

PREFEASIBILITY ON SETTING UP ACTIVATED CARBON FROM RICE HUSKS PROCESSING PLANT IN NIGERIA

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ABOUT THIS REPORT

This prefeasibility study is designed to provide potential and startups entrepreneurs' valuable information on setting up plant for production of activated carbon from rice husks business in the food processing industry of Nigeria's market; aimed at encouraging and facilitating industrial activities across the country. It is our realization that industrialization is at the heart of economic development and that every effort has to be made to bring about industrial growth and encourage our people to be part of it.

The Activated carbon from rice husk business shows over 50% local content in terms of availability of raw material, equipment and machinery, manpower and other requirements.

The key areas covered in this report include:

- i) Technical and economic analysis of the production, marketing and profitability of the project.
- ii) Recommendations in respect of procurement of equipments and associated problems.
- iii) Recommendation on suitable agronomic management practices to ensure efficient running of the projects.
- iv) Detailed financial analysis including project cash flows for the projects.

This prefeasibility report provides a comprehensive and detailed coverage of the above terms of reference and is designed to facilitate investment decisions.

The implementation of this project will also impact positively on the economy of the immediate community where the project is located. This is in terms of employment-direct and indirect, skilled and unskilled. Government also stands to benefit from internal revenue from taxation.

In view of the result of the analysis using some economic indicators as stated in the proposed project, it is hereby recommended that the project is viable.

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PART I

EXECUTIVE SUMMARY

1.0

This prefeasibility study is for setting up of processing plant for the production and marketing of activated carbon from rice husks proposed to be sited in the most suitable part of Nigeria.

The activated carbons are widely used for the absorption of toxic gasses. This product has a good marketability with proper linkages of the manufacturers, especially in the sugar and sewerage industries. Research shows that 90% of the activated carbon used in the country is imported, although the major market for the product is on export.

This project is a small scale rural enterprise. The location of the factory should take into consideration the proximity of raw material sources, the availability of cheap labour, lower cost of operations and access to market.

The estimated daily production capacity is 500grams of activated carbon which translates to 156,000grams annually at 60% capacity utilization, working 312 day per annum.

The total investment estimate is N15,415,400, capital cost of N12,114,000 and working capital of N3,310,400.

1.1 SUMMARY OF TOTAL PROJECT COST

S/N	DESCRIPTION	COST INCURRED	COST TO BE INCURRED	TOTAL
1	Land & building	-	600,000	600,000
2	Machinery & equipments	-	7,584,000	9,244,000
3	Utility equipment	-	1,920,000	1,920,000
4	Office equipment	-	350,000	350,000
	TOTAL CAPITAL COST	-	10,454,000	12,114,000
5	Working capital	-	1,900,000	1,900,000
6	10 % Contingencies and preliminary expenses	-	1,401,400	1,401,400
	TOTAL PROJECT COST	-	13,755,400	15,415,400

1.2 FINANCIAL ACCOUNTING RATIOS ANALYSIS

PERFORMANCE RATIOS AVERAGES

- (a) Return on Sales =19%
- (b) Return on Equity =219%
- (c) Return on Investment =278%
- (d) Positive NPV = ~~N~~33,130,416
- (e) IRR =47%
- (f) ARR =67%
- (g) Payback Period = 2 year and 2 months.

PART II

MARKET ANALYSIS

2.1 INTRODUCTION

Activated carbon is veritable product most especially in developed and developing countries for industrial and commercial purposes. Factors such as increasing population and urbanization in developing countries such as China, India (Asia Pacific) and other parts Europe have fueled the growth of the activated carbon market size.

2.2 MARKET AREA ANALYSIS

Activated Carbon (AC) is a highly porous material, and it has versatile applications in environmental contaminant removal, electrode material preparation, development of super capacitors, catalytic support for various applications, and energy storage system development. AC has a high surface area, a highly porous structure, and high thermal stability, as well as high acid and basic stability with different surface functional groups. These properties develop when AC is produced through different physical or chemical activation processes. AC has widespread applications in the removal of inorganic material, organic pollutants and gaseous environments, with applications with respect to energy. However, the versatile use of AC is sometimes hindered due to its high production and processing costs. Therefore, many attempts have been put forward for AC production from different low-cost precursors including industrial and agricultural waste. Agricultural solid wastes are very common in every country, and are very cheap resources which can be converted into AC with excellent properties.

2.3 GLOBAL MARKET ANALYSIS

The global Rice Husk Ash (RHA) market is expected to witness a category spend growth of USD 700 million between 2016-2021, with spend momentum accelerating at a CAGR of 5.92% during the forecast period. This spend growth is mainly attributed to the wide applications of rice husk ash. The growth of the segments such as building and construction has increased the demand for rice husk ash in the manufacturing of concrete mixes and steel. Rice husk ask is also used in various other applications such as activated carbon, low-cost water purification solutions, and oil adsorbents. The increased consumption of rice husk in many such applications is driving the growth of the global rice husk ash market size.

2.4 TARGET MARKET ANALYSIS

The market for AC is wide and provides good investment opportunities for entrepreneurs to tap. The application and use includes the following:

- Used in concrete construction as replacement for cement.
- Energy production of mill operations.

- Household lighting in rural regions
- Manufacturing of silica gels and silicon chips
- Synthesis of activated carbon
- Production of lightweight construction materials
- Ingredients for lithium-ion batteries
- Insecticides and bio-fertilizers
- Specialty paints.

PART III TECHNICAL ANALYSIS

3.1 PRODUCT DESCRIPTION

RHA is produced by burning the outer shell of paddy called the rice husk. Rice milling of paddy generates about 22% rice husk and 78% rice. The husk produced is used in rice mills as fuel to generate steam for the parboiling process. This husk contains approximately 75% organic volatile matter, and the remaining 25% is converted to RHA during the firing process.

3.2 RICE HUSK ASH - PROCUREMENT BEST PRACTICES

One of the procurement best practices that the buyers of the rice husk ash category can follow is to engage with suppliers that provide cost-effective and flexible transportation and packaging options. Key suppliers in the market are improving their offerings to provide necessary assistance to the buyers in selecting the best shipping, handling, and packaging methods for RHA products. Such initiatives enable buyers in optimizing transportation costs and preventing litigation costs due to non-adherence of regulations set by institutions such as DOT and IATA. For instance, transportation requirements such as dedicated containers, mobile filter units, bulk tank car, bulk bags, and bulk containers are taken care of by the suppliers.

3.3 SPECIFICATION AND QUALITY STANDARD

The raw materials as well as the machines used in the production must meet quality norms so that the machines can operate at its best rating to reach its expected life's span. In order to achieve these goals, the entrepreneur is to set their own standard with detailed specifications.

3.4 PRODUCTION PROCESS

The process of making activated carbon from rice husks consists of crushing the rice husks in a hammer mill to required size and then pulverizing them in a ball mill. The husk powder is digested with zinc chloride. The mass is then activated at elevated temperature. The activated pellets are quenched and leached counter-currently by diluted hydrochloric acid and dried in a tray drier.

3.5 RAW MATERIALS AND EQUIPMENTS

Raw materials like rice husks can be procured locally in Ebonyi, Benue and highland rice farmers in different parts of Nigeria while equipments can be imported from countries China and Japan.

3.5 SOURCES OF FUNDS

The project can be funded through a number of sources which include but not limited to the following; Agric-Business, Small & Medium Scale Investment Scheme (AGSMEIS), Bank of Industry, Bank of Agriculture (BOA), Nigeria Export-Import (NEXIM) Bank, International Finance Corporation (IFC), grants etc., though the conditions and criteria for accessing the loans and grants varies.

PART IV

FINANCIAL ANALYSIS

Basically, the financial section of this prefeasibility study consists of three financial statements: Income statement, Balance sheet, Cash flow projection. This section determines whether or not the project is viable using some economic indicators such as Net Present Value (NPV), Internal Rate of Return (IRR), and payback period as are detailed in the appendices below.

ASSUMPTIONS

1. Assuming that the project will last for the period of five years and the salvage value at the end of the project life ignored.
2. The Machineries, Equipments and Utility Equipment have uniform depreciation of 20%.
3. Production costs assumed 312 days per year with a daily capacity of 500grams of activated carbon which translates to 156,000grams annually at 60% capacity utilization.
4. The proposed capacity utilization are 60% in the first year of commercial production, 70%, 80% in the 2nd and 3rd year respectively and 90% in the 4th and 5th years.
5. Raw materials will be sourced locally and Market for the product is readily available.
6. Staff and labour cost will increase by 10% yearly.
7. Prices and unit costs are assumed unchanged in the five years of projection.
8. The valuation currency used is Naira.

4.2 ACCOUNTING /FINANCIAL ANALYSIS

4.2.1 NET PROFIT

The projected Annual Trading Profit and Loss Account is proposed to make the following Net Profit after tax during the corresponding projected periods – all things being equal.

4.2.2 NET PRESENT VALUE (NPV)

NPV is one of the four methods of discounted cash flows techniques which state that money that is immediately available for use, has a greater value than same amount receivables in future date.

Using this method however, all net cash inflows will be discounted to present value using the estimated interest rate of 60% discount factor. At 12% discount factor the project produced a positive **NPV NGN 33,130,416**

4.2.3 INTERNAL RATE OF RETURN (IRR)

This is the discount rate which gives zero NPV or the rate which equates the present value of cash inflows with present value of cash outflows of the project.

The cash flow of this project was discounted systematically until the NPV of the project finally become zero. The project produces the **IRR** of **47%**. Thus, the project accepted as being viable. This is because **IRR** is more than the cost of capital.

4.2.4 ACCOUNTING RATE OF RETURN (ARR)

ARR uses accounting information as revealed by financial statements (Income Statement) to measure profitability of the project under consideration. The forecast **ARR** of the project is **67%**.

4.2.5 PROFITABILITY INDEX (PI)

This is the present value of future cash flows over the present value of cash outlays. The project PI further confirm the viability of the project , because as the rules of the accepting and rejecting hold, a project should be accepted if the PI is equal or greater than one (1). Consequently, the PI of this project is **1.72** and thus recommended as being viable to be accepted for financing.

4.2.6 PAYBACK PERIOD

The payback period of any project is the length of time it would take the business investors to recover the capital invested in a project in spite of asset replacement. For this particular project the capital investment is expected to be fully recovered in about 2 years and 2 months.

APPENDIX I TOTAL PROJECT COST

S/N	DESCRIPTION	UNITS	QTY	COST TO BE INCURRED	TOTAL
	LAND & BUILDING				
1	Rent of factory space			600,000	600,000
	Sub total			600,000	600,000
	MACHINERY & EQUIPMENTS				
2	Hammer mill	No	1	1,724,000	1,724,000
3	Open pan evaporation steam boiler	No	1	400,000	400,000
4	Rotary Digester	No	1	800,000	800,000
5	Plate and frame filler presses	No	1	560,000	560,000
6	Tunnel dryer	No	1	880,000	880,000
7	Vibrating screens	No	1	320,000	320,000
8	Treating and setting tanks	No	1	200,000	200,000
9	High pressure steam boilers	No	2	1,600,000	3,200,000
10	Rotary Activation kiln	No	1	200,000	200,000
11	Activated carbon storage silo	No	2	60,000	120,000
12	Non corrosive materials	Set	1	240,000	240,000
13	Tank filters press. Etc	No	1	600,000	600,000
	Sub total			7,584,000	9,244,000
	UTILITY EQUIPMENT				
14	Industrial Borehole	No	1	700,000	700,000
	Generating set	No	1	1,220,000	1,220,000
	Sub total		2	1,920,000	1,920,000
	OFFICE EQUIPMENT				
15	Laptop and printer	No	1	200,000	200,000
16	Furniture & fittings	Set	1	150,000	150,000
	Sub total			350,000	350,000
	TOTAL CAPITAL COST			10,454,000	12,114,000
17	Working capital			1,900,000	1,900,000
18	10 % Contingencies			1,401,400	1,401,400
	TOTAL PROJECT COST			13,755,400	15,415,400

APPENDIX II
ESTIMATION OF WORKING CAPITAL REQUIREMENT
N'

Year of Commercial Operation	2 weeks
% Capacity Utilization (Inventory)	60%
2 weeks stock of raw material	1,350,000
1 Day stock of finished products	-
Work in Progress	-
Bank/ Cash (5% sales of the products)	550,000
Working capital	1,900,000

APPENDIX III
FINANCING PLAN
N

DESCRIPTION	EXISTING	PROPOSED	TOTAL
Equity	3,415,400	-	3,415,400
Term loan from	-	12,000,000	12,000,000
Total project cost	3,415,400	12,000,000	15,415,400
% Contribution	20.5%	79.5%	100%

APPENDIX IV
TERM LOAN REPAYMENT SCHEDULE

LOAN AMOUNT: 12,000,000 (Twelve Million Naira)
 TYPE : ANY LOCAL AVAILABLE SME FUND
 INTEREST RATE USED: 12%
 REPAYMENT: 5 YEARS EQUAL INSTALLMENT (Annually)

YEAR	OPENING BALANCE	REPAYMENT	INTEREST DUE	TOTAL YEAR INTEREST
1	12,000,000	2,400,000	1,440,000	3,840,000
2	9,600,000	2,400,000	1,152,000	3,552,000
3	7,200,000	2,400,000	864,000	3,264,000
4	4,800,000	2,400,000	576,000	2,976,000
5	2,400,000	2,400,000	288,000	2,688,000
Total		12,000,000	4,320,000	16,320,000

APPENDIX V
FORECAST STAFFING SCHEDULE (1ST OPERATIONAL YEAR)

N'ooo

POSITION	No	Unit Scale	Scale/ Month	Scale / Year
DIRECT LABOUR				
Factory Manager	1	60	60	720
Production Manager	1	60	60	720
Unskilled labour	6	30	180	3,120
Sub total	8	90	120	4,560
INDIRECT LABOUR				
Accounts/ Admin	1	50	50	600
Marketing Officer	2	50	100	1,200
Sub total	3	100	150	1,800
Total on staff (1st year)	11	190	270	6,360

APPENDIX VI
ESTIMATE OF ANNUAL DEPRECIATION ALLOWANCE

N'

ITEMS	INITIAL VALUE	DEPRECIATION (20%)
Machinery and Equipments	9,244,000	1,848,800
Utility Equipments	1,920,000	384,000
Office equipment	350,000	70,000
TOTAL	11,514,000	2,302,800

APPENDIX VII
ESTIMATION OF ADMINISTRATIVE / OVERHEAD EXPENSES

N'ooo

COST ITEM	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Selling and Distribution	480	504	528	554	554
Utilities	312	327.6	343.2	360	360
Miscellaneous	40	44	48.4	53.2	53.2
Diesel	1,780	1,869	1,958	2,056	2,056
TOTAL	2,596	2,725.8	2,855.6	2,998.38	2,998.38

APPENDIX VIII ESTIMATION OF PRODUCTION AND OPERATION COSTS

Cost Item	Units	@	Qty/day	Pdn cost	Pdn cost/ month	Pdn cost/ year
Direct costs						
Rice husks	kgs	51	385	19,981.5	519,600	6,235,200
Zinc chloride	Ltrs	393	50	19,650	510,900	6,130,800
Hydrochloric acid	Ltrs	690	30	20,700	538,200	6,458,400
Sub-total		1,134	465	60,331.5	1,568,700	18,824,400

APPENDIX IX ESTIMATION OF RAW MATERIAL/PRODUCTION COST AND SALES

Year of Commercial Production	Year 1	Year 2	Year 3	Year 4	Year 5
% Capacity Utilization	60%	70%	80%	90%	90%
1. Output					
Activated carbon (gs)	145,080	159,588	174,096	191,506	191,506
Total output	145,080	159,588	174,096	191,506	191,506
2. Cost of Production	N'	N'	N'	N'	N'
Activated carbon @ N129.7(gs)	18,824,400	20,706,840	22,589,280	24,848,208	24,848,208
Total cost of production	18,824,400	20,706,840	22,589,280	24,848,208	24,848,208
3. SALES					
Activated carbon @ N300 (gs)	43,524,000	47,876,400	52,228,800	57,451,800	57,451,800
TOTAL SALES/ TURNOVER	43,524,000	47,876,400	52,228,800	57,451,800	57,451,800

APPENDIX X
FORECAST INCOME STATEMENT (PROFIT & LOSS ACCOUNT)

Year of commercial operation	Year 1	Year 2	Year 3	Year 4	Year 5
% Capacity Utilization	60%	70%	80%	90%	90%
1. SALES	N'	N'	N'	N'	N'
Gross Sales	43,524,000	47,876,400	52,228,800	57,451,800	57,451,800
VAT @ 5%	2,176,00	2,393,820	2,611,440	2,872,590	2,872,590
Net Revenue	41,347,800	45,482,580	49,617,360	54,579,210	54,579,210
2. OPERATION COST					
Cost of Raw materials consumed	18,824,400	20,706,840	22,589,280	24,848,208	24,848,208
Staff and labour	6,360,000	6,996,000	7,632,000	8,395,000	8,395,000
Admin. & Overhead Expenses	2,596,000	2,725,800	2,855,600	2,998,380	2,998,380
Depreciation	2,302,800	2,302,800	2,302,800	2,302,800	2,302,800
Total Operating Cost	30,083,200	32,731,440	35,379,680	38,544,388	38,544,388
3. OTHER COSTS					
Interest on Term Loan (12%)	1,440,000	1,152,000	864,000	576,000	288,000
Loan Repayment	2,400,000	2,400,000	2,400,000	2,400,000	2,400,000
Total (Other Costs)	33,923,200	36,283,440	38,643,680	41,520,388	41,232,388
Profit Before Tax	7,424,600	9,199,140	10,973,680	13,058,822	13,346,822
Tax @ 12%	890,952	1,103,896	1,316,841	1,567,058	1,601,618
Profit after tax (NET PROFIT)	6,533,648	8,095,243	9,656,838	11,491,763	11,745,203
% Return on Sales	0.16	0.18	0.20	0.21	0.22
% Return on Equity	1.273	1.701	2.129	2.882	2.967
% Return on Investment	1.91	2.37	2.83	3.37	3.44

APPENDIX XI

FORECAST HIGH RATE AND LOW RATE COMPUTATION

Year	C/F	DF 12%	NPV
	N'		N'
0	(15,415,400)	1	(15,415,400)
1	6,533,648	0.893	5,834,547
2	8,095,243	0.797	6,451,908
3	9,656,838	0.712	6,875,668
4	11,491,763	0.636	7,308,761
5	11,745,203	0.567	6,659,530
Total Profit	47,522,695		33,130,416
Average Profit	9,504,539		

Year	C/F	DF 60%	NPV
	N'		N'
0	(15,415,400)	1	(15,415,400)
1	6,533,648	0.625	4,083,530
2	8,095,243	0.3906	3,162,001
3	9,656,838	0.2441	2,357,234
4	11,491,763	0.1526	1,753,643
5	11,745,203	0.0954	1,120,492
Total Profit	47,522,695		12,476,901
Average Profit	9,504,539		

APPENDIX XII FORECAST IRR AND ARR COMPUTATION

$$IRR = a + \left(\frac{A}{A+B} \right) (b-a)$$

Where

$$a = 12\%$$

$$b = 60\%$$

$$A = 33,130,416$$

$$B = 12,476,901$$

$$12\% + \frac{33,130,416}{33,130,416 + 12,476,901} (60-12)$$

$$12\% + 35.3$$

$$47\%$$

$$ARR = \frac{\text{Estimated Average Profit} \times 100}{\text{Estimated initial investment}}$$

$$ARR = \frac{9,504,539 \times 100}{15,415,400}$$

$$67\%$$

**APPENDIX XIII
CASH FLOW PROJECTION**

Year of Comm. Production	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
% Capacity Utilization		60%	70%	80%	90%	90%
A) CASH RECEIPTS	N'	N'	N'	N'	N'	N'
Equity Capital	3,415,400	-	-	-	-	-
Term Loan	12,000,000	-	-	-	-	-
Gross Revenue		41,347,800	45,482,580	49,617,360	54,579,210	54,579,210
Total Receipts	15,415,400	41,347,800	45,482,580	49,617,360	54,579,210	54,579,210
B) CASH PAYMENTS						
Capital Payment						
Machinery & Equipments	9,244,000	-	-	-	-	-
Utility Equipment	1,920,000	-	-	-	-	-
Office equipments	350,000	-	-	-	-	-
TOTAL	11,514,000	-	-	-	-	-
(ii) Operating Expenses						
Depreciation	-	2,302,800	2,302,800	2,302,800	2,302,800	2,302,800
Change in working capital	3,901,400	27,780,400	30,428,640	33,076,880	36,241,588	36,241,588
Sub total	3,901,400	30,083,200	32,731,440	35,379,680	38,544,388	38,544,388
(iii) Financial Expenses						
Repayment of Term Loan	-	2,400,000	2,400,000	2,400,000	2,400,000	2,400,000
Interest on Term Loan	-	1,440,000	1,152,000	864,000	576,000	288,000
Value Added Tax	-	2,176,00	2,393,820	2,611,440	2,872,590	2,872,590
Corporate Tax	-	890,952	1,103,896	1,316,841	1,567,058	1,601,618
Sub total	-	4,730,952	7,049,716	7,192,281	7,415,648	7,162,208
Total cash payment (ii)-(iii)	3,901,400	25,352,248	25,681,724	28,187,399	31,128,740	31,382,180
Net cash flow c/f	3,901,400	25,352,248	25,681,724	28,187,399	31,128,740	31,382,180

**APPENDIX XIV
BALANCE SHEET PROJECTION**

Year of comm. Operation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
ASSETS	N'000	N'000	N'000	N'000	N'000	N'000
(i) Fixed assets						
Machinery and Equipments	9,244,000	-	-	-	-	-
Utility equipment	1,920,000	-	-	-	-	-
Office Equipment	350,000	-	-	-	-	-
Value at Acquisition		11,514,000	11,514,000	11,514,000	11,514,000	11,514,000
Less Cumulated Depreciation	-	2,302,800	4,605,600	6,908,400	9,211,200	11,514,000
Net fixed assets	11,514,000	9,211,200	6,908,400	4,605,600	2,302,800	0
(ii) Current Assets/ liability						
Stock of Raw Materials	1,900,000	11,099,776	18,620,756	17,547,183	20,321,585	22,605,243
Debtors /prepayment	-	2,453,000	4,098,000	10,308,000	12,139,000	14,653,000
Bank and Cash Balances	2,001,400	4,150,024	5,160,031	6,170,539	7,180,674	7,180,741
Creditor / accruals	-	(4,074,000)	(6,039,000)	(8,947,000)	(11,013,000)	(13,785,000)
Company Tax	-	(890,952)	(1,103,896)	(1,316,841)	(1,567,058)	(1,601,618)
Net current assets	3,901,400	12,737,848	20,735,891	23,761,881	27,061,201	29,052,366
TOTAL NET ASSETS	15,415,400	21,949,048	27,644,291	28,367,481	29,364,001	29,052,366
(ii) FINANCED BY						
Equity Capital	3,415,400	3,415,400	3,415,400	3,415,400	3,415,400	3,415,400
P&L	-	6,533,648	8,095,243	9,656,838	11,491,763	11,745,203
Retained Profit	-	-	6,533,648	8,095,243	9,656,838	11,491,763
SHAREHOLDERS FUND	3,415,400	9,949,048	18,044,291	21,167,481	24,564,001	26,652,366
Long Term Loan	12,000,000	12,000,000	9,600,000	7,200,000	4,800,000	2,400,000
TOTAL EQUITY & LIABILITY	15,415,400	21,949,048	27,644,291	28,367,481	29,364,001	29,052,366