

**132. PROFILE ON PRODUCTION OF
CARBON BRUSH**

TABLE OF CONTENTS

	<u>PAGE</u>
I. SUMMARY	132-3
II. PRODUCT DESCRIPTION & APPLICATION	132-3
III. MARKET STUDY AND PLANT CAPACITY	132-4
A. MARKET STUDY	132-4
B. PLANT CAPACITY & PRODUCTION PROGRAMME	132-6
IV. RAW MATERIALS AND INPUTS	132-6
A. RAW & AUXILIARY MATERIALS	132-6
B. UTILITIES	132-7
V. TECHNOLOGY & ENGINEERING	132-8
A. TECHNOLOGY	132-8
B. ENGINEERING	132-8
VI. MANPOWER & TRAINING REQUIREMENT	132-10
A. MANPOWER REQUIREMENT	132-10
B. TRAINING REQUIREMENT	132-11
VII. FINANCIAL ANALYSIS	132-11
A. TOTAL INITIAL INVESTMENT COST	132-11
B. PRODUCTION COST	132-12
C. FINANCIAL EVALUATION	132-13
D. ECONOMIC BENEFITS	132-14

I. SUMMARY

This profile envisages the establishment of a plant for the production of carbon brush with a capacity of 37 tonnes per annum.

The present demand for the proposed product is estimated at 24 tonnes per annum. The demand is expected to reach at 52 tonnes by the year 2017.

The plant will create employment opportunities for 26 persons.

The total investment requirement is estimated at about Birr 6.80 million, out of which Birr 271,530 is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 20 % and a net present value (NPV) of Birr 3.10 million discounted at 8.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

A carbon brush is typically constructed of carbon with an amorphous structure or graphite which is an allotropic form of carbon. Electrical brushes and brush materials are used in conjunction with slip rings, commutators or other contact applications. Electrical brushes and brush materials require very good frictional characteristics combined with high to moderate conductivity.

Electrical brushes and brush materials are made of copper graphite, amorphous carbon, graphite and flake graphic, electro graphite, metal graphite, resin-bonded graphite, silver and silver alloys, silver graphite, and specialized or proprietary materials.

Brushes made of carbon fibers are used to improve the thermal conductivities of phase change materials packed around heat transfer tubes.

There are many applications for carbon brushes. Electrical contact for direct current devices (DC) are designed to avoid the material transfer and severe arc damage that can occur in DC applications. Carbon brushes are used in Railways, Automobiles, and Dynamos etc.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past supply and present Demand

Carbon brushes are used in automobile motor starters, generators, distributors etc. It is a product which requires frequent replacement. Since there is no domestic producer of the product the entire demand is met through import. Import of Carbon brushes in the past seven years is shown in Table 3.1.

Table 3.1
IMPORT OF CARBON BRUSHES (TON)

Year	Quantity
2000	7.2
2001	12.5
2002	11.5
2003	12.1
2004	40.8
2005	13.2
2006	18.9

Source:- Customs Authority

As could be seen from Table 3.1 there is some increase of import during the years 2000-2006. The annual average level of import during 2000-2003 was around 11 tons while during the period 2004-2006 the annual average has increased to about 24 tons. This amount is taken to fairly reflect the present demand.

2. Demand Projection

The future demand for carbon brushes depends on the growth of the fleet size of vehicles of various classifications in the country. Moreover, the number or stock of generators and distributors and the like will influence the demand for the product. In Ethiopia, the average annual growth of the total vehicle stock was 8%. Assuming, this growth to rate will be maintained, the demand for carbon brushes is forecasted in the manner shown in Table 3.2.

Table 3.2
PROJECTED DEMAND FOR CARBON BRUSH(TON)

Year	Quantity
2008	26
2009	28
2010	30
2011	33
2012	35
2013	38
2014	41
2015	44
2016	48
2017	52

3. Pricing and Distribution

A factory gate price of Birr 12,510 per ton is recommended based on import data. The product will find its market outlet through the exiting spare part wholesalers.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

As per the out come of market assessment and the minimum scale of production, an annual capacity of 37 tones is proposed for establishing a plant that manufactures carbon brushes, assuming a single shift of 8 hours per day and 300 working days per annum.

2. Production Programme

The envisaged plant shall start at 75% & 85 % capacity in the first and second years, respectively. Considering a time needed for development of production skill and market penetration, in the third year and then after full capacity production will be achieved.

IV. MATERIALS AND INPUTS

A. MATERIALS

The annual raw material cost is estimated at Birr 236,330 (Please refer table 4.1 below)

Table 4.1

**ANNUAL REQUIREMENT FOR RAW AND AUXILIARY MATERIALS AND
THEIR COSTS**

No	Description	Qty Tone	Cost, 000 Birr		
			F.C	L.C	Total
1	Carbon Block	2.4	65.98	26.39	92.374
2	Copper flexible wire	0.50	23.91	9.56	33.47
3	Copper and Brush Sheet	1.0	47.82	19.13	66.95
4	Copper & Lead mixture powder	0.8	31.10	12.44	43.54
5	Other Misc. items	L.S	-	-	15.00
	Total	-	168.81	67.52	236.33

B. UTILITIES

Utilities required are electricity & water. The annual quantities and cost of utilities are estimated as shown in Table 4.2.

Table 4.2

ANNUAL UTILITY REQUIREMENT

No	Description	Qty	Cost, 000 Birr		
			F.C	L.C	Total
1	Electric Power	65,000 KHz	-	30.784	30.784
2	Water	500 m ³	-	5.00	5.00
	Total			35.784	35.784

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

The basic operations involved in the manufacturing of carbon brush are: shearing, finishing, assembling and testing.

The method of manufacturing carbon brushes for use in electrical machinery, comprising the steps of mixing carbon particles together with particles of binder, pressing the mixture in a mold to form a brush blank, removing the pressed blank from the mold and sintering it at a temperature between 300°C and 500°C, Then binder being pressed in an amount which is between 0.5 and 50% by weight of the amount of carbon in said mixture. After shearing and assembling process is completed, the test will be conducted for package.

2. Source of Technology

The above described technology is available from the following sources:

Industrial development zone Baochang Town

Haimen City Jiangsu Province, China.

Tel:0086-513-8277222 82671855

Fax: 0086-513-82866500

E-mail:hl@hlcarbon.com

B. ENGINEERING

1. Machinery and Equipment

The list of machinery and equipment required for the envisaged plant is given in Table 5.1.

Table 5.1
MACHINERY & EQUIPMENT & ESTIMATED COSTS

No		Qty	Cost, (000 Birr)		
			F.C	L.C	Total
1	A. <u>Production Machinery & Equipment</u>				
	Circular Saw	2	43.25	17.30	60.55
	Bench Drill	1	33.58	13.43	47.01
	Sanding and Finishing machine	1	28.45	11.38	39.83
	Ball Press	1	63.67	25.47	89.14
	Sub – Total	-	168.95	67.58	236.53
2	B. <u>Auxiliary Machinery & Equipment</u>				
	Testing Equipment	Lump sum			
	Miscellaneous Tools and Ancillaries				
	Sub – Total		25.00	10.00	35.00
	Grand Total	-	193.95	77.58	271.53

2. Land, Buildings & Civil Works

The production building will be made by hollow blocks, both sides of the walls will be plastered, reinforced concrete floor, RHS truss and EGGA sheet roof. Taking into consideration space for easy movement and possible future expansion, the total area of the project will be 1,000 square meters the lease value at a rate of Birr 0.40 per square meter and for 80 years will amount to Birr 32,000. The built-up area will be 400 square meters and considering a unit cost of Birr 2,300.00 is estimated at about Birr 920,000.00 Therefore, the total cost of land; building and civil works is estimated at Birr 952,000.

3. Proposed Location

The plant can be located in any of the region where power and other infrastructures are available for the smooth operation of the plant. Therefore it is proposed to locate the plant at Bero Woreda in Jeba town.

VI MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

Total manpower required is 26 persons. The details of the manpower requirement and the estimated annual labor cost including employees' benefit are given in Table 6.1.

Table 6.1

MANPOWER REQUIREMENT AND ESTIMATED LABOUR COST

No	Job Title	No. of Persons	Salary (Birr)	
			Monthly	Annual
1	General Manager	1	2000	24,000
2	Secretary	1	600	7,200
3	Production & Technical Head	1	1,400	16,800
5	Finance & Administration Head	1	1,300	15,600
6	Accountant	1	1,000	12,000
7	Accounts Clerk	1	500	6,000
8	Cashier	1	650	7,800
9	Operator	6	750x6	54,000
10	Assistant Operator	4	500x4	24,000
11	Laborer	5	250x3	9,000
12	Electrician	1	850	10,200
13	Driver	1	500	6,000
14	Guard	2	200x2	4,800
	Sub – Total	26		197,400
	Employee's Benefit 25% basic salary			49,350
	Grand Total			246,750.00

B. TRAINING REQUIREMENT

The production & technical head, electrician and operators need at least two weeks training for the technology and maintenance during commissioning of the plant. Total training cost is estimated at about 30,000 Birr.

VII. FINANCIAL ANALYSIS

The financial analysis of the carbon brush project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 year
Source of finance	30 % equity
	70 % loan
Tax holidays	3 years
Bank interest	8%
Discount cash flow	8.5%
Accounts receivable	30 days
Raw material local	30 days
Raw material, import	90 days
Work in progress	2 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 6.80 million, of which 36 per cent will be required in foreign currency.

The major breakdown of the total initial investment cost is shown in Table 7.1.

Table 7.1
INITIAL INVESTMENT COST

Sr. No.	Cost Items	Total Cost (‘000 Birr)
1	Land lease value	9.0
2	Building and Civil Work	1,602.5
3	Plant Machinery and Equipment	2,366.3
4	Office Furniture and Equipment	125.0
5	Vehicle	450.0
6	Pre-production Expenditure*	488.3
7	Working Capital	1,768.3
	Total Investment cost	6,809.4
	Foreign Share	36

* *N.B Pre-production expenditure includes interest during construction (Birr 338.34 thousand) training (Birr 30 thousand) and Birr 120 thousand costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 11.53 million (see Table 7.2). The material and utility cost accounts for 89.63 per cent, while repair and maintenance take 1.03 per cent of the production cost.

Table 7.2**ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)**

Items	Cost	%
Raw Material and Inputs	9,265.00	80.47
Utilities	1053.89	9.15
Maintenance and repair	118.32	1.03
Labour direct	153	1.33
Factory overheads	51	0.44
Administration Costs	153	1.33
Total Operating Costs	10,794.21	93.75
Depreciation	449.26	3.90
Cost of Finance	269.92	2.34
Total Production Cost	11,513.39	100

C. FINANCIAL EVALUATION**1. Profitability**

According to the projected income statement, the project will start generating profit in the first year of operation. Important ratios such as profit to total sales, net profit to equity (Return on equity) and net profit plus interest on total investment (return on total investment) show an increasing trend during the life-time of the project.

The income statement and the other indicators of profitability show that the project is viable.

2. Break-even Analysis

The break-even point of the project including cost of finance when it starts to operate at full capacity (year 3) is estimated by using income statement projection.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 40 \%$$

3. Pay Back Period

The investment cost and income statement projection are used to project the pay-back period. The project's initial investment will be fully recovered within 5 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 20% and the net present value at 8.5% discount rate is Birr 3.10 million.

D. ECONOMIC BENEFITS

The project can create employment for 26 persons. In addition to supply of the domestic needs, the project will generate Birr 2.55 million in terms of tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.