10. PROFILE ON SUGAR CANE FARM AND SUGAR MILL

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I. SUMMARY

This profile envisages the establishment of a an integrated sugar cane farm and sugar mill for the production of 4,860 tonnes of sugar per annum.

The present demand for the proposed product is estimated at 283,000 tonnes and it is projected to reach at 718,917 tonnes by the year 2019.

The plant will create employment opportunities for 159 persons.

The total investment requirement is estimated at Birr 32.92 million, out of which Birr 15 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 24% and a net present value (NPV) of Birr 33.91 million, discounted at 10.5%.

II. PRODUCT DESCRIPTION AND USE

Sugar, the common name for the disaccharide carbohydrate called sucrose extracted from sugar cane, sugar beet, and to a lesser extent from sorghum and maple. It is an energy giving food stuff notable for its sweet taste.

The product is mainly used for direct consumption as well as to prepare other types of food such as confectioneries and breweries. Households, foods and beverages, pharmaceuticals and catering industries are identified as the major categories of consumers.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply And Present Demand

The primary product of the Ethiopian Sugar Industry is white sugar. The volume of annual sugar production currently has reached 263,000 tonnes. The maximum production capacity of the industry is 290,000 tonnes. The factory producing the largest proportion is the Metahara factory, accounting for 45% of total output, followed by Fincha factory and wonji/showa, which account for 28% and 27% of production, respectively.

About 400 tonnes of sugar is also annually being imported, on average into the country legally. Nearly all imported sugar is consumed by industrial users, mainly beverage

bottling companies. The imports are not, normally, meant for merchandizing proposes or household consumption.

Sugar is also imported illegally into the country, especially in the Eastern parts (Harari, Dire Dawa, Somali and parts of Oromiya Region). Market Studies conducted by Ethiopian Sugar Industries Support Center (ESIC) indicate that 15-18% of household sugar consumption is supplied by contraband trade. This trend, however, is declining with increased control of the smuggling roots by customs forces. The supply and consumption data of sugar in the past 10 years is shown in Table 3.1.

Most of the sugar produced in the country is consumed domestically, exports constituting a minor proportion of production, about 10% in most years. Per capita consumption is about 4 Kg per year, which is extremely low, even by Africa standards, which is on average about 14.5 kg (Sugar Year Book, 2000). Domestic consumption of sugar, constituting imports (legal and Illegal) and domestic production, currently amounts to about 283,000 tonnes (see Table 3.1) which is considered to represent the present domestic demand for sugar in Ethiopia.

Table 3.1

DOMESTIC DEMAND FOR SUGAR IN ETHIOPIA

Year	Dom. Production (MT)	Legal Import (MT)	Illegal Import(MT)	Export (MT)	Domestic Sales (MT)	Domestic Consumption (MT)	Per capita Cons. (Kgs)
1992/1993	1138026.6	116	32098	13631	128393	160491	3.1
1993/1994	121225.1	3789	26048	3085	104190	130238	2.4
1994/1995	127783.1	3600	23984	0	95934	119918	2.2
1995/1996	173599.3	1873	45988	13150	183950	229938	4.1
1996/1997	171473.6	5029	33145	0	132579	165724	2.9
1997/1998	181571.7	3421	44638	0	178550	223188	3.7
1998/1999	234760.9	4373	40420	0	161680	202100	3.3
1999/2000	250866.6	5499	50658	33900	202630	253288	4.0
2000/2001	251368.3	6971	45936	58100	183742	229678	3.5
2001/2002	261041.1	3194	42186	69631	168742	210928	3.1
2002/2003	263209.3	5000	28276	52996	254480	282756	4.1

***Source**: -ESISC,*

-Customs authority, External Trade Statistics, Annual Issue.

2. Projected Demand

As could be inferred from Table 3.1, the average growth rate of domestic consumption of sugar over the past eleven years (1992/93-2002/2003 was about 6 %. Over the same period, per capita consumption has grown at a rate of 2.9% annually. Assuming this trend will be maintained, future demand is projected to range from 317,978 tonnes in the year 2005 to 718,900 tonnes by the year 2019. The unsatisfied demand in the same span of time range from, 9980 tonnes to about 428,000 tonnes (see Table 3.2).

Table 3.2

PROJECTED DEMAND FOR SUGAR (TONNES)

(2004-2019)

Year	Projected Demand	Existing Capacity	Demand Gap
2004	299980	290,000	9980
2005	317978	290,000	27978
2006	337057	290,000	47057
2007	357280	290,000	67280
2008	378718	290,000	88718
2009	401440	290,000	111440
2010	425526	290,000	135526
2011	451057	290,000	161057
2012	478121	290,000	188121
2013	506808	290,000	216808
2014	537217	290,000	247217
2015	569450	290,000	279450
2016	603617	290,000	313617
2017	639834	290,000	349834
2018	678224	290,000	388224
2019	718917	290,000	428170

3. Pricing and distribution

Ethiopian Sugar Industries Support Center (ESIC) is presently the state organ that is entrusted with setting of sugar prices. The factory gate prices were set as follows by ESIC for the last four years:

Wonji	-	412 Birr/quintal/
Metehara	-	408 Birr/quintal/
Fincha	-	400 Birr/quintal/

Despite occasional price raise of short duration, sugar price has remained more or less constant for the last few years. However, currently sugar is occasioned by ESIC at a price ranging from 505 to 527 Birr/quintal. The current wholesale price of sugar in Addis Ababa is 545 Birr/quintal .The retail Price for household consumers is currently 6.00 Birr /kg. For the envisaged plant a factory-gate price of Birr 400 per quintal is recommended.

Regarding distribution, the auction sales metuod was, in use since 1994. A minimum tender quality of low quintals and a fixed minimum tender bidding price of 400 Birr/quintals was set by ESIC. Since April 2002, a direct sales method was introduced and the minimum quantity requirements was also lifted. Recently, however, ESIC has re-introduced the auction sales method. Buyers of 50 quintals or less of sugar can collect it from leased stores in Addis Ababa. Those wholesalers who buy more than 50 quintals make collection from the factory stores.

B. FARM AND PROCESSING PLANT CAPACITY AND PROGRAMME

1. Processing Capacity

a) Plant capacity

Based on the market study a mini-sugar plant with 4,860 tonnes of sugar producing capacity per annum is proposed to partially cover local market demand.

b) Farm Capacity

The sugar cane farm will have 357 ha. of net irrigable land at full capacity, producing 54 tonnes of sugar cane.

2. Production Programme

a) Sugar Mill

The sugar mill will commence operation when the first harvest from the farm is ready, which usually takes about a year. The sugar mill will operate for 270 days per year, working in three shift system. Production will start at 85% of its rated capacity in the first production year, then 90% and 95% in the second and third year, respectively. The plant will operate at full production capacity on the fourth year and then after.

b) Sugar Farm

The farm will start production at 50% of its capacity in the first year. Production capacity will then be built upto 61%, 74%, 85%, 97% and 100% in the 2^{nd} , 3^{rd}, 4^{th}, 5^{th} and 6^{th} year respectively. The area and production programme in each year is shown in Table 3.3 below.

Table 3.3

FARM CAPACITY AND PROUDCTION PROGRAMME

Year	Area (ha.)	Production ('000 Tonnes)
2005	179	26
2006	221	33
2007	263	39
2008	305	45
2009	347	52
2010	357	54

IV. FARMING AND PROCESSING PLANT MATERIALS AND INPUTS

A. MATERIALS

The main raw material for the sugar mill, sugar cane will be supplied from the farm. Except sulphur the other raw materials required by the sugar mill are locally available. Regarding to the sugar cane farm fertilizer and chemicals will be imported. Table 4.1 indicates the total raw material requirement of the integrated sugar mill and farm at full capacity and the corresponding cost.

Table 4.1

ANNUAL RAW MATERIALS REQUIREMENT AND COST

AT FULL CAPACITY PRODUCTION

Sr. No.	Description	Qyt.	Cost ('000 Birr)		
			F.C	L.C	T.C
1.	**Sugar mill**				
1.1	Sugar cane	54,000 tonnes	-	-	-
1.2	Lime	131.22 tonnes	-	104.97	104.97
1.3	Sulphur	40.5 tonnes	113.4	-	113.4
1.4	Jute sack	49,000 pcs	-	147.0	147.0
Sub-Total	**-**	-	**113.4**	**251.97**	**365.37**
2.	**Sugar cane farm**				
2.1	Fertilizer	1648.5 Quintals	499.2	332.03	824.25
2.2	Seeds/planting material	5 Quintals	-	158.0	158.0
2.3	Chemicals	4,909 litters	1184	789.6	1974.6
2.4	Slachier	-	-	7.0	7.0
Sub-Total	**-**	-	**1677.0**	**1286.63**	**2963.3**
Grand Total	**-**	-	**1790.4**	**1538.1**	**3328.5**

B. UTILITIES

Water & electricity are the utilities required by the sugar mill. With the improved shell furnace the open pan sulphitation plant (mini-sugar plant) will be self sufficient in relation to the key energy intensive boiling process which utilizes wet bagasse. Electricity is, however, required for the crushing, crystallizing, centrifuging and drying stage. Estimated

requirement are 100 kWA using 140 kW per hour. The total annual electricity requirement is 907,200 kWh. The annual water requirement for the envisaged plant is 60,000m^3. The annual expenditure on utilities assuming unit cost of water Birr 1.50/m^3 and electricity Birr 0.4738/kWh is estimated at Birr 520,013.

On the other hand fuel, lubricants, electricity and water, etc are the main utilities required by the sugar cane farm for the production process such as land development, ploughing discing, harrowing, cultivation, and transportation and other activities. Electricity for operating equipment, lighting and domestic use, water for different purposes are also the utilities required by the farm. The total utilities cost required for running the farm is estimated to be Birr 350,800.

Therefore, the total utility cost of the integrated sugar cane farm and sugar mill at full capacity operation is estimated at Birr 879,813.

V. FARMING AND PROCESSING TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

a) Sugar Mill

In sugar processing there appears to be a clear choice between large scale and capital intensive technology (the vacuum pan or VP), and small scale and labour-intensive technology open-pan sulphitation, OPS). The latter is appropriate one for the envisaged plant since it require less than forty per cent of the investment of the large-scale technique and provide over six times the total employment. The drawback of this technology is its lower recovery rates from sugar cane.

The major steps involved in the production of sugar from cane can be grouped into six distinct categories; crushing, clarification, boiling crystallization, centrifuging and drying / packing.

i) Crushing:- Sucrose which seldom exceeds 15% (by weight) together with soluble solids, is dissolved in cane juice which is stored in the cells made of cellulose material cemented together by fibres and then covered by a hard rind. So cane is crushed and inordinate pressures exerted to rupture the inner cells in order to extract the sucrose containing juice. To do so a system of five set of roller each grooved to permit the run off of the juice has been developed in which regular and controlled pressure is applied through hydraulic loading.

ii) Clarification:- In addition to sucrose, the juice also contains suspended solids, colloidal matter and other soluble impurities which inhibit the formation of approximately sized crystals of sugar and discolour the final product. Impurities be reduced, the solids, colloidal matter and some of the dissolved salts are generally removed by adding lime together with acid gas (so_2), heating the juice allowing it to settle and decanting off the clear juice.

iii) Boiling:- OPS basically consists of a series of open pans (usually five) each boiling a successively higher concentration of juice at progressively higher temperature. The final syrup is taken off about 84^o brix.

iv) Crystallization:- Sugar is crystallized from the concentrated juice after boiling.

v) Centrifuging:- Once crystal has been formed it is separated from the remaining molasses, which consist of a solution of inverted sugar which cannot be separated in crystalline form by placing the concentrate in a perforated drum and rotating rapidly.

vi) Drying and packing:- The sugar is laid out in the open air to be dried by the sun. The final product can then be packed in individual containers (100 kg jute sack).

Effluent from sugar factory contains organic materials which will have to be contained and treated prior to disposal to the environment. The objective of treatment of such effluent is to reduce the biological and chemical oxygen demands to allowable levels.

b) Farm

1) Land Development

The main process of sugar cane farm will start with land surveying, land clearing, leveling and irrigation land construction.

2) Land Preparation, Planting and Fertilization

The actual land preparation is started by ploughing and followed by discing and harrowing in order to get fine seedbed. Fine seedbed preparation is followed by planting of vegetative stem pieces and fertilizer application. Both operations are expected to be conducted by manual labour.

3) Pre-harvest Management

The sugar cane production, cultivation for weed control and soil fertility improvement, insect and disease control, fertilization and irrigation water application are the predominant agricultural operations. Tractor mounted sprayer will be used to spray chemicals for insect pests, disease and weed controls. Fertilization will be carried out manually.

4) Post-harvest Management

The sugar cane harvesting is the initial stage of post harvest management which includes standing cane firing to burn off leaves, cutting stalks, topping and loading. The operations will be undertaken by hand.

2. Source of Technology

a) Sugar Mill

The address of machinery supplier for the mini sugar plant is given below:-

Shree engineers
208. sharadand B/dg, 274274
Samuel street, vadagadi
Mumbai- 4000 003
India
Tel. 0091 22 345060/65
Fax 0091 223450558

b) Farm

The machinery and equipment required for the sugar cane farm can be supplied by Ries Engineering, Tetraco Plcs. etc.

B. ENGINEERING

1. Machinery and Equipment

Machinery and equipment required by the integrated sugar farm and mill are shown Table 5.1. The total cost of plant machinery and equipment is estimated at Birr 15 million, out of which Birr 13.7 million is required in foreign currency.

Table 5.1

LIST OF MACHINERY AND EQUIPMENT

Sr. No.	Machinery and Equipment	Qty.
	Sugar Factory	
1	Crushing unit	1
2	Raw juice tank	1
3	Juice strainer	1
4	Automatic juice weighing machine	1
5	Juice pump	2
6	Hot juice pump	2
7	Rotary positive blower	1
8	Sulphur furnace	1
9	Scrubber, 18x48 in, double walled water cooled	1
10	Sulphitation tank	1
11	Sulphitation bell	1
12	Lime soulution making equipment	1
13	Settling tank	2
14	Filtration equipment with mud pump	2
15	Juice boiling bells	2
16	Mollasses bel	1
17	Crystallizers	2
18	Centrifuge	1
19	Magma pump	2
20	Rab feeding equipment with drive	1
21	Gear pump for molasses	2
22	Hopper dryer	1
23	Weighting bridge	1
24	Plat form balance	1
	Farm	
25	Tractor1 10-12549	3
26	Disc plough	3
27	Disc Harrow	3
28	Ridger	3
29	Tractor mounted sprayer	3
30	Cultivator	3
31	Generator	1
32	Trailor	6
33	Work shop equipment	Set
34	Tools	Set

2. Land, Building and Civil Works

The total area required by the integrated sugar cane farm and sugar mill including open area, staff canteen, etc. is estimated to be 375 ha. Building area of the project which includes processing plant, treatment plant, administration building stores and workshops is estimated to be 10,000 m^2. The total cost of building at an average unit cost of Birr 1,000 per m^2 is estimated at Birr 10 million.

Land development for 375 ha of irrigated land including irrigation infrastructure, access road construction is estimated to cost about Birr 3.5 million.

Rural land lease rate in BGRS ranges from Birr 15 to Birr 30 per hectare. Accordingly taking the maximum lease rate and 70 years land holding the total lease cost is estimated at Birr 787,500. Even though only a portion of the total lease cost is required to be paid in advance and the balance with in a defined period, in this project profile it is assumed that the total land lease cost will be paid in advance.

3. Proposed Location

The plant can be located in area where sugar cane can be grown. The area requires a temperature range between 32^{o}C-38^{o}C, and a minimum rainfall of 1000 - 1500 mm during the growing season or near rivers, which has the capacity to irrigate large area of land. So the envisaged plant is proposed to be located at Metekel zone.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The envisaged project requires 159 work forces. The mill requires production manpower specialized in the areas of chemical (process) engineering, mechanical and electrical engineering, chemists, production operators, mechanics and electricians. The details of manpower required for accomplishing plant and farm operation and administrative functions is presented in Table 6.1.

Table 6.1

MANPOWER REQUIREMENT AND LABOUR COST (BIRR)

Sr. No.	Description	Req. No.	Monthly Salary	Annual Salary
1	Plant manager	1	2500	30,000
2	Executive Secretary	1	900	10,800
3	Quality control service head	1	1800	21,600
4	Administrative manager	1	2000	24,000
5	Finance manager	1	2000	24,000
6	Commercial manager	1	2000	24,000
7	Technic manager	1	2000	24,000
8	Production manager	1	2000	24,000
9	Chemical engineer	3	1500	18,000
10	Mechanical engineer	3	1500	18,000
11	Chemist	3	1500	18,000
12	Agronomist	3	1200	14,400
13	Personnel	3	900	10,800
14	Accountant	1	1500	18,000
15	Sales head	1	1500	18,000
16	General Service	1	1500	18,000
17	Head	1	1500	18,000
18	Clerks	5	600	36,000
19	Time keepers	3	500	18,000
20	Store keepers	1	500	6,000
21	Mechanics	3	600	21,600
22	Electricians	3	600	21,600
23	Production operators	90	600	648,000
24	Unskilled laborers	30	300	108,000
25	Messengers	3	300	10,800
26	Cleaners	3	300	10,800
27	Drivers	10	300	30,000
28	Guards	10	250	36,000
	Sub-total	**159**		**1,291,200**
	Benefit 25% of sub total			322,800
	Grand Total	**159**		**1,614,000**

B. TRAINING REQUIREMENT

Training is required for production operators, engineers and technicians. A one month training needs to be planned for engineers and chemists in the country of technology supplier and on job training for operators, mechanics & electricians during commissioning

by experts of the technology suppliers. Total cost of training is estimated to be Birr 200,000.

VII. FINANCIAL ANALYSIS

The financial analysis of integrated sugar cane farm and sugar production project is based on the data provided in the previous chapters and the following assumptions:-

Construction period	2 years
Source of finance	30 % equity
	70 % loan
Tax holidays	3 years
Bank interest	10.5%
Discounted cash flow	10.5%
Repair and maintenance	3 % of plant machinery and equipment
Accounts receivable	30 days
Raw material, local	30 days
Raw materials, 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 initial investment cost of the project including working capital is estimated at Birr 32.92 million, out of which about 42% will be required in foreign currency. Details are indicated in Table 7.1.

Table 7.1

INITIAL INVESTMENT COST ('000 BIRR)

Sr. No.	Cost Items	Foreign Currency	Local Currency	Total
1	Land	-	1,300	787.50
2.	Building and Civil Work	-	10,000.00	10,000.00
3.	Plant Machinery and Equipment	13,700.00	1,300.00	15,000.00
4.	Office Furniture and Equipment	-	150.00	150.00
5.	Vehicle	-	1,500.00	1,500.00
6.	Pre-production Expenditure*	-	4,901.71	4,901.71
	Total Investment cost	**13,700.00**	**18,639.21**	**32,339.21**
7	Working Capital	183.75	400.0	583.75
	Grand Total	**13,883.75**	**19,039.21**	**32,922.96**

B. PRODUCTION COST

The annual production cost at full operation capacity of the plant is estimated at Birr 10.30 million (see Table 7.2). The material and utility cost accounts for 64 per cent while repair and maintenance take 1.5 per cent of the production cost.

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* *Pre-production expenditure include interest during construction (Birr 4.4 million), training (Birr 200,000) and costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

Table 7.2

ANNUAL PRODUCTION COST ('000 BIRR)

Items	Year			
	4	**5**	**7**	**10**
Raw Material and Inputs	2,829.23	2,995.65	3,328.50	3,328.50
Labour direct	662.18	701.18	779.04	779.04
Utilities	740.19	783.73	870.81	870.81
Maintenance and repair	395.25	418.50	465.0	465.0
Factory overheads	275.91	292.16	324.60	324.60
Administration Overheads	441.46	467.46	519.36	519.36
Total Operating Costs	**5,344.22**	**5,972.95**	**6,287.31**	**6,287.31**
Depreciation	2,433.57	2,426.25	2,426.25	2,033.57
Cost of Finance	2,396.85	2,396.85	1,822.02	1,046.44
Total Production Cost	**10,174.64**	**10,167.32**	**10,308.85**	**9,367.32**

C. FINANCIAL EVALUATION

1. Profitability

According to the projected income statement, the project will start generating profit in the second year of operation. Important ratios such as the profit to total sales, net profit to equity (Return on equity) and net profit plus interest to total investment (return on total investment) will show an increasing trend throughout the production life of the project.
The income statement and other profitability indicators show that the project is viable.

2. Break-even Analysis

The break-even point of the project is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable cost}} = 16\ \%$$

3. Pay-Back Period

The investment cost and income statement projection are used to project the pay-back period. The project will fully recover the initial investment and working capital within 5 years time.

4. Internal Rate of Return and Net Present Value

Based on the cashflow statement, the calculated IRR of the project is 24% and the net present value at 10.5% discount rate is Birr 33.91 million.

D. ECONOMIC BENEFITS

The project can create employment for 159 persons. In addition to supply of the domestic needs, the project will generate Birr 39.18 million interms of tax revenue. Moreover, the Regional Government can collect employment, income tax and sales tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.