87. PROFILE ON IMPROVED STOVES

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1. SUMMARY

This profile envisages the establishment of a plant for the production of 15,000 pcs of different sizes of improved stove per annum.

The current demand for the proposed product is estimated at 26,237 pcs and it is projected to reach 52,829 pcs by the year 2014.

The plant will create employment opportunities for 14 persons.

The total investment requirement is estimated at Birr 1.59 million, out of which Birr 145,400 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 1.44 million, discounted at 10.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Improved stoves are household items used for cooking and boiling, using charcoal as a fuel. Improved stoves have an advantage of saving fuel, minimizing heat loss, efficiency and reducing hazards. Other forms of biomass or charcoal can also be used. Fuel efficiencies between 25 to 40% can be achieved with institutional stoves as compared to traditional domestic stoves with only 10% to 15% and improved domestic stoves with only 20 to 35% efficiencies, respectively.

Traditional foods are cooked on simple inefficient stoves such as three stone cooker, usually for single family groups. As long as wood used as fuel for cooking is in plentiful supply and much of the cooking done outdoors, allowing smoke to disperse over a wide area, there was no great incentive to introduce improved and more efficient cooking methods. However, with more recent concern over access to fuel, deforestation, smoke production during inefficient cooking indoors, fires – sometimes fatal caused by cooking,

the length of time spent on cooking and the fact that the food may lack nutrition or even cause harm due to smoke contamination and inadequate cooking, has prompted worldwide efforts to develop and disseminate improved cooking stoves and methods.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Improved stoves are household items used in cooking and boiling using charcoal as a fuel, improved stoves have an advantage of saving fuel, minimizing heat loss, efficiency and reducing hazards.

According to the 1994 Population and Housing Census (CSA), there were 9,162 rural and 27,618 urban households using charcoal as fuel. The respective charcoal using households in Benishangul-Gumuz region were 1,027 in rural and 205 in urban areas. Stoves using charcoal as a fuel are more common in urban areas than rural areas. For this reason, only urban households are considered in this study.

Housing units by major type of fuel used for cooking in urban areas is presented in Table 3.1. As can be seen from the table, the majority of households use firewood with another type of fuel alternatively. As a very conservative approach, housing population of the 1994 census is considered representing the current household units. Therefore, an estimated 27,618 stoves using charcoal as a fuel are present in urban areas of the country.

Table 3.1

URBAN AREAS BY MAJOR TYPE OF FUEL USED FOR COOKING BY REGIONAL HOUSEHOLD UNTIS (1994)

Fuel Type	Country Level	Benishangul-Gumuz
Uses no fuel	52,985	456
Electricity	9,247	12
Gas	4,928	10
Kerosene	53,666	18
Charcoal	27,618	205
Fire wood/Kerosene	371,415	3392
Dung/Manure	8,694	5
Fire wood & Charcoal	454,295	3880
Fire Wood & Dung	179,671	422
Fire Wood & Kerosene	132,637	5
Total	**1,482,892**	**8,499**

In recent years, small-scale producers are introducing different types of improved stoves to the market. However, their share is estimated not to be more than 5%. Hence, the current unsatisfied estimated demand for improved stoves replacing existing ones is 26,237 pieces.

2. Projected Demand

The demand for improved stoves is dependant on the number of households which can use charcoal as a fuel. The household population using charcoal increases every year with new housing units joining these segments.

The 1984 Population Census registers 896,944 urban households while in 1994 it grew to 1,484,588. The average annual growth rate of households is, therefore, 7.25%. The potential customer of improved stoves being charcoal using households, in order to assess the future demand, forecast is made based on the urban households growth rate of 7.25%. Accordingly, projection of demand for improved stoves indicates that by the year 2014 the demand for improved stove will be 52,829 pieces (see Table 3.2).

Table 3.2

PROJECTED DEMAND FOR IMPROVED STOVES

Year	Improved Stoves
2005	28,139
2006	30,179
2007	32,367
2008	34,714
2009	37,830
2010	39,929
2011	42,824
2012	45,928
2013	49,258
2014	52,829

3. Pricing and Distribution

Based on the current price for improved stoves in Addis Ababa, the average factory-gate price for the envisaged plant is recommended to be Birr 70/pcs. The product can be distributed by establishing own distribution outlets in major towns or by using household equipment retailers.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

Based on the demand projection indicated herein above the proposed plant will have a capacity to produce 15,000 pieces of different size improved stoves. The plant is envisaged to operate in one shift of 8 hours per day for 264 days per year. However, it is also possible to work in two shifts based on actual market conditions.

2. Production Programme

The fact that manufacturing of improved stoves is not complicated process, it may take only a short time to develop the specific skills and knowhow by the production workers. The maximum attainable capacity of machines at the beginning of its operation is assumed at 60% because of the wastage of time during cleaning & trial runs of the machine. It is, hence, recommended to gradually raise the plant to its full capacity in the 3rd year of operation. The detailed production programme is given in Table 3.3.

Table 3.3

PRODUCTION PROGRAMME

Year of Production	1st Year	2nd Year	3rd Year
Production in %	60%	85%	100%
Improved Stoves (pcs)	9000	12750	15000

IV. MATERIALS AND INPUTS

A. MATERIALS

The stove consists of two concentric sheet steel cylinders, one considerably larger than the other, with a gap between them. This gap is filled with mixture of sand and cement for improved stove insulation and covered by a metal cap. The pot rests in the hollow cavity formed by the inner cylinder, in which the firebox is also situated. The stove has been designed to facilitate fabrication in a small-scale workshop. The raw materials required for the manufacturing of improved stoves are mainly sheet metal, cement and sand whose breakdown is as indicated in Table 4.1.

Table 4.1

LIST OF RAW MATERIALS AND COSTS

Sr. No.	Description	Unit of Measure	Req. No.	Unit Cost	Cost in Birr
1.	Low carbon sheet metals	pcs	4,545	75	340,900
2.	Flat iron	pcs	1,000	20.00	20,000
3.	Cement	kg	15,000	0.80	12,000
4.	Sand	m^3	15	75	1,100
5.	Welding electrodes	packet	225	21	4,700
6.	Others	LS	LS	LS	5,681
Grand Total					**384,381**

B. UTILITIES

The plant will use electrical energy and water as main utilities. Estimated annual utilities consumption along with corresponding cost is indicated in Table 4.2.

Table 4.2

ANNUAL UTILITIES REQUIREMENT AND COST

Utility	Unit	Consumption	Unit Cost	Total Cost
Electrical energy	kWh	6,072	0.4736	12,650
Water	M^3	1,100	1.67	1,837
Grand Total				**14,487**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

The production process to manufacture improved stoves includes sheet metal cutting, forming and welding in such a way that to form two concentric sheet steel cylinders which will be filled by sand and cement mix that will act as insulator. The process is simple and doesn't have adverse effect to the environment.

2. Source of Technology

The machinery required to manufacture improved stoves is simple. All the machinery have to be imported from abroad. The following company is recommended as source of technology to manufacture different designs of improved stoves.

ARECOP
(Asia Regional Cookstove Programme)
Jalan Kaliurang Km. 7
P.O. Box 19
Bulaksumur

Yogyakarta

Indonesia

Tel: + 62-274-561247

Fax:+ 62-274-563423.

B. ENGINEERING

1. Machinery and Equipment

The list of main machinery required for the production of improved stoves which can locally be purchased is given in Table 5.1. The total cost of plant machinery and equipment is estimated to be Birr 145,390.

Table 5.1

MACHINERY AND EQUIPMENT

Sr. No.	Machine / Equipment Description	Qty.
1.	Sheet metal shearing machine	1
2.	Gas welding	1
3.	Mixer	2
4.	Bench grinding machine	1
5.	Hand drilling machines	2
6.	Others hand tools measuring instruments	

2. Land, Building and Civil Works

The required area for both building and open space for the plant is estimated to be 400m^2, out of which 300 m^2 will be built-up area. The total cost of civil works, at the rate of Birr 1,500 per m^2, is estimated at Birr 600,000. The total land lease cost at lease a rate of Birr

2.5/m^2, for 70 years of land holding is estimated to be Birr 70,000. Thus, the total investment cost for land, building ad civil works assuming that the total land lease cost will be paid in advance is estimated at Birr 670,000.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The plant will require about 14 workers. The breakdown of manpower allocation and the corresponding cost is indicated in Table 6.1.

Table 6.1

MANPOWER REQUIREMENT AND ANNUAL LABOUR COST (BIRR)

Sr. No.	Position	Req. No.	Monthly Salary	Annual Salary
1.	Plant manager	1	1,500	18,000
2.	Production & Tech. Dept	1	1,000	12,000
3.	Operators	5	2,000	24,000
4.	Prod & Tech. helpers	2	400	4,800
5.	Sells & purchase	2	1,000	12,000
6.	Store	1	400	4,800
7.	Driver	2	1,000	12,000
	Sub total	**14**	**7,300**	**87,600**
8.	Workers benefit 25% of basic salary		1,825	21,900
	Grand Total	**14**	**9,125**	**109,500**

B. TRAINING REQUIREMENT

The manufacturing of improved stoves is not such a complicated process that will not require any advanced training. However, it is advantageous to arrange a local training for the production and technical head on design and development of improved stoves for a week. This training may cost the project Birr 6,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the improved stoves project is based on the data provided in the previous chatpers 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	5 % of Plant machinery and equipment
Accounts receivable	30 days
Raw material (local)	30 days
Work in progress	3 days
Finished products	30 days
Cash at 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 1.59 million. Details are indicated in Table 7.1.

Table 7.1

INITIAL INVESTMENT COST ('000 BIRR)

Sr. No.	Cost Items	Cost
1	Land	70.00
2	Building and Civil Work	600.00
3	Plant Machinery and Equipment	145.39
4	Office Furniture and Equipment	100.00
5	Vehicle	250.00
6	Pre-production Expenditure*	295.8
	Total Investment Cost	**1460.39**
7	Working Capital	129.1
	Grand Total	**1589.49**

B. PRODUCTION COST

The annual production cost at full operation capacity of the plant is estimated at Birr 556,800 (see Table 7.2). The material and utility cost accounts for 72 per cent while repair and maintenance take 1.31 per cent of the production cost.

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* Pre-*production expenditure include interest during construction (Birr 195,800), training (Birr 6,000) and cost of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

Table 7.2

ANNUAL PRODUCTION COST

('000 BIRR)

Items	Year			
	3	**4**	**7**	**10**
Raw Material and Inputs	230.6	326.7	384.4	384.4
Labour Direct	31.5	44.7	52.6	52.6
Utilities	8.7	12.3	14.5	14.5
Maintenance and repair	4.4	6.2	7.3	7.3
Overheads	13.1	18.6	21.9	21.9
Administrative Cost	21.0	29.8	35.0	35.0
Total Operating Costs	**309.4**	**438.3**	**515.6**	**515.6**
Depreciation	140.1	140.1	41.0	41.0
Cost of Finance	113.6	90.9	-	-
Total Production Cost	**563.0**	**669.2**	**556.6**	**556.6**

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 the percentage of net 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.

$$Be = \frac{\text{Fixed Cost}}{\text{Sales-Variable Cost}} = 27\ \%$$

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 6 years time.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 24 % and the net present value at 10.5% discount rate is Birr 1.44 million.

D. ECONOMIC BENEFITS

The project can create employment opportunities for 14 persons. In addition to supply of the domestic needs, the project will generate Birr 1.71 million in terms of tax revenue. Moreover, the Regional Government can collect employment, income tax and sales tax revenue.