

**94. PROFILE ON PRODUCTION OF FUEL
WOOD PLANTATION AND CHARCOAL
PRODUCTION**

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I. SUMMARY

This profile envisages the establishment of a plantation for the production of fuel wood and charcoal with a capacity of 2000 tonnes and 10,000 tonnes per annum respectively.

The present demand for the proposed product is estimated at 7.32 million tones and 254,343 tonnes for fuel wood and charcoal per annum respectively. The demand is expected to reach at 10.23 million tones and 355,088 tonnes for fuel wood and charcoal per annum respectively by the year 2020.

The plant will create employment opportunities for 46 persons.

The total investment requirement is estimated at Birr 4.53 million, out of which Birr 1.31 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 35 % and a net present value (NPV) of Birr 5.19 million discounted at 8.5 %.

II. PRODUCT DESCRIPTION AND APPLICATION

Fuel, either in the form of fire wood or charcoal and lumber are undoubtedly the forest products for which there is the greatest demand at present in the country, as well as in SNNPRS Regional State. Although alternative energy sources other than fuel wood are being developed, wood fuel would be the major source of energy for a large segment of the population in the foreseeable future. Furthermore, the forest will remain the main sources of lumber for houses construction and furniture manufacturing.

Charcoal is the most important house hold fuel, meeting the energy need of urban house holds. During the production of charcoal, heat is applied to organic matter inside a relatively airtight container commonly referred to as a kiln. Due to its lack of moisture

and high carbon content, charcoal contains large amounts of energy. It has about twice the amount of energy as an equal amount of air dry wood.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Fuel wood and charcoal constitute the most important sources of household fuel meeting the energy need of rural and urban households. According to the study conducted by the Woody Biomass Inventory Strategic Project Planning, the annual demand for energy in the Southern Nations Nationalities and Peoples Region is estimated at about 41686 terracalories (Tcals). About 72% of the Region's energy demand is in the form of bio-fuel while the remaining 28% is accounted for by modern energy (electricity, gas, etc.).

According to the Ethiopian Forestry Action Program (1994), the average daily per capita energy consumption requirement is 2.10 kg of wood equivalent in rural areas and 1.68 kg per capita in urban areas. Fuel wood including charcoal contributes 66 and 62 percent, respectively, of the energy consumption in rural and urban areas. And the balance is accounted for by animal dung and crop residues in rural areas and through kerosene and electricity in urban areas.

Based on the above estimates, taking into account the Region's current rural and urban population of 13983000 and 1338000, respectively, and assuming the energy need of rural households is essentially met through fuel wood while that of urban households is met 50% through fuel wood and the remaining 50% through charcoal, the Region's present demand for fuel wood and charcoal is estimated at 7328203 and 254343 tons, respectively.

2. Projected Demand

According to the Regional Forestry Action Program (1999), the demand for fuel wood in the rural sector across the Region is estimated to increase by about 2.6 % per annum. This rate of growth is applied in projecting the demand for both fuel wood and charcoal in the Region. The projected demand for the products is depicted in Table 3.1.

Table 3.1
PROJECTED DEMAND FOR FUEL WOOD & CHARCOAL (TONNES)

Year	Fuel wood	Charcoal
2007	7,328,203	254,343
2008	7,518,736	260,956
2009	7,714,223	267,741
2010	7,914,793	274,702
2011	8,120,578	281,844
2012	8,331,713	289,172
2013	8,548,337	296,691
2014	8,770,594	304,405
2015	8,998,630	312,319
2016	9,232,594	320,439
2017	9,472,641	328,771
2018	9,718,930	337,319
2019	9,971,622	346,089
2020	10,230,884	355,088

3. Pricing and Distribution

A head load (about 30 kg) of fuel wood is retailed at about Birr 32. And the retail price of charcoal is about Birr 1.25 per kg. Allowing margins for retailers and wholesalers, the

price of fuel wood and charcoal for the envisaged plant is estimated at Birr 0.50 and Birr 0.60 per kg, respectively.

The product can get its market outlet through wholesale and retail network.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

According to the market study indicated above, the demand for fuel wood in SNNPRS is 7,328,202 tons and that for charcoal is 254343 tons in 2007. These figures would grow to 10230884 tons and 355088 tons, respectively, in 2020. In order to meet these demands of fuel wood and charcoal, eucalyptus tree plantation is one component of the project, while the other component is the production of charcoal to meet the demand of this energy source of the region.

In view of this situation, and based on the demand projection (Table 3.1), the envisaged plant will have annual fuel wood production of 2000 tons and charcoal production of 10,000 tons. The proposed fuel wood production is only very small part of the annual demand of the region in 2007. For charcoal, the proposed capacity is about 20% of the demand in 2007. It is generally intended that production of fuel wood and charcoal shall be started at small scale level, and will be made to grow gradually in the future. This is very important because the demand for fuel wood and charcoal is so high (Table 3.1), and is expected to grow as population will grow.

In order to produce 2000 tons of fuel wood annually, eucalyptus tree plantation shall be carried out on a farm area of 50 to 60 hectares.

Eucalyptus trees can grow and be harvested in four to five years time. This is possible as the region is endowed with sufficient rain fall over the seasons of the year. In order to harvest 2000 tons of fuel wood annually appropriate tree planting program has to be

devised. Production will start when the trees mature and are ready for cutting. This will occur on the fourth or fifth year of tree plantation. Yield of fuel wood from eucalyptus trees is shown in Table 3.2 below.

Table 3.2
YIELD FIGURES OF FUEL WOOD FROM EUCALYPTUS TREE

Description	Age (Year)	Average Height (Metres)	Average thickness (CM)	Quantity of Fuel Wood from 35 Ha (M ³)
1 st cutting	4	18	16	1900
2 nd cutting	5	22	22	2250
3 rd cutting	6	25	25	3000
Final cutting	8	27	30	3750

2. Production Programme

Production building-up of fuel wood and charcoal is shown in Table 3.3 below.

Table 3.3
PRODUCTION PROGRAMME

Year	Unit	1	2	3	4 and above
Capacity utilization (%)		50	65	85	100
Production					
a) Fuel wood	Ton	1,000	1,300	1,700	2,000
b) Charcoal	Ton	5,000	6,500	8,500	10,000

Charcoal shall be produced from biomass materials such as wood, millet stems and corn (maize) cobs. Millet stems and corn cobs can be collected from private and state farms. Stems, branches and tops of wood can also be collected to be used as inputs to the envisaged plant. Another source of raw material for charcoal production are residues of saw mills. As there are considerable number of saw mills in the Region, special arrangement can be made with those saw mills to collect the residues.

IV. MATERIALS AND INPUTS

A. RAW AND AUXILIARY MATERIAL

The major input to eucalyptus plantation is the seed. The quantity required is shown in Table 4.1 below. For charcoal production biomass materials are major inputs. These are millet stems and corn cobs, stems, branches and tops of wood, hard woods, residues of saw mills and others. These materials are available in different locations of SNNPRS, and collection of these materials have to be excited through proper planning.

Auxiliary inputs to the plantation and charcoal production consist of fertilizer, PP sacks, jute fiber, and other materials. Annual requirement, of raw and auxiliary materials including costs are given in Table 4.1 below.

Table 4.1

ANNUAL REQUIREMENT AND COST OF RAW & AUXILIARY MATERIALS

Sr. No.	Description	Qty	Cost ('000 Birr)		
			LC	FC	TC
	<u>A. Raw Material</u>				
	Eucalyptus seed (kg)	40	60	-	60
	Woody biomass (ton)	40,000	2400	-	2400
	Sub-total	-	2460	-	2460
	<u>B. Auxiliary Materials</u>				
	Fertilizer (ton)	5	30	-	30
	PP sacks(pcs)	100,000	669	-	669
	Jute fiber	Reqd	30	-	30
	Other inputs	Reqd	15	-	15
	Sub-total	-	744	-	744
	Total	-	3204	-	3204

B. UTILITIES

Fuel, lubricants, electricity and water are utilities required by the envisaged plant. The annual requirement and related costs are given in Table 4.2 below.

Table 4.2
ANNUAL REQUIREMENT OF UTILITIES AND COST

Sr. No.	Description	Qty	Cost (‘000 Birr)
1	Electricity (kWh)	30,000	14.22
2	Water (m ³)	65,000	650
3	Fuel oil (litres)	5,500	30
4	Lubricant (litres)	5,500	605
	Total		1299.22

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

Eucalyptus tree plantation & management:-

The production process of fuel wood will start with tree species selection and followed by nursery establishment for seedling raising. Nursery management will be the next operation to be undertaken in the nursery. Plantation site selection and preparation are also part of the production process to be carried out prior to transplanting seedlings to plantation site.

Generally, planting of seedlings and tree management are among the main activities in fuel wood production. Tree management is the process of improving, protecting, and other wise managing forest lands for the production of timber for fuel wood. Included are tree planting, timber stand improvement, protection of forests from fire and insects, etc.

Tree failing, logging and transporting will be the final operations of the production process. In general terms, the nursery activities, planting holes preparation, transplanting of seedlings and tree management are mainly expected to be carried out by casual labourers.

Charcoal Production:-

Charcoal is produced by heating wood under limited access of oxygen. When wood is heated slowly to 280°C, an exothermic reaction occurs. In the usual carbonization procedure heating is prolonged to 400-500°C in the absence of air.

For charcoal production a kiln is used if the raw material is in the form of round wood, saw mill slabs, or edgings. Sawdust, shavings, or milled wood and bark are converted to charcoal. The yield is 25 wt % on a dry basis. The higher heating value of charcoal is 28 KJ/kg.

Charcoal briquettes have a higher heating value of 23-25 kJ/g (9900-10800 Btu/lb) due to added ingredients.

2. Source of Technology

The machinery and equipment required by the envisaged plant can be supplied by Ries Engineering, Nazareth Tractor Assembly Plant, Tetraco PLC, Hagbes PLC, etc.

B. ENGINEERING

1. Machinery and Equipment

The required plant machinery and equipment are listed in Table 5.1. The total cost for machinery and equipment is estimated to be Birr 1.69 million, out of which Birr 940,000 is required in foreign currency.

Table 5.1

MACHINERY AND EQUIPMENT REQUIREMENT AND COST

Sr. No.	Description	Qty	Cost ('000 Birr)		
			LC	FC	TC
1	Tractor (110-125 HP)	1	-	270	270
2	Vehicle	1	-	375	375
3	Chain Saw	10	-	35	35
4	Nursery Equipment	LS	30	-	30
5	Trailor	6	420	-	420
6	Generator	1	-	150	150
7	Motor cycle	2	-	60	60
8	Workshop equipment	LS	-	40	40
9	Tools	LS	-	10	10
10	Kiln (for charcoal)	1	180	-	180
11	Other auxiliary equipment	LS	150	-	150
	Total	-	750	940	1690

2. Land, Building and Civil Works

Land required for eucalyptus tree plantation will be 30 hectares. The cost of this land development is estimated to be Birr 0.8 million. The project might also require

construction of access roads and roads within the farm area. Cost related to these roads is estimated to be Birr 50,000.

Land is also required for production of fire wood and charcoal, including open space, land for canteen, stores, offices, residential houses, workshops, etc. This in turn can be estimated to be 5 hectares. Thus, the total land requirement of the project will be 35 hectares, or 350,000 square metres. It is proposed here that special agreement shall be made with the regional state to use the 35 hectares of land with no lease value. This would be possible since tree plantation has a positive impact on protecting the environment.

Total area for building is estimated to be 1500 m², and at the rate of Birr 800 per m², the total investment on building will be Birr 1.2 million.

3. Proposed Location

Location of a plant is determined on the basis of proximity to raw materials, availability of infrastructure and distance to market outlets. Potential woredas identified are Endegagne, Adracha and Dita. Of this Endegagne woreda is selected. It is, therefore, appropriate to establish the plant in Dinkula town.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The plant requires both production workers and administrative personnel. The details of manpower and related costs is shown in Table 6.1.

B. TRAINING REQUIREMENT

Training arrangement is not required for the envisaged project.

Table 6.1
MANPOWER REQUIREMENT AND LABOUR COST

Sr. No.	Job Title	Req. No.	Monthly Salary	Annual Wages
	<u>A. Administration</u>			
1	Plant manager	1	2,000	24,000
2	Secretary & cashier	1	700	8,400
3	Accountant	1	800	9,600
4	Purchaser	1	700	8,400
5	Salesman	1	700	8,400
6	Storeman	1	700	8,400
7	Guards	24	200	57,600
8	Janitor	1	200	2,400
9	Driver	2	500	12,000
		33		139,200
	<u>B. Production</u>			
1	Forest expert	1	1,500	18,000
2	Skilled workers	3	600	21,600
3	Laborers	6	280	10,160
4	Generator operator	1	500	6,000
5	Technician	2	600	14,400
	Sub-total	13		80,160
	Workers Benefit (25% BS)	-		54,840
	Total	46		274,200

VII. FINANCIAL ANALYSIS

The financial analysis of the fuel wood and charcoal 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	5 years
Bank interest	8%
Discount cash flow	8.5%
Accounts receivable	30 days
Raw material local	60 days
Work in progress	360 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 4.53 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	-
2	Building and Civil Work	1,200.0
3	Plant Machinery and Equipment	1,315.0
4	Office Furniture and Equipment	175.0
5	Vehicle	750.0
6	Pre-production Expenditure*	424.5
7	Working Capital	674.4
	Total Investment cost	4,538.9
	Foreign Share	36

* N.B Pre-production expenditure includes interest during construction (Birr 274.52 thousand) and Birr 150 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 5.79 million (see Table 7.2). The material and utility cost accounts for 77.71 per cent, while repair and maintenance take 4.83 per cent of the production cost.

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

Items	Cost	%
Raw Material and Inputs	3,204.00	55.29
Utilities	1299.22	22.42
Maintenance and repair	280	4.83
Labour direct	135	2.33
Factory overheads	129.14	2.23
Administration Costs	139.2	2.40
Total Operating Costs	5,186.56	89.51
Depreciation	389	6.71
Cost of Finance	219.01	3.78
Total Production Cost	5,794.57	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) is estimated by using income statement projection.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 48 \%$$

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 3 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 35% and the net present value at 8.5 % discount rate is Birr 5.19 million.

D. ECONOMIC BENEFITS

The project can create employment for 46 persons. In addition to supply of the domestic needs, the project will generate Birr 3.03 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.