189. PROFILE ON THE PRODUCTION SOLAR WATER PUMP & HEATER

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I. SUMMARY

This profile envisages the establishment of a plant for the production of 2,500 pieces of solar pump and 2,000 pieces of solar heater per annum. Solar water heater is equipment used to heat water by solar radiation energy. Solar water heater is used for domestic purposes like showers, baths and wash and for industrial plants, hotels, hospitals, schools and the like. Pumps are operated by power to lift water from deep wells to the surface point for the user.

The demand for solar pump and for solar heater is met through import. The present (2012) demand for solar pump and solar heater is estimated at 10,507 pieces and 5,243 pieces, respectively. The demand for solar pump and solar heater is projected to reach 16,922 pieces and 7,016 pieces by the year 2017 and 27,253 pieces and 9,388 pieces by the year 2022, respectively.

The principal raw materials required are aluminum frame, glazing caps, aluminum bolts, aluminum rivets, polyisocyanurate foam board, solar glass with 91% transmittance, parts of the pump set (pump parts, wiring, motor, control system) , and RHS pipe which have to be imported.

The total investment cost of the project including working capital is estimated at Birr 44.09 million. From the total investment cost the highest share (Birr 29.03 million or 65.84%) is accounted by fixed investment cost followed by initial working capital (Birr 10.81 million or 24.53%) and pre operation cost (Birr 4.24 million or 9.63%). From the total investment cost Birr 17.53 million or 39.75% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 23.57% and a net present value (NPV) of Birr 30.51 million discounted at 10%.

The project can create employment for 69 persons. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports and also generates income for the Government in terms of tax revenue and payroll tax.

II. PRODUCT DESCRIPTION AND APPLICATION

Solar energy has become increasingly an attractive source of energy owing to its free and inexhaustible supply, and its no-polluting characters which are in contrast to fuel, such as coal, petroleum and fire wood. In Ethiopia, like in many other developing countries, the most widely used sources of energy for heating and pumping water and spaces (in household and other commercial buildings), are fuel gases, electricity and firewood.

Solar water heater is equipment used to heat water by solar radiation energy. Solar water heater is used for domestic purposes like showers, baths and wash and for industries. Industrial plants, hotels, hospitals, schools and the community are users of solar water heater. Pumps are pumps operated by power to lift water from deep wells to the surface point for the user.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

According to the data collected from the Ethiopian Customs Authority the country has been importing various types of water heaters for the past many years. These include-

- Solar water heaters,
- Instantaneous gas water heaters,
- Instantaneous water heater, non electric,
- Electric instantaneous water heaters and immersion water heater, and
- Other instantaneous water heaters.

Ethiopia has also been importing various types of pumps for liquids for many yeas. These include pumps for dispensing fuel & lubricants, concrete pumps, pumps with measuring device, reciprocating and rotary positive displacement pumps, centrifugal pumps, wind pumps and solar pumps.

Substantial efforts have been made in recent years to develop reliable and cost effective solar powered pumping stations. Nowadays, solar water pumps are used both in urban and rural areas of many of developing countries. Ethiopia has also started applying solar energy for different purposes like in telecommunication, health, education and water sector mainly in areas where there is no electricity.

Import of the various types of water heaters and solar water pump is given in Table 3.1.

Table 3.1

IMPORT OF WATER HEATERS AND SOLAR WATER PUMP (PIECES)

Year	Instantaneous water heater	solar water heaters	Solar water pump
2001	25	-	20,273
2002	85	-	63,040
2003	559	102	36,979
2004	87	83	25,725
2005	131	672	45,624
2006	2,960	2,557	10,371
2007	25,464	347	5,883
2008	54,937	2,237	36,109
2009*****	47,332	2,425	37,840
2010	67,594	2,491	52,137
2011	52,734	2,547	23,543
Total	251,908	13,461	20,273
Average	22,901	1,496	63,040

Source: - Ethiopian Revenues & Customs Authority

***** *Although there are import data of solar water heater in Customs Authority External Trade Statistics, the volume of the product for the year 2009 has not been registered in number. The figure given in the External trade statistics is in weight/kilo gram and in value. Therefore, looking at data on other recent years, adjustment has been made for the data of the year.*

As could be seen from Table 3.1, the country has imported various types of water heater for many years. During the period 2001-2011 a total of 251,908 different types of instantaneous water heaters were imported. Since the import figures during 2001-2005 are small and do not show a consistent trend, to be realistic the import data from 2007 - 2011 is considered for the demand projection. Hence, the total imported quantity of instantaneous water heaters of the five years (2007-2011), is 49,612. This indicates that on the average the Ethiopia imported around 50,000 instantaneous water heaters water heaters every year during the period.

Regarding the solar water heaters, the Ethiopian Customs Authority document shows that there was no import of solar water heaters until 2002. According to the document import of solar water heaters was started in 2003.

The above data indicates that import of solar water heater was started in year 2003 with 102 in quantity (number). In general the import data shows an increasing trend although there are some fluctuations in some years. During 2003– 2006 the import data varies from the lowest 83 to the highest 2,557. Although it sharply declined from year 2006 t0 year 2007, the import data shows a consistently increasing trend from 2008 to 2011.

Therefore, to estimate the current effective demand, the average of the last four years (2008 – 2011), which is 2,425, has been taken. As indicated in table 3.1, the yearly average import of other types of water heaters is about 50,000. Hence, the total current demand for water heaters is about 52,425 .Assuming 10% of the total demand for solar water heater, the current (2012) demand for the product is 5,243.

Although the county imports various types of pumps including solar water pumps, data on import of solar pumps could not be found from the Customs Authority External Trade Statistics due to aggregation problem. Hence, import data for hand pumps has been used as proxy to estimate the demand for solar pumps. This is taken by assuming that solar water pumps will substitute some portion of the demand for hand pumps in the future if they are made available.

As could be seen from Table 3.1, import of hand pumps shows an increasing trend although there are some fluctuations. During 2000 - 2002 the figure ranges from the lowest 10,065 to the highest 63,040 and there was a big jump in the import figure from 20,273 in 2001 to 63,040 hand pumps in 2002. But starting from 2004 the figure has shown some 'ups' and 'downs' in trend. The import figure for 2007 is extremely low (5,883 pumps) compared to the other years. However, the import data during 2008 – 20011, (except that of 2011), has shown an increasing trend.

Therefore, the average quantity of hand pumps imported during the period 2008-2011, which is 4,209, has been taken as an effective demand for the year 2012, and the share of solar pumps from the estimated hand pumps demand has been estimated to be 25%.
Based on the above assumption present demand for solar water pumps in the county is estimated at 10,507.

2. Projected Demand

The demand for solar water heater is expected to increase with the growth of the end users and understanding level of the population on the advantages of the product. The service sector such as hotels, hospital, schools and the like are expected to be the major users of the product. The service sector has been growing by about 6% in the past few years and this is applied to forecast the future demand as given table 3.3 below. The demand for solar water pumps is expected to increase with the government's plan of expanding water supply coverage in the rural areas of the county for water supply, irrigation and other purposes. Moreover, solar water pumps will be preferred in the future if proper promotional measures are taken by the concerned organizations. Solar water pumps could be preferred because of their low running and maintenance costs. Hence, by taking the current effective demand as a base an annual average growth rate of 10% has been taken for the projection of the future the future demand.

Table 3.3

PROJECTED DEMAND (IN PIECES)

Year	Solar Water Heaters	Solar water pump
2013	5,558	11,558
2014	5,891	12,714
2015	6,244	13,984
2016	6,619	15,384
2017	7,016	16,922
2018	7,437	18,614
2019	7,883	20,475
2020	8,356	22,523
2021	8,857	24,775
2022	9,388	27,253
2023	9,951	29,978

3. Pricing and Distribution

The price of solar water heaters varies on the size or the capacity and model of the heater. The currently price of Solar Water Heater in Addis Ababa varies from about Birr 7,500 to Birr 15,000. However, for the purpose of this study Birr 10,000 is proposed for sales revenue Projection. The price of solar water pumps varies depending on the capacity of the pumps and the country of origin. Accordingly, for the purpose of financial analyses an average price of Birr 16,500 is suggested.

Solar Water Heater can find its market outlet through agents such as the Household and Office Furniture Enterprise, and other agents. The plant can sell solar water pumps either directly to end users or through agents that distribute similar products throughout the country.

B. PLANT CAPACITY AND PRODUCION PROGRAM

1. Plant Capacity

Considering the economic scale of production, available technology relative to the market demand projection and production management, the annual total production capacity of the plant is set to be 2500 pieces of solar pump and 2000 pieces of solar heater. The envisaged plant will operate in two shifts eight hours per day for three hundred days within a year considering 13 holidays and 52 Sunday per year and assuming that maintenance activities will be performed during off hours and Sunday

2. Production Program

The envisaged manufacturing plant undertake assembly manufacturing process for solar water pump and production for solar heater and it requires the manpower to take little time until they develop a skill and knowledge of the assembly and production process. The assembly process line of solar water pump will run in full load after one year of project implementation and the solar heater production line will achieve its full capacity after three years of implementation which will be justified by the nature of complexity of assembly and production process of solar heater and solar pump

Table 3.3

PRODUCTION PROGRAM

No.	Description	year			
		1	2	3	4
1	Capacity utilization rate (%)	85.00	100.00	100.00	100.00
1.1	Solar water pump	2,125.00	2,500.00	2,500.00	2,500.00
2	Capacity utilization rate (%)	65.00	75.00	85.00	100.00
2.1	Solar water heater	1,300.00	1,500.00	1,700.00	2,000.00

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

The direct and auxiliary raw materials required for annual plant production capacity with their quantity and related cost is shown in Table 4.1

Table 4.1

ANNUAL RAW MATERIAL REQUIREMENT

Sr. No.	Description	Unit	Qty	Unit Cost (Birr)	Cost (000 Birr)		
					LC	FC	Total
A	**SOLAR HEATER**						
1	copper pipe 3/4"	Mtr	120	338	8	41	49
2	Bronze acrylic	KG	600	225	27	135	162
3	aluminum frame	Mtr	3,600	324	233	1,166	1,400
4	Glazing caps	pcs	12,000	72	173	864	1,037
5	Aluminum bolts	pcs	12,000	9	22	108	130
6	Aluminum rivets	pcs	18,000	3	10	49	58
7	Welding electrodes	Kg	600	15	2	9	11
8	Cutting Disc	Pcs	240	45	2	11	13
9	Grinding Disc	Pcs	240	45	2	11	13
10	Aluminum paint	liters	1,609	180	58	290	347
11	Polyisocyanurate foam board	Kg	9,000	216	389	1,944	2,333
12	Solar glass with 91% transmittance	M2	6,000	288	346	1,728	2,074
13	Teflon film	KG	60	810	10	49	58
14	Continuous rubber gasket	KG	84	4,050	68	340	408
15	Valves and fittings	set	3,000				

Sr. No.	Description	Unit	Qty	Unit Cost (Birr)	Cost (000 Birr)		
					LC	FC	Total
				243	146	729	875
16	Galvanized pipe ½'	Mtr	200	87	3	17	21
17	Aluminum sheet, 2mm thick	Tone	25	52,200	261	1,305	1,566
18	Soldering flux 2mm	Roll	300	720	43	216	259
19	Brazing rod	Kg	120	585	14	70	84
20	RHS pipe (40x40x2 mm)	Mtr	18,000	125	450	2,250	2,700
B	**SOLAR WATER PUMP**						
1	Parts of the pump set (Pump parts, PV modules, wiring, motor, control system)	Set	3,000	8,000	4,800	24,000	28,800
2	RHS pipe (40x40x2 mm)	Mtr	22,500	125	563	2,813	3,375
				Total	**7,629**	**38,144**	**45,773**

B. UTILITES

The annual utility requirements such as electricity as a source of energy and water as a cleaning agent are estimated with their associated cost for the envisaged plant with planned production program and capacity shown below:

Table 4.2

UTILITY CONSUMPTION

No.	Description	Annual consumption	Unit	Unit Cost (Birr)	Total Cost (`000) Birr
1	Electricity	1,152,000	kwh	0.65	748.8
2	water	1,200	m^3	10.00	12.0
Total Annual cost					**760.8**

V. TECHNOLOGY AND ENGINNERING

A. TECHNOLOGY

1. Production process

- **Solar Water Heater**

In the solar collector unit progressive Tube collectors are highly insulated with special closed cell foam, and the unit is double glazed for maximized heat retention. Eight copper tubes are welded into a "series" flow pattern - so that the top of the lower tube feeds the bottom of the next tube. This allows the Progressive Tube to contain the colder replacement water in the lower tubes where the sun heats it as it flows from one tube to the next.

The main components of solar water heater with their manufacturing process and their main function is described below

Fluid Connection – Inlet and outlet connections are made hard copper pipes. This allows for fast, leak-free "sweat fit" soldering of plumbing connections.

Collector Case – The baked-on bronze acrylic finish of the extruded aluminum frame wall and glazing caps assures years of attractive rust-free appearance. All rivets and bolts are aluminum or stainless steel.

Absorber / Storage Tank – Constructed entirely of copper tubes are welded to the interconnecting pipes to form a "series" flow pattern. Each tank is pressure rated to 300 psi and is coated with a high-temperature selective solar radiation absorption surface that maximizes heat gain and reduces heat loss.

Insulation – Rigid closed cell polyisocyanurate foam board, the most efficient available, is used to maximize heat retention.

Glazing – Outer glazing is a tempered low-iron solar glass with 91% transmittance. Inner glazing is Teflon film, known for its high temperature tolerance [525°F] and its long-term durability and stability, with 96% transmittance. The 3/4" air space between glazing's reduces heat loss.

Glazing Gaskets – A continuous gasket made of special long life EDPM synthetic the glazing caps to seal compress rubber out the weather. The inner glazing spine is made of high-temperature tolerant EPDM.

Water Collector- The water collector is made of aluminum plate by shearing, bending, welding and insulating by layers of lagging materials to retain the heat.

Pipes and Fittings- Pipes, made of galvanized steel, are cut in to required size and fittings like unions, elbows T-joints, reducers and bronze valves are put in place

Assembling- Solar Water Heater set assembling is a manual process involving:

--Assembling of parts of the Heater, Solar collector, Water collector, Pipes and Fittings

--Testing (Mechanical and electrical)

--Packing

- **Solar Water Pump**

Solar Water Pump parts will be imported as raw material component wise and will be assembled in the factory manually further to be tested by special equipments and the production process involves

---Assembly of parts of the pump, PV modules, motor, control system ,and accessories

---Assembling of pump set together with wiring system;

---Testing (Mechanical and electrical); and

---Packing.

The envisaged plant will assemble a solar water pump set having the specification given below:

Motor pump/configuration: ---------- Submerged borehole motor pump

Output (m^3/day) isolation: ---------- 25

Head (Mt.): ---------- 20

2. Environmental Impact

The envisaged plant is a manufacturing plant with no chemical or any hazardous waste to the surrounding environment and there will not be additional investment for environmental protection.

B. ENGINNERING

1. Machinery and Equipment

The list of direct and auxiliary machinery, tools and equipments required for the plant and their estimated cost is shown in Table 5.1.

Table 5.1

LIST OF MACHINERIES, TOOLS ANDEQUIPMENTS

NO.	Description	Qty	Unit	Unit Cost Birr	Cost ("000) Birr		
					LC	FC	Total (Birr)
A	**SOLAR HEATER**						
1	Hand drilling machine and its accessories	6	Set	90,000.00		540.00	540.00
2	Hand Grinding machine and its accessories	6	Set	63,000.00		378.00	378.00
3	Solar glass cutter	6	pcs	720.00		4.32.00	4.32
4	Air compressor, 7bar and its accessories	1	Set	162,000.00		162.00	162.00
5	Power hacksaw up to 100 mm dia. cap.	1	Pcs	180,000.00		180.00	180.00
6	Hand shearing machine	6	Pcs	9,000.00		54.00	54.00
7	Riveting machine	5	Pcs	90,000.00		450.00	450.00
8	Mechanic tool kit with metallic tool box	6	Set	27,000.00		162.00	162.00
9	Work bench with 4x vise,	10	Pcs	0.00	25.00		25.00
10	Soldering gun, and its accessories	8	Set	360.00		2.88	2.88
11	Welding rectifier and its accessories	8	Set	2,700.00		21.60	21.60
12	Gas welding unit and its accessories	8	Set	1,458,000.00		11,664.00	11,664.00
13	Testing equipments and tools	4	Set	45,000.00		180.00	180.00
B	**SOLAR WATER PUMP**					0.00	0.00
1	Crimpers.	16	Set	900.00		14.40	14.40
2	Screw drivers,	16	Set	360.00		5.76	5.76

NO.	Description	Qty	Unit	Unit Cost Birr	Cost ("000) Birr		
					LC	FC	Total (Birr)
3	Hacksaw,	16	Pcs	630.00		10.08	10.08
4	Work bench with 4x vise,	16	Pcs	0.00	15.00		15.00
5	Wrenches,	16	Set	1,170.00		18.72	18.72
6	Digital multi-meter (V,A,W)	16	Pcs	2,250.00		36.00	36.00
7	Pressure gauge	4	Pcs	1,530.00		6.12	6.12
8	Heat gun,	16	Set	450.00		7.20	7.20
9	Air compressor	2	Pcs	162,000.00		324.00	324.00
10	Steel measuring tap	16	Pcs	90.00		1.44	1.44
11	Toasting equipments and tools	1	Set	270,000.00		270.00	270.00
12	milling machine	1.00	Pcs	723,600.00		723.60	723.60
13	drilling machine	1.00	Pcs	781,650.00		781.65	781.65
14	welding	1.00	Pcs	699,300.00		699.30	699.30
Total					**40.00**	**16,697.07**	**16,737.07**
c	Spare parts (5%)					834.85	834.85
Total Fob Price						**17,531.92**	**17,531.92**
D	CIF (15%)				2,629.79		2,629.79
Total machinery cost					**2,669.79**	**17,531.92**	**20,201.71**

2. Land, Building and Civil Works

The envisaged plant requires total land area of 3,000 meter square out of which built up are is 1,500 meter square and the remaining area will be open for various logistic activities. The cost of building and civil work at the rate of Birr 5,000 per m2 is estimated at Birr 7,500,000.

According to the Federal Legislation on the Lease Holding of Urban Land (Proclamation No 721/2004) in principle, urban land permit by lease is on auction or negotiation basis, however, the time and condition of applying the proclamation shall be determined by the concerned regional or city government depending on the level of development.

The legislation has also set the maximum on lease period and the payment of lease prices. The lease period ranges from 99 years for education, cultural research health, sport, NGO , religious

and residential area to 80 years for industry and 70 years for trade while the lease payment period ranges from 10 years to 60 years based on the towns grade and type of investment.

Moreover, advance payment of lease based on the type of investment ranges from 5% to 10%.The lease price is payable after the grace period annually. For those that pay the entire amount of the lease will receive 0.5% discount from the total lease value and those that pay in installments will be charged interest based on the prevailing interest rate of banks. Moreover, based on the type of investment, two to seven years grace period shall also be provided.

However, the Federal Legislation on the Lease Holding of Urban Land apart from setting the maximum has conferred on regional and city governments the power to issue regulations on the exact terms based on the development level of each region.

In Addis Ababa, the City's Land Administration and Development Authority is directly responsible in dealing with matters concerning land. However, regarding the manufacturing sector, industrial zone preparation is one of the strategic intervention measures adopted by the City Administration for the promotion of the sector and all manufacturing projects are assumed to be located in the developed industrial zones.

Regarding land allocation of industrial zones if the land requirement of the project is below 5,000m^2, the land lease request is evaluated and decided upon by the Industrial Zone Development and Coordination Committee of the City's Investment Authority. However, if the land request is above 5,000 m^2, the request is evaluated by the City's Investment Authority and passed with recommendation to the Land Development and Administration Authority for decision, while the lease price is the same for both cases.

Moreover, the Addis Ababa City Administration has recently adopted a new land lease floor price for plots in the city. The new prices will be used as a benchmark for plots that are going to be auctioned by the city government or transferred under the new "Urban Lands Lease Holding Proclamation."

The new regulation classified the city into three zones. The first Zone is Central Market District Zone, which is classified in five levels and the floor land lease price ranges from Birr 1,686 to Birr 894 per m^2. The rate for Central Market District Zone will be applicable in most areas of the city that are considered to be main business areas that entertain high level of business activities. The second zone, Transitional Zone, will also have five levels and the floor land lease price ranges from Birr 1,035 to Birr 555 per m^2 .This zone includes places that are surrounding the city and are occupied by mainly residential units and industries.

The last and the third zone, Expansion Zone, is classified into four levels and covers areas that are considered to be in the outskirts of the city, where the city is expected to expand in the future. The floor land lease price in the Expansion Zone ranges from Birr 355 to Birr 191 per m^2 (see Table 5.2).

Accordingly, in order to estimate the land lease cost of the project profiles it is assumed that all new manufacturing projects will be located in industrial zones located in expansion zones. Therefore, for the profile a land lease rate of Birr 266 per m^2, which is equivalent to the average floor price of plots located in expansion zone, is adopted.

Table 5.2

NEW LAND LEASE FLOOR PRICE FOR PLOTS IN ADDIS ABABA

Zone	Level	Floor price/m^2
Central Market District	1st	1686
	2nd	1535
	3rd	1323
	4th	1085
	5th	894
Transitional zone	1st	1035
	2nd	935
	3rd	809
	4th	685
	5th	555
Expansion zone	1st	355
	2nd	299
	3rd	217
	4th	191

On the other hand, some of the investment incentives arranged by the Addis Ababa City Administration on lease payment for industrial projects are granting longer grace period and extending the lease payment period. The criterions are creation of job opportunity, foreign exchange saving, investment capital and land utilization tendency etc. Accordingly, Table 5.3 shows incentives for lease payment.

Table 5.3

INCENTIVES FOR LEASE PAYMENT OF INDUSTRIAL PROJECTS

Score point	Grace period	Pay completion period	Down payment
Above 75%	5 Years	30 Years	10%
From 50 - 75%	5 Years	28 Years	10%
From 25 - 49%	4 Years	25 Years	10%

For the purpose of this project profile the average i.e. five years grace period, 28 years payment completion period and 10% down payment is used. The land lease period for industry is 60 years.

Accordingly, the total land lease cost at a rate of Birr 266 per m^2 is estimated at Birr 798,000 of which 10% or Birr 79,800 will be paid in advance. The remaining Birr 718,200 will be paid in equal installments with in 28 years i.e. Birr 25,650 annually

VI. HUMANRESOURCE AND TRAINING REQUIREMENTS

A. HUMANRESOURCE REQUIREMENT

The plant will employ 67 persons. Annual cost of labor is Birr 1.5 million. The list of direct and indirect labor requirement and their monthly and annual cost is shown in Table 6.1.

B. TRAINING REQUIREMENT

Individual operators will be trained during machinery commissioning and erection so that the operators and mechanics will be hired one month before the project implementation. So the training will be conducted on job base arrangement focused on the process parameters and specifications. A total of Birr 100,000 is required for training.

Table 6.1

HUMAN RESOURCE REQUIREMENT AND COST

No.	Description	Qty	Monthly (Birr)	Annual (000 Birr)
1	Plant manager	1	6,000.00	72.0
2	Secretary	1	1,500.00	18.0
3	Administration and finance	1	3,500.00	42.0
4	Accountant	1	2,000.00	24.0
5	Mechanic	4	2,200.00	105.6
6	Electrician	4	2,200.00	105.6
7	Technician	32	1,400.00	537.6
8	production foreman	2	3,000.00	72.0
9	Clerk	2	800.00	19.2
10	Cashier	1	1,000.00	12.0
11	Assistant technician	8	700.00	67.2
12	Quality supervisor	4	1,600.00	76.8
13	store keeper	1	1,400.00	16.8
14	time keeper	1	1,200.00	14.4
15	Driver	2	1,200.00	28.8
16	Guards	4	800.00	38.4
Total		**69**	**30,500.00**	**1,250.4**
18	Employment benefits (20%)		6,100.00	250.1
Total Annual Labor cost (Direct +Indirect)				**1,500.5**

VII. FINANCIAL ANALYSIS

The financial analysis of the Solar water pump & heater project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 year
Source of finance	30 % equity and 70% loan
Tax holidays	5 years
Bank interest	10%
Discount cash flow	10%
Accounts receivable	30 days
Raw material imported	120 days
Work in progress	1 day
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days
Repair and maintenance	5% of machinery cost

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 44.09 million (See Table 7.1). From the total investment cost the highest share (Birr 29.03 million or 65.84%) is accounted by fixed investment cost followed by initial working capital (Birr 10.81 million or 24.53%) and pre operation cost (Birr 4.24 million or 9.63%). From the total investment cost Birr 17.53 million or 39.75% is required in foreign currency.

Table 7.1

INITIAL INVESTMENT COST ('000 Birr)

Sr. No	Cost Items	Local Cost	Foreign Cost	Total Cost	% Share
1	**Fixed investment**				
1.1	Land Lease	79.80		79.80	0.18
1.2	Building and civil work	7,500.00		7,500.00	17.01
1.3	Machinery and equipment	2,669.79	17,531.92	20,201.71	45.81
1.4	Vehicles	900.00		900.00	2.04
1.5	Office furniture and equipment	350.00		350.00	0.79
	Sub total	**11,499.59**	**17,531.92**	**29,031.51**	**65.84**
2	**Pre operating cost ***				
2.1	Pre operating cost	1,360.09		1,360.09	3.08
2.2	Interest during construction	2,884.71		2,884.71	6.54
	Sub total	**4,244.80**		**4,244.80**	**9.63**
3	**Working capital ****	**10,818.50**		**10,818.50**	**24.53**
	Grand Total	**26,562.88**	**17,531.92**	**44,094.80**	**100**

* *N.B Pre operating cost include project implementation cost such as installation, startup, commissioning, project engineering, project management etc and capitalized interest during construction.*

** *The total working capital required at full capacity operation is Birr 15.43 million. However, only the initial working capital of Birr 10.81 million during the first year of production is assumed to be funded through external sources. During the remaining years the working capital requirement will be financed by funds to be generated internally (for detail working capital requirement see Appendix 7.A.1).*

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 56.59 million (see Table 7.2). The cost of raw material account for 80.87% of the production cost. The other major components of the production cost are depreciation, financial cost, direct labour, and utility which account for 8.53%, 4.20%, 2.21%, and 1.34% respectively. The remaining 2.84% is the share of cost of marketing and distribution, repair and maintenance, labour overhead and administration cost. For detail production cost see Appendix 7.A.2.

Table 7.2

ANNUAL PRODUCTION COST AT FULL CAPACITY (year four)

Items	Cost (000 Birr)	%
Raw Material and Inputs	45,773.00	80.87
Utilities	761.00	1.34
Maintenance and repair	606.00	1.07
Labour direct	1,250.00	2.21
Labour overheads	250.00	0.44
Administration Costs	250.00	0.44
Land lease cost	-	-
Cost of marketing and distribution	500.00	0.88
Total Operating Costs	**49,390.00**	**87.27**
Depreciation	4,827.36	8.53
Cost of Finance	2,379.88	4.20
Total Production Cost	**56,597.24**	**100**

C. FINANCIAL EVALUATION

1. Profitability

Based on the projected profit and loss statement, the project will generate a profit through out its operation life. Annual net profit after tax will grow from Birr 3.32 million to Birr 8.05 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 76.57 million. For profit and loss statement and cash flow projection see Appendix 7.A.3 and 7.A.4 respectively.

2. Ratios

In financial analysis financial ratios and efficiency ratios are used as an index or yardstick for evaluating the financial position of a firm. It is also an indicator for the strength and weakness of the firm or a project. Using the year-end balance sheet figures and other relevant data, the most important ratios such as return on sales which is computed by dividing net income by revenue, return on assets (operating income divided by assets), return on equity (net profit divided by equity) and return on total investment (net profit plus interest divided by total investment) has been carried out over the period of the project life and all the results are found to be satisfactory.

3. Break-even Analysis

The break-even analysis establishes a relationship between operation costs and revenues. It indicates the level at which costs and revenue are in equilibrium. To this end, the break-even point for capacity utilization and sales value estimated by using income statement projection are computed as followed.

$$\text{Break Even Sales Value} = \frac{\text{Fixed Cost + Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 26{,}399{,}741$$

$$\text{Break Even Capacity utilization} = \frac{\text{Break even Sales Value}}{\text{Sales revenue}} \times 100 = 43\%$$

4. Pay-back Period

The pay-back period, also called pay – off period is defined as the period required for recovering the original investment outlay through the accumulated net cash flows earned by the project. Accordingly, based on the projected cash flow it is estimated that the project's initial investment will be fully recovered within 4 years.

5. Internal Rate of Return

The internal rate of return (IRR) is the annualized effective compounded return rate that can be earned on the invested capital, i.e., the yield on the investment. Put another way, the internal rate of return for an investment is the discount rate that makes the net present value of the investment's income stream total to zero. It is an indicator of the efficiency or quality of an investment. A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments or putting the money in a bank account. Accordingly, the IRR of this project is computed to be 23.57% indicating the viability of the project.

6. Net Present Value

Net present value (NPV) is defined as the total present (discounted) value of a time series of cash flows. NPV aggregates cash flows that occur during different periods of time during the life of a project in to a common measuring unit i.e. present value. It is a standard method for using the time value of money to appraise long-term projects. NPV is an indicator of how much value an investment or project adds to the capital invested. In principal a project is accepted if the NPV is non-negative. Accordingly, the net present value of the project at 10% discount rate is found to be Birr 30.51 million which is acceptable. For detail discounted cash flow see Appendix 7.A.5.

D. ECONOMIC AND SOCIAL BENEFITS

The project can create employment for 69 persons. The project will generate Birr 18.96 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. The project will also generate other income for the government.

Appendix 7.A

FINANCIAL ANALYSES SUPPORTING TABLES

Appendix 7.A.1
NET WORKING CAPITAL (in 000 Birr)

Items	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Total inventory	8,010.28	9,154.60	10,298.93	11,443.25	11,443.25	11,443.25	11,443.25	11,443.25	11,443.25	11,443.25
Accounts receivable	2,893.58	3,301.00	3,708.42	4,115.83	4,117.97	4,117.97	4,117.97	4,117.97	4,117.97	4,117.97
Cash-in-hand	22.91	26.18	29.45	32.72	33.08	33.08	33.08	33.08	33.08	33.08
CURRENT ASSETS	**10,926.76**	**12,481.78**	**14,036.79**	**15,591.81**	**15,594.30**	**15,594.30**	**15,594.30**	**15,594.30**	**15,594.30**	**15,594.30**
Accounts payable	108.27	123.73	139.20	154.67	154.67	154.67	154.67	154.67	154.67	154.67
CURRENT LIABILITIES	**108.27**	**123.73**	**139.20**	**154.67**	**154.67**	**154.67**	**154.67**	**154.67**	**154.67**	**154.67**
TOTAL WORKING CAPITAL	**10,818.50**	**12,358.04**	**13,897.59**	**15,437.14**	**15,439.63**	**15,439.63**	**15,439.63**	**15,439.63**	**15,439.63**	**15,439.63**

Appendix 7.A.2
PRODUCTION COST (in 000 Birr)

Item	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Raw Material and Inputs	32,041	36,618	41,196	45,773	45,773	45,773	45,773	45,773	45,773	45,773
Utilities	533	609	685	761	761	761	761	761	761	761
Maintenance and repair	424	485	545	606	606	606	606	606	606	606
Labour direct	875	1,000	1,125	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Labour overheads	175	200	225	250	250	250	250	250	250	250
Administration Costs	175	200	225	250	250	250	250	250	250	250
Land lease cost	0	0	0	0	26	26	26	26	26	26
Cost of marketing and distribution	500	500	500	500	500	500	500	500	500	500
Total Operating Costs	**34,723**	**39,612**	**44,501**	**49,390**	**49,416**	**49,416**	**49,416**	**49,416**	**49,416**	**49,416**
Depreciation	4,827	4,827	4,827	4,827	4,827	335	335	335	335	335
Cost of Finance	0	3,173	2,777	2,380	1,983	1,587	1,190	793	397	0
Total Production Cost	**39,550**	**47,613**	**52,105**	**56,597**	**56,226**	**51,337**	**50,941**	**50,544**	**50,147**	**49,751**

Appendix 7.A.3
INCOME STATEMENT (in 000 Birr)

Item	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
Sales revenue	42,875	55,125	61,250	61,250	61,250	61,250	61,250	61,250	61,250	61,250
Less variable costs	34,223	39,112	44,001	48,890	48,890	48,890	48,890	48,890	48,890	48,890
VARIABLE MARGIN	**8,652**	**16,013**	**17,249**	**12,360**	**12,360**	**12,360**	**12,360**	**12,360**	**12,360**	**12,360**
in % of sales revenue	20.18	29.05	28.16	20.18	20.18	20.18	20.18	20.18	20.18	20.18
Less fixed costs	5,327	5,327	5,327	5,327	5,353	861	861	861	861	861
OPERATIONAL MARGIN	**3,325**	**10,686**	**11,922**	**7,033**	**7,007**	**11,499**	**11,499**	**11,499**	**11,499**	**11,499**
in % of sales revenue	7.75	19.38	19.46	11.48	11.44	18.77	18.77	18.77	18.77	18.77
Financial costs		3,173	2,777	2,380	1,983	1,587	1,190	793	397	0
GROSS PROFIT	**3,325**	**7,512**	**9,145**	**4,653**	**5,024**	**9,913**	**10,309**	**10,706**	**11,103**	**11,499**
in % of sales revenue	7.75	13.63	14.93	7.60	8.20	16.18	16.83	17.48	18.13	18.77
Income (corporate) tax	0	0	0	1,396	1,507	2,974	3,093	3,212	3,331	3,450
NET PROFIT	**3,325**	**7,512**	**9,145**	**3,257**	**3,517**	**6,939**	**7,217**	**7,494**	**7,772**	**8,050**
in % of sales revenue	7.75	13.63	14.93	5.32	5.74	11.33	11.78	12.24	12.69	13.14

Appendix 7.A.4
CASH FLOW FOR FINANCIAL MANAGEMENT (in 000 Birr)

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Scrap
TOTAL CASH INFLOW	**30,392**	**56,686**	**55,140**	**61,265**	**61,250**	**61,250**	**61,250**	**61,250**	**61,250**	**61,250**	**61,250**	**22,904**
Inflow funds	30,392	13,811	15	15	0	0	0	0	0	0	0	0
Inflow operation	0	42,875	55,125	61,250	61,250	61,250	61,250	61,250	61,250	61,250	61,250	0
Other income	0	0	0	0	0	0	0	0	0	0	0	22,904
TOTAL CASH OUTFLOW	**30,392**	**48,534**	**48,307**	**52,799**	**58,687**	**56,875**	**57,943**	**57,665**	**57,387**	**57,110**	**52,865**	**0**
Increase in fixed assets	30,392	0	0	0	0	0	0	0	0	0	0	0
Increase in current assets	0	10,927	1,555	1,555	1,555	2	0	0	0	0	0	0
Operating costs	0	34,223	39,112	44,001	48,890	48,916	48,916	48,916	48,916	48,916	48,916	0
Marketing and Distribution cost	0	500	500	500	500	500	500	500	500	500	500	0
Income tax	0	0	0	0	1,396	1,507	2,974	3,093	3,212	3,331	3,450	0
Financial costs	0	2,885	3,173	2,777	2,380	1,983	1,587	1,190	793	397	0	0
Loan repayment	0	0	3,966	3,966	3,966	3,966	3,966	3,966	3,966	3,966	0	0
SURPLUS (DEFICIT)	**0**	**8,152**	**6,834**	**8,466**	**2,563**	**4,375**	**3,307**	**3,585**	**3,863**	**4,140**	**8,385**	**22,904**
CUMULATIVE CASH BALANCE	**0**	**8,152**	**14,986**	**23,452**	**26,015**	**30,390**	**33,698**	**37,283**	**41,145**	**45,286**	**53,670**	**76,575**

Appendix 7.A.5
DISCOUNTED CASH FLOW (in 000 Birr)

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Scrap
TOTAL CASH INFLOW	**0**	**42,875**	**55,125**	**61,250**	**61,250**	**61,250**	**61,250**	**61,250**	**61,250**	**61,250**	**61,250**	**22,904**
Inflow operation	0	42,875	55,125	61,250	61,250	61,250	61,250	61,250	61,250	61,250	61,250	0
Other income	0	0	0	0	0	0	0	0	0	0	0	22,904
TOTAL CASH OUTFLOW	**41,210**	**36,263**	**41,152**	**46,041**	**50,788**	**50,923**	**52,389**	**52,508**	**52,627**	**52,746**	**52,865**	**0**
Increase in fixed assets	30,392	0	0	0	0	0	0	0	0	0	0	0
Increase in net working capital	10,818	1,540	1,540	1,540	2	0	0	0	0	0	0	0
Operating costs	0	34,223	39,112	44,001	48,890	48,916	48,916	48,916	48,916	48,916	48,916	0
Marketing and Distribution cost	0	500	500	500	500	500	500	500	500	500	500	0
Income (corporate) tax		0	0	0	1,396	1,507	2,974	3,093	3,212	3,331	3,450	0
NET CASH FLOW	**-41,210**	**6,612**	**13,973**	**15,209**	**10,462**	**10,327**	**8,861**	**8,742**	**8,623**	**8,504**	**8,385**	**22,904**
CUMULATIVE NET CASH FLOW	**-41,210**	**-34,598**	**-20,624**	**-5,415**	**5,047**	**15,374**	**24,235**	**32,976**	**41,599**	**50,102**	**58,487**	**81,391**
Net present value	-41,210	6,011	11,548	11,427	7,145	6,412	5,002	4,486	4,022	3,606	3,233	8,831
Cumulative net present value	-41,210	-35,199	-23,650	-12,223	-5,078	1,334	6,336	10,822	14,844	18,451	21,683	30,514

NET PRESENT VALUE	30,514
INTERNAL RATE OF RETURN	23.57%
NORMAL PAYBACK	4 years