

| Required amount of hardware investment in 2016 | EUR 5 million   |
| Form of investment                            | Equit           |
| Proposed capital/equity structure            | Minority share  |

Investment schedule

- 2016 - plant and technology hardware installation: EUR 4,000,000 (including full value technology insurance)
- 2017 – operating costs: EUR 1,000,000

Proposed exit strategy

Trade sale for a strategic investor. Exit after 3-4 years. Terms and conditions to be flexibly discussed.

CONTACT DETAILS
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