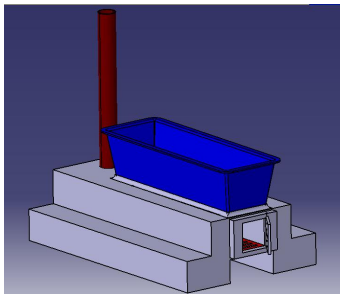
DETAILED PROJECT REPORT
ON
ENERGY EFFICIENT CHULHA
(SOLAPUR TEXTILE CLUSTER)








Bureau of Energy Efficiency

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ENERGY EFFICIENT CHULHA

SOLAPUR TEXTILE CLUSTER

BEE, 2010

Detailed Project Report on Energy Efficient Chulha

Textile SME Cluster, Solapur, Pune, Maharashtra (India)

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Acknowledgement

We sincerely appreciate the efforts of industry, energy auditors, equipment manufacturers, technology providers, consultants and other experts in the area of energy conservation for joining hands with Bureau of Energy Efficiency (BEE), Ministry of Power, and Government of India for preparing the Detailed Project Report (DPR) under BEE SME Program in SMEs clusters. We appreciate the support of suppliers/vendors for providing the adoptable energy efficient equipments/technical details to the SMEs.

We have received very encouraging feedback for the BEE SME Program in various SME Clusters. Therefore, it was decided to bring out the DPR for the benefits of SMEs. We sincerely thank the officials of BEE, Executing Agencies and ISTSL for all the support and cooperation extended for preparation of the DPR. We gracefully acknowledge the diligent efforts and commitments of all those who have contributed in preparation of the DPR.

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List of Abbreviations

kWh	kilo Watt Hour
GoI	Government of India
MSME	Micro Small and Medium Enterprises
GHG	Green House Gas
BEE	Bureau of Energy Efficiency
DPR	Detailed Project Report
O&M	Operational & Maintenance
NPV	Net Present Values
ROI	Return on Investment
IRR	Internal Rate of Return
DSCR	Debt Service Coverage Ratio
PBT	Profit Before Tax
PAT	Profit After Tax
SIDBI	Small Industries Development of India

EXECUTIVE SUMMARY

Zenith Energy Services Pvt. Ltd is executing BEE-SME program in Solapur textile cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Solapur textile cluster is one of the largest textile clusters in India; accordingly this cluster was chosen for energy efficiency improvements by implementing energy efficient measures/technologies, so as to facilitate maximum replication in other textile clusters in India.

The main energy forms used in the cluster units are Wood. Wood is used as fuel in chulha for dyeing process. Energy cost used in dyeing process is major cost in the overall energy cost in majority of textile industries in Solapur cluster.

Replacement of convention chulha with energy efficient chulha will lead to reduction in wood consumption by 36 tonne per year however; this intervention will not have any effect on the existing consumption pattern of electricity.

The total investment, debt equity ratio for financing the project, monetary savings, Internal rate of return (IRR), Net present value (NPV),Debt service coverage ratio (DSCR), Return on investment (ROI) etc. for implementing energy efficient economizer is furnished in Table below

S.No	*Particular*	*Unit*	*Value*
1	Project cost	₹(in Lakh)	0.53
2	Wood saving	Tonne/year	18
3	Monetary benefit	₹(in Lakh)	0.45
4	Debit equity ratio	ratio	3:1
5	Simple payback period	years	1.18
6	NPV	₹(in Lakh)	0.55
7	IRR	%age	176.04
8	ROI	%age	42.99
9	DSCR	ratio	2.88
10	Project Implementation time	week	2

The projected profitability and cash flow statements indicate that the project implementation will be financially viable and technically feasible.

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 25 selected SMEs clusters. Solapur Textile Cluster is one of them. The BEE's SME Programme intends to enhance the energy efficiency awareness by funding / subsidizing need based studies in SME clusters and giving energy conservation recommendations. For addressing the specific problems of these SMEs and enhancing energy efficiency in the clusters, BEE will be focusing on energy efficiency, energy conservation and technology up-gradation through studies and pilot projects in these SMEs clusters.

Major activities in the BEE -SME program are furnished below:

Energy use and technology audit

The energy use technology studies would provide information on technology status, best operating practices, gaps in skills and knowledge on energy conservation opportunities, energy saving potential and new energy efficient technologies, etc for each of the sub sector in SMEs.

Capacity building of stake holders in cluster on energy efficiency

In most of the cases SME entrepreneurs are dependent on the locally available technologies, service providers for various reasons. To address this issue BEE has also undertaken capacity building of local service providers and entrepreneurs/ Managers of SMEs on energy efficiency improvement in their units as well as clusters. The local service providers will be trained in order to be able to provide the local services in setting up energy efficiency projects in the clusters

Implementation of energy efficiency measures

To implement the technology up-gradation projects in clusters, BEE have proposed to prepare the technology based detailed project reports (DPRs) for a minimum of five technologies in three capacities for each technology.

Facilitation of innovative financing mechanisms for implementation of energy efficiency projects

The objective of this activity is to facilitate the uptake of energy efficiency measures through innovative financing mechanisms without creating market distortion

1 INTRODUCTION TO THE EXISTING SITUATION

1.1 About the solapur textile cluster

The products manufactured in Solapur Textile Cluster are cotton terry towels and bed sheets. The towels and bed sheets are renowned in the country and have good market in India. The main raw material for the units is cotton yarn, which is procured from local spinning mills and agents. The cost of energy (electrical and thermal energy) as percentage of manufacturing cost varies between 8 and 10%.

Majority of the cluster units are of integrated type, where the raw material yarn is processed in-house to the final product. The energy cost is second to the raw materials cost. Majority of the units in the cluster are dependent on local/ run of the mill technologies of low end and with little investment initiatives and technology up-gradation.

The main energy forms used in the cluster units are grid electricity, wood, and small quantity of coal. The electricity is used for power looms, doubling machines, winding machines, hydro extractors, warping machines and lighting. Wood is used as fuel for boilers, thermic fluid heaters, and chulha for hot water generation. The details of annual energy consumption of a typical unit having a production capacity of 94,000 kg of final product of the cluster are furnished in the Table1.1 below:

Table 1.1 Details of annual energy consumption of a typical unit

Parameter	*Unit*	*Value*
Electricity consumption	kWh	1,03,500
Wood consumption	Tonne	36
Production	kg	94,000

1.1.1 Production process

The main operational process for production of towels and bed sheets in cluster units are:

Doubling

In the Doubling process, thin single yarn is converted to double yarn for strengthening the yarn by using doubling machine.

Yarn dyeing

Initially, the yarn is soaked in soap water for 24 hours to remove the dirt and other foreign materials and after soaking, the yarn is taken for bleaching. Bleaching is carried out by

soaking the yarn in tanks mixed with bleaching agents and after completion of the process; the yarn is washed with normal water.

The dyeing is carried out manually, where the chulha are installed for hot water generation. The container is filled with required quantity of normal water with required chemicals and dyeing agents are added. The temperature of the water is raised by placing the container over the Chulha. Fire wood is used as fuel. The required colors are added to the yarn and the dyeing process takes about 3 to 4 hours in a day. After dyeing, the yarn is washed with normal water, and the yarn is taken for soaping for colour fixation either in hot water or normal water. The wet yarn is taken for drying in the natural sunlight.

Winding

The yarn after drying is taken for winding in which the yarn is wounded to bobbins and cones. The winded yarn is taken for further process.

Warping

In warping, the winded yarn is wound to beams according to designed pattern (customized designs). Then the beams are taken for Weaving.

Weaving

The beams, which are wound with yarn are taken and placed in power looms where the designed pattern is already set. In power looms, the yarn is converted to final product (Towel or bed sheets) by weaving. The product obtained from weaving is taken for stitching and packing. The general process flow diagram of a typical unit for production of towels and bed sheets is furnished in Figure 1.1.

Existing process flow in textile industry:

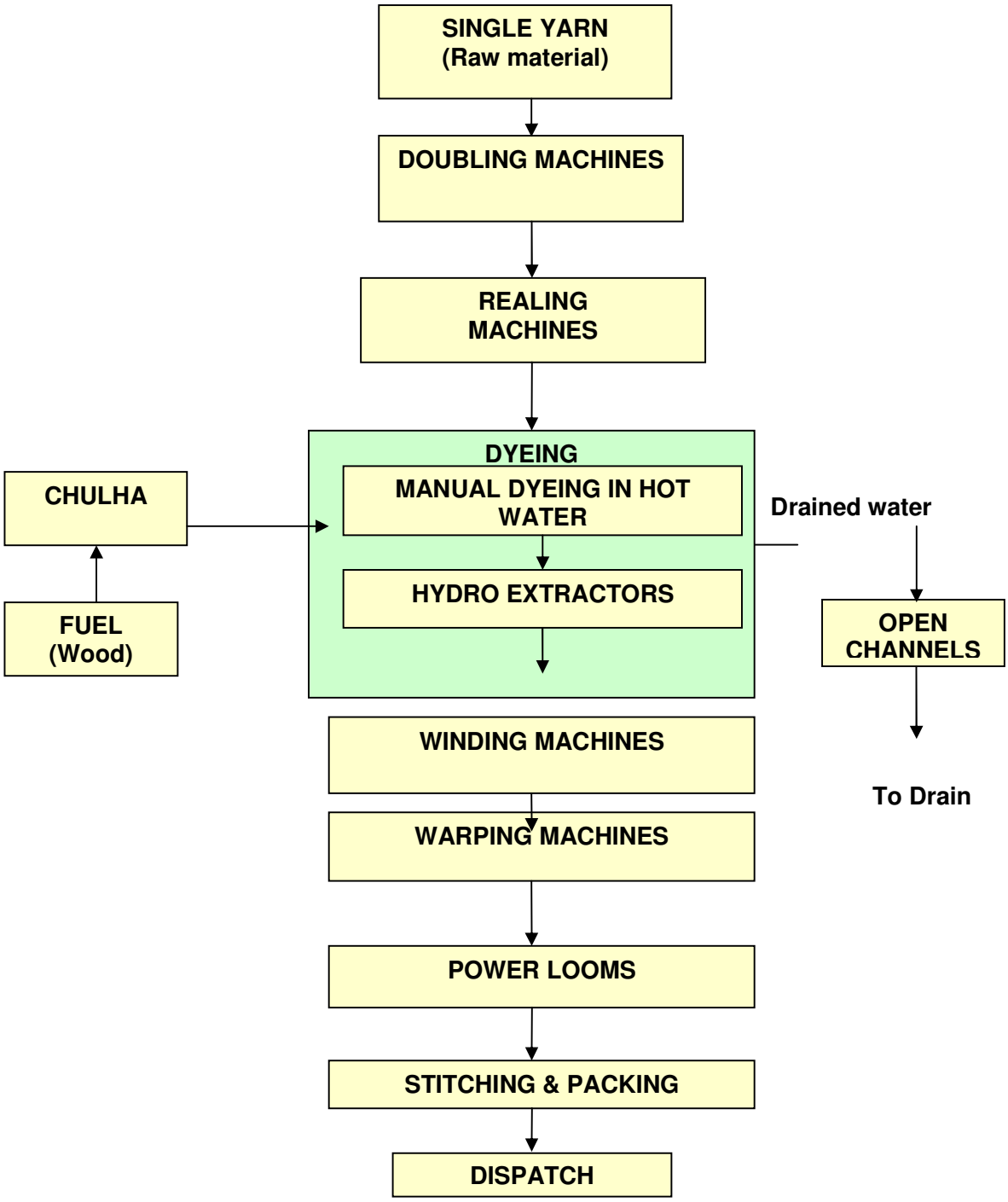


Figure 1.1 Process flow chart of typical textile unit

The production process as depicted above is similar for all textile units in Solapur textile cluster. However, depending on type of product and product quality, the above stated process flow varies as per the requirement of the industry.

1.2 Energy performance in solapur textile cluster

In a typical textile manufacturing unit annual consumption of electrical energy and wood is 1,03,500 kWh and 36 tonne respectively. Average production capacity of a typical textile manufacturing unit in Solapur textile cluster is around 94,000 kg per annum.

1.2.1 Specific energy consumption of final product

Specific electrical and thermal energy consumption in textile unit depends upon the final product manufactured in that unit. The electrical and thermal energy consumption of typical textile unit is 1.10 kWh/kg of final product and 0.38 kg of wood/kg of final product respectively (includes all colours dyeing in cold water, medium temperature water and high temperature water)

1.3 Proposed equipment to be upgrade

1.3.1 Description of existing equipment

There are about 250 conventional chulha in the Solapur textile cluster of various sizes. The chulha are used for generating hot water and preparation for soap stock. The chulha are of conventional type and open fired. Based on detailed studies carried out on chulha, the efficiency was found to be in the range of 6 to 10% only

Considering the above facts and for improving efficiency and to reduce wood consumption in the present chulha, the energy efficient chulha design had been developed by Zenith Energy Services Pvt. Ltd. to improve the efficiency. The efficiency evaluation for Chulha during energy use & technology audit details of various industries is furnished in Annexure 1.

Figure 1.2 Conventional Chulha

1.3.2 Role in process

For production of towels and bed sheets of different colours, the dyeing of cotton yarn is vital and dying process requires hot water. The chulha is used for hot water generation required for processing and to maintain the constant temperature during dyeing and soaping.

1.4 Baseline for existing equipment

Energy consumption in chulha would depend on following:

- Dyeing temperature which depend on the color of the yarn required
- Climate conditions
- Type of wood and its calorific value

Energy use and technology audit studies were conducted in various units of Solapur textile cluster, the baseline energy consumption of chulha and the performance of the same is carried out and attached in Annexure 1.

1.4.1 Operating efficiency

The conventional chulha is open fired and wood consumption is 36 Tonne per annum. The operating efficiency of the conventional chulha is 6.25 % and the details of operating parameters and efficiency of chulha are furnished in Annexure 1.

1.4.2 Specific energy consumption

The specific fuel consumption per kg of yarn processing in three typical units of the cluster separately for dyeing and soaping process is furnished in Table 1.2 below.

Table 1.2 Details of specific energy consumption

S.No	*Name of the unit*	*Specific fuel consumption (kg/kg)*
1	M/s Burugul Textiles	0.67
2	M/s Chatla Textiles	0.63
3	M/s Yemul Textiles	0.38

1.5 Barriers for adoption of proposed equipment

1.5.1 Technological Barriers

The major technical barriers that prevented the implementation of energy efficient chulha are:

- Lack of awareness and information about the new and emerging energy efficient technologies
- Absence of technical knowledgeable local service providers and non-availability of design of energy efficient
- More focus on investing in enhancing production capacity for the economic viability of the plant, than benefits in the form of future savings due to implementation of energy efficiency measures.

1.5.2 Financial Barrier

Implementation of the proposed project activity requires investment of ₹ 0.53 lakh per unit. Further, from the business perspective of SMEs, it is more viable, assured, and convenient to invest on project expansion for improving the production capacity or quality, rather than make piecemeal investment in retrofit and replace options for energy savings. In view of this and given the limited financial strength of the textile mills, it is evident that the owners would not like to take the risk and invest in energy efficiency measures.

However, the financial attractiveness of the project activity may motivate the owners to move forward in taking up initiatives in energy conservation and efficiency.

1.5.3 Skilled manpower

The non-availability of skilled manpower having awareness about energy efficiency and related issues in the cluster is one of the major barriers. Though, the skilled manpower is available in the cluster, they are not aware of energy conservation/efficiency and its importance. Their prime responsibility is to maintain machines and ensure uninterrupted production by minimizing down time as per the targets set by the management.

Specialized training with the local service providers for better operation and maintenance of the equipments, importance of energy use and conservation will create awareness among workforce thereby enhancing their skill set about efficient use of energy and its conservation.

1.5.4 Other barrier (If any)

The non-availability of local supplier for energy efficient chulha

2 PROPOSED ENERGY EFFICIENT EQUIPMENT

2.1 Energy efficient wood fired Chulha

2.1.1 Description of equipment

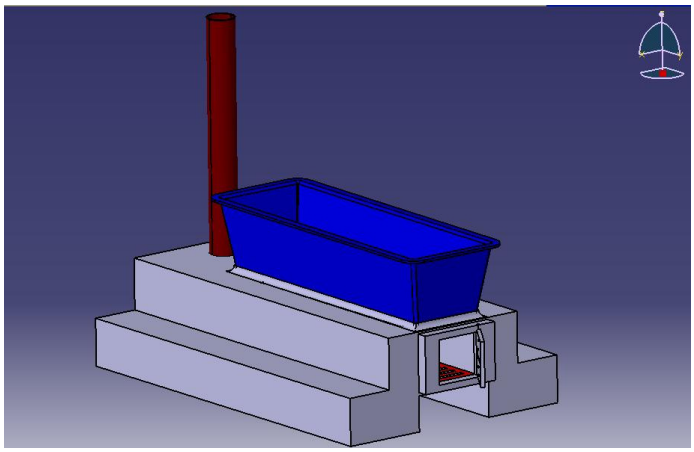


Figure 2.1 Energy efficient wood fired chulha

Zenith Energy Services Pvt. Ltd. has developed an energy efficient chulha design. The energy efficient Chula is basically a 'Smokeless Chulha', of bigger size with a provision for regular air circulation, damper for regulating the air flow for combustion, optimized furnace area, improved design grate for reducing heat losses, maximum utilization of heat in waste flue gases and a chimney for the removal of smoke.

An energy efficient chulha has been constructed at one of the unit of Solapur Textile Cluster and the efficiency of the chulha has been found to be around 30% and wood consumption has been reduced. The chulha are constructed in various sizes as per the requirement of the plant and design remains same, only size of the chulha varies

Comparison of existing chulha with energy efficient chulha

Technical, economic, Environmental and safety aspects of existing chulha and energy efficient chulha are compared on life cycle of equipment, same is given in Table 2.1 below

Table 2.1 Comparison of existing chulha with energy efficient chulha

S. No	Details	Existing Chulha	Energy Efficient Chulha
1	Wood consumption	High	Low
2	Environment pollution	High	Low
3	Safety of workers	Poor	Good
4	Maintenance	High	Low

S. No	Details	Existing Chulha	Energy Efficient Chulha
5	Operational cost	High	Low
6	Availability of local service providers	Yes	Yes
Technical comparison between existing chulha & energy efficient chulha			
7	Draught system	Forced	Natural
8	Fuel combustion	Partial(due to inefficient combustion chamber design)	Complete
9	Waste heat recovery	No	Yes
10	Heat losses through grate and surface	High	Low
11	Radiation losses	More	Less
16	Operation and maintenance	Less easy	Easy

2.1.2 Equipment specification

Equipment specification of new wood fired energy efficient chulha is furnished in Annexure 8.

2.1.3 Suitability with existing process

New proposed equipment is used for hot water generation which is earlier generated by conventional thermic fluid heater. Hence new proposed equipment is completely suitable with existing process.

2.1.4 Availability of equipment

Based on the detailed energy use and technology audits conducted in various textile industries in Solapur Textile cluster, it is suggested to replace the present conventional chulha with energy efficient chulha of suitable capacity.

The technology/ equipments will be procured from Pune based equipment suppliers. The proposed equipment is manufactured by well known vendor who is involved in making energy efficiency equipments.

2.1.5 Source of equipment supplier

Technology/service provider selected for implementation of the proposed energy efficiency project is having good experience in producing and supplying energy efficient chulha. This technology/service provider is having in house R&D team to develop the new products, which are energy efficient & eco friendly. Recommended technology supplier has the desired

technical and financial capability to inspire trust in cluster on products/ services developed/ offered by them.

2.1.6 Technical specifications of Energy Efficient Wood fired Chulha

Design specifications of proposed energy efficient chulha are presented in Table 2.2 below

Table 2.2 Technical specifications of existing and proposed technology

Details	*Units*	*Existing technology*	*Proposed technology*
Name of equipment	NA	Conventional chulha	Energy Efficient Chulha
Fuel used	NA	Wood	Wood
Fuel consumption	Tonne/annum	36	18
Thermal efficiency	%age	6.25	25-30
Firing control	NA	Manual	Manual
Fuel saving	Tonne/annum		18
Monetary saving	₹		0.45

2.1.7 Process down time during Implementation

If the improved chulha is constructed by dismantling the conventional chulha then the process down time may be around 14 days. If the proposed chulha is constructed beside the existing location, no process down time is considered.

2.2 Life cycle assessment and risks analysis

The life of the proposed energy efficient chulha is considered as 10 years.

2.3 Suitable unit for implementation of proposed technology

The chulha is a tailor made and is constructed as per the requirement and detailed engineering drawings in the typical unit of 600 liters per day capacity of hot water.

3 ECONOMIC BENEFITS OF PROPOSED EUIPMENT

3.1 Technical benefits

3.1.1 Fuel saving

Analysis was carried out on existing chulha, average wood consumption from various energy use and technology audit studies in textile units in Solapur textile cluster; it comes out to be 36 tonne per annum. Wood consumption of proposed energy efficient chulha is 18 tonne per annum and hence wood savings is estimated as 18 tonne per annum.

3.1.2 Electricity saving

No electricity savings are considered, as the proposed energy efficient chulha also requires a small pump for hot water circulation from tank to energy efficient chulha.

3.1.3 Improvement in product quality

Product quality achieved would be same as the present quality. It does not have any impact in improving the quality of the product.

3.1.4 Increase in production

The proposed equipment does not contribute to any increase in production.

3.1.5 Reduction in raw material consumption

Raw material consumption is same even after the implementation of proposed technology.

3.2 Monetary benefits

Annual monetary savings after implementation of energy efficient chulha in place of conventional chulha is ₹ 0.45 lakh per annum. Energy & cost benefit analysis of energy efficient chulha in place of conventional chulha is presented in Table 3.1 below:

Table 3.1 Energy and cost benefit of energy efficient chulha

Parameter	*Unit*	*Value*
Present wood consumption of existing chulha	tonne/annum	36
Operational hours	hours/day	8
Operational days per annum	days/annum	240
Wood consumption of Energy efficient chulha	tonne/annum	18
Saving of wood in replacement of chulha with energy efficient chulha	tonne/annum	18
Cost of wood	₹/kg	2.50

Parameter	*Unit*	*Value*
Cost savings after implementation	₹ lakh	0.45
Cost of implementation	₹ lakh	0.53
Simple payback period	months	1.18

From the above table it is evident that project to replace the conventional chulha with energy efficient chulha is financially viable and technically feasible. Detailed cash flow evaluation and financial parameters in replacing the existing chulha with energy efficient chulha are discussed in detail in the next chapter.

3.3 Social benefits

3.3.1 Improvement in working environment

The energy measures identified will utilize state-of-the-art technologies to ensure energy efficiency and conservation of non renewable wood. The replacement of chulha with energy efficient chulha will reduce the fuel consumption and will improve the work condition and environment. As the project activity will have less radiation losses and unburnt carbon in ash.

3.3.2 Improvement in skill set of workers

The equipment selected for the implementation is new and energy efficient. The training provided by equipment suppliers will improve the technical skills of manpower for better operation and maintenance; hence the equipment implementation will create awareness among the workforce and will improve their skill set.

3.3.3 Impact on wages/emoluments

The awareness about the technologies and training imparted during implementation of the project will lead to direct and indirect increase in the wages of the employees, as it improves the technical skills of the workforce during operation and maintenance of equipments. Further, the remuneration will improve in the market or in other companies of the work force.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

The effluent generation due to implementation of the project activity is insignificant.

3.4.2 Reduction in GHG emission such as CO_2, NOx, etc

The major GHG emission reduction source is CO_2 and the technology will reduce non renewable wood consumption due to better efficiency than the existing equipment. The total

emission reductions are estimated as 25 Tonne of CO_2 (taking CO_2 emission factor as 1.4 tCO_2 per tonne of wood consumption) per annum due to implementation of the project activity. Therefore, units of the cluster may become eligible for carbon credit under Clean Development Mechanism.

3.4.3 Reduction in other emissions like SOx

As the technology reduces the wood consumption and doesn't contain sulphur and hence there is no impact on SOx emissions.

3.4.4 Reduction of deforestation

Most of units in the cluster are using the non renewable wood for hot water generation; therefore, by adopting the proposed energy efficient wood fired chulha in place of conventional chulha will reduce consumption of non renewable wood. Wood consumption is low in proposed energy efficient chulha compared to conventional chulha, which is expected to reduce the deforestation.

4 INSTALLATION OF PROPOSED EQUIPMENT

4.1 Cost of equipment implementation

4.1.1 Cost of equipment

The total cost of plant and machinery is estimated at ₹ 0.36 lakh, which includes energy efficient chulha, chimney, and electrical works and distribution system.

4.1.2 Other costs

The total cost of implementation of the energy efficient chulha is estimated at ₹ 0.53 lakh. The above cost includes cost of equipment/machinery, cost of fabrication (and/or) commissioning charges and the details are furnished below:

Table 4.1 Details of project cost

S. No	Details	Cost (₹ in lakh)
1	Equipment and machinery	0.36
2	Civil work	0.10
3	Interest during implementation	0.02
4	Other charges(Contingency)	0.05
5	Total	0.53

4.2 Arrangement of funds

4.2.1 Entrepreneur's contribution

The total cost of the proposed technology is estimated at ₹ 0.53 lakh. The entrepreneur's contribution is 25% of total project cost, which is ₹ 0.14 lakh.

4.2.2 Loan amount

The term loan is 75% of the total project, which is ₹ 0.39 lakh.

4.2.3 Subsidy by Government

As the overall energy efficiency in the project is more than 15% therefore it qualifies for subsidy of 25% of the project cost as per the NMCP scheme of Ministry of MSME, GoI. 25% of the project cost in this case works out to ₹0.14 lakh. As the subsidy is normally available after implementation of the project the same has not been taken in the project cost and means of finance. On receipt of subsidy from Ministry of MSME, GoI through the nodal

agency the amount of subsidy is generally set off [reduced] from the loan outstanding by the lender bank. Availability of this subsidy will make the project economically more attractive

4.2.4 Terms & conditions of loan

The interest rate is considered at 10.00% which is SIDBI'S Lending rate for energy efficiency projects. The loan tenure is assumed 3 years and the moratorium period is 3 months.

4.3 Financial indicators

4.3.1 Cash flow analysis

Considering the above discussed assumptions, initial own funds (equity) required is ₹0.89 lakh.

4.3.2 Simple payback period

The total project cost of the proposed technology is ₹ 0.53 lakh and monetary savings due to reduction in wood consumption is ₹ 0.45 lakh and the simple payback period works out to be 1.18 years (14 months).

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10.00% works out to be ₹ 0.55 lakh.

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 176.04 % thus the project is financially viable.

4.3.5 Return on investment (ROI)

The average return on investment of the project activity works out at 42.99 % for an investment of ₹ 0.53 lakh.

Table 4.2 Financial indicator of project

S. No	Particulars	Unit	Value
1	Simple Pay Back period	months	14
2	IRR	%age	176.04%
3	NPV	lakh	0.55
4	ROI	%age	42.99%
5	DSCR	ratio	2.88

4.4 Sensitivity analysis

A sensitivity analysis has been carried out to as certain how the project financials would behave in different situations like there is an increase in fuel savings or decrease in fuel savings. For the purpose of sensitive analysis, two scenarios are considered are.

- Increase in fuel savings by 5%
- Decrease in fuel savings by 5%

In each scenario, other inputs are assumed as constant. The financial indicators in each of the above situation are indicated along with standard indicators.

Table 4.3 Sensitivity analysis in different scenario

Particulars	*IRR*	*NPV*	*ROI*	*DSCR*
Normal	176.04	0.55	42.99	2.88
5% increase in fuel savings	176.04	0.60	43.33	3.02
5% decrease in fuel savings	176.04	0.49	42.61	2.73

As could be seen from the above table, though the project is highly sensitive to fuel savings, DSCR works out to be 2.73 times in worst scenario, which indicates the strength of the project.

4.5 Procurement and Implementation schedule

The project is expected to be completed in 2 weeks from the date of financial closure. The detailed schedule of project implementation is furnished in Annexure 6.

Annexure 1 Efficiency of the conventional chulha (Direct Method)

Unit 1: M/s Burgul Textiles:

Parameter	*Unit*	*Value*
Electricity consumption	kWh	1,08,040
Wood consumption	tonne	20
Production	kg	30,000

Efficiency Evaluation

Parameter	*Unit*	*Details*
Fuel used	--	Wood
Quantity of hot water generated	litre/day	350
Initial temperature of water	^{0}C	30
Final temperature of water	^{0}C	90
Quantity of wood consumption	kg/day	130
Calorific value of wood	kCal/kg	3,200
Heat input	kCal/day	16,000
Heat output	kCal/day	21,000
Efficiency	%age	5.04

Unit 2: M/s Chatla Textiles:

Parameter	*Unit*	*Value*
Electricity consumption	kWh	73,434
Wood consumption	Tonne	60
Production	kg	95,000

Efficiency Evaluation

Parameter	*Unit*	*Details*
Fuel used	-	Wood
Quantity of hot water generated	litre/day	1000
Initial temperature of water	^{0}C	30

Final temperature of water	^{0}C	80
Quantity of wood consumption	kg/day	250
Calorific value of wood	kCal/kg	3,200
Heat input	kCal/day	8,00,000
Heat output	kCal/day	50,000
Efficiency	%age	6.25

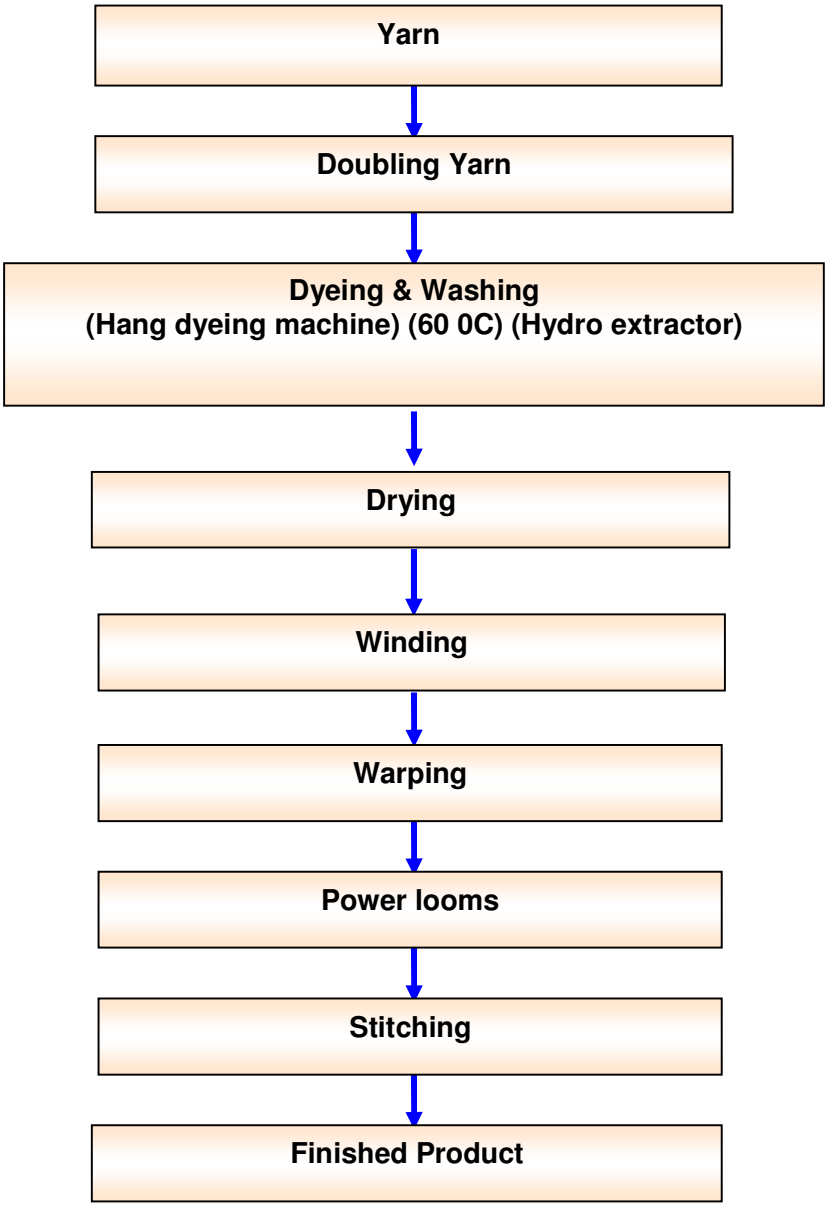
Unit 3: M/s Yemul Textiles

Parameter	*Unit*	*Value*
Electricity consumption	kWh	1,03,500
Wood consumption	Tonne	36
Production	kg	94,000

Efficiency Evaluation

Parameter	*Unit*	*Details*
Fuel used		Wood
Quantity of hot water generated	litre/day	600
Initial temperature of water	^{0}C	30
Final temperature of water	^{0}C	80
Quantity of wood consumption	kg/day	150
Calorific value of wood	kCal/kg	3,200
Heat input	kCal/day	4,80,000
Heat output	kCal/day	30,000
Efficiency	%age	6.25

Annexure 2 Process Flow Diagram



Annexure 3 Technology Assessment Report (Energy Efficient Chulha)

S.No	Particular	Unit	Value	
			Existing equipment	Proposed equipment
1	Operating hour	hrs	8	8
2	Operating days	days	240	240
3	Fuel Used	NA	Wood	Wood
4	Thermal Efficiency	%age	6.25	25-30
5	Firing control	NA	Manual	Manual
6	Calorific value of wood	kCal/kg	3200	3200
7	Wood consumption	Tonne/annum	36	18
8	Saving of wood consumption	Tonne		18
9	Cost of wood	₹ / Tonne	2500	2500
10	Monetary saving	₹ in lakh		0.45
11	Cost of project	₹ in lakh		0.53

Benefits of Energy Efficient chulha

- Easy to construct, operate and repair. Maintenance required is minimal too.
- Reduces processing time by more than 50% and hence increased production
- Reduces man hours for the same production and can be utilized for other purposes
- Improved chulha efficiency will be around 25 to 30% and thus reduces energy bill by more than 50% and enhances profitability of the company.
- Payback period is less than 2 years

Basis for Selection of Equipment

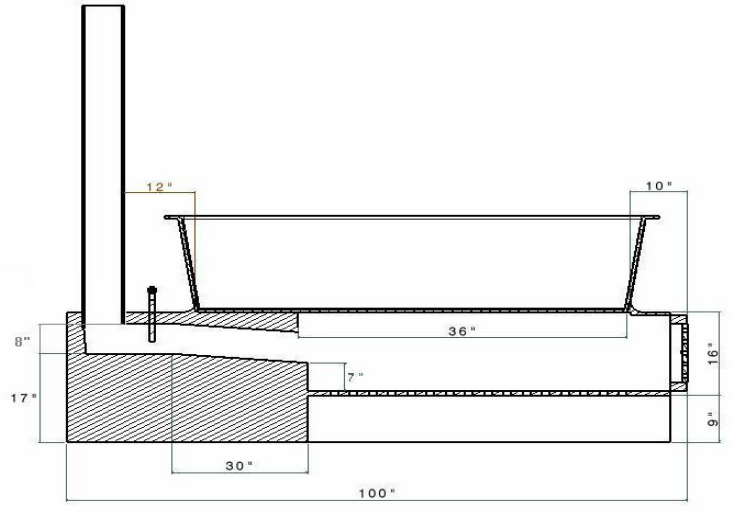
Quantity of hot water required

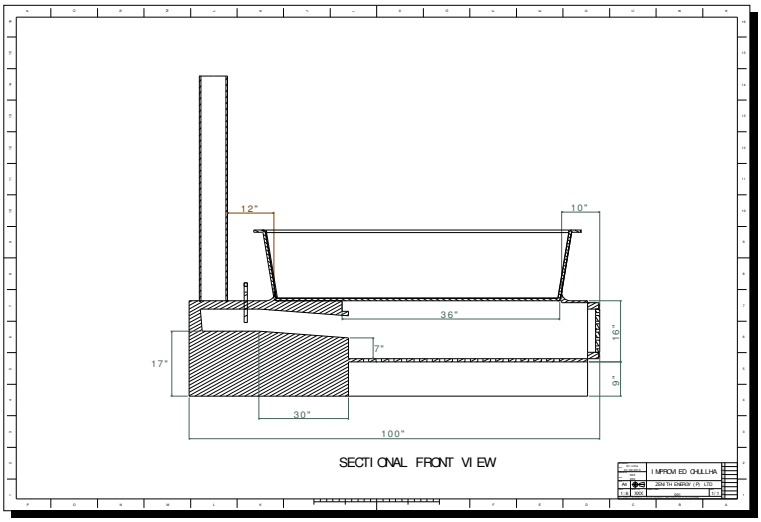
Temperature of hot water required for the process

Space availability

Cost Economics

Annexure 4 Electrical & civil work Drawings for proposed equipment





Annexure 5 Detailed financial analysis of Energy Efficient Chulha

Assumptions

Name of the Technology	***Energy Efficient Chulha***		
Rated Capacity	600 litre/day		
Detail	***Unit***	***Value***	
Installed Capacity	litre/day	600	Feasibility Study
No of working days	Days	240	Feasibility Study
No of Shifts per day	Shifts	1	Feasibility Study
Proposed Investment			
Plant & Machinery	₹ (in lakh)	0.36	Feasibility Study
Civil work	₹ (in lakh)	0.10	Feasibility Study
Investment without IDC	₹ (in lakh)	0.46	Feasibility Study
Interest During Implementation	₹ (in lakh)	0.01	Feasibility Study
Other charges(Contingency)	₹ (in lakh)	0.05	Feasibility Study
Total Investment	₹ (in lakh)	0.53	Feasibility Study
Financing pattern			
Own Funds (Internal Accruals)	₹ (in lakh)	0.13	Feasibility Study
Loan Funds (Term Loan)	₹ (in lakh)	0.39	Feasibility Study
Loan Tenure	Years	3	Assumed
Moratorium Period	Months	3	Assumed
Repayment Period	Months	42	Assumed
Interest Rate	%age	10	SIDBI'S Lending rate
Estimation of Costs			
O & M Costs	% Plant & Equip	4.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Wood savings	Tonne/year	18	-
Cost	₹/Tonne	2500	-
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax Act 2008-09

Estimation of Interest on Term Loan ***(₹ in lakh)***

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	0.39	0.09	0.30	0.03
2	0.30	0.12	0.18	0.02
3	0.18	0.15	0.03	0.01
4	0.03	0.03	0.00	0.00
		0.39		

WDV Depreciation:

Particulars / years	1	2	3
Plant and Machinery			
Cost	0.53	0.11	0.02
Depreciation	0.42	0.08	0.02
WDV	0.11	0.02	0.00

Projected Profitability

Particulars / Years	1	2	3	4	Total
Revenue through Savings					
Fuel savings	0.45	0.45	0.45	0.45	1.80
Total Revenue (A)	0.45	0.45	0.45	0.45	1.80
Expenses					
O & M Expenses	0.02	0.02	0.02	0.02	0.08
Total Expenses (B)	0.02	0.02	0.02	0.02	0.08
PBDIT (A)-(B)	0.43	0.43	0.43	0.43	1.72
Interest	0.03	0.02	0.01	0.00	0.07
PBDT	0.40	0.41	0.42	0.43	1.65
Depreciation	0.02	0.02	0.02	0.02	0.10
PBT	0.37	0.38	0.39	0.40	1.55
Income tax	-	0.11	0.14	0.15	0.39
Profit after tax (PAT)	0.37	0.27	0.26	0.26	1.16

Computation of Tax ***(₹ in lakh)***

Particulars / Years	1	2	3	4
Profit before tax	0.37	0.38	0.39	0.40
Add: Book depreciation	0.02	0.02	0.02	0.02
Less: WDV depreciation	0.42	0.08	0.02	-
Taxable profit	(0.02)	0.32	0.40	0.43
Income Tax	-	0.11	0.14	0.15

Projected Balance Sheet ***(₹ in lakh)***

Particulars / Years	1	2	3	4
Liabilities				
Share Capital (D)	0.13	0.13	0.13	0.13
Reserves & Surplus (E)	0.37	0.64	0.90	1.16
Term Loans (F)	0.30	0.18	0.03	0.00
Total Liabilities D)+(E)+(F)	0.81	0.96	1.07	1.29

Assets

Gross Fixed Assets	0.53	0.53	0.53	0.53
Less: Accm. Depreciation	0.02	0.05	0.07	0.10
Net Fixed Assets	0.50	0.48	0.45	0.43
Cash & Bank Balance	0.31	0.48	0.61	0.87
Total Assets	0.81	0.96	1.07	1.29
Net Worth	0.50	0.78	1.03	1.29
Debt Equity Ratio	0.60	0.24	0.03	0.00

Projected Cash Flow: ***(₹ in lakh)***

Particulars / Years	***0***	***1***	***2***	***3***	***4***
Sources					
Share Capital	0.13	-	-	-	-
Term Loan	0.39				
Profit After tax		0.37	0.27	0.26	0.26
Depreciation		0.02	0.02	0.02	0.02
Total Sources	0.53	0.40	0.30	0.28	0.28
Application					
Capital Expenditure	0.53				
Repayment of Loan	-	0.09	0.12	0.15	0.03
Total Application	0.53	0.09	0.12	0.15	0.03
Net Surplus	-	0.31	0.18	0.13	0.25
Add: Opening Balance	-	-	0.31	0.48	0.61
Closing Balance	-	0.31	0.48	0.61	0.87

Internal Rate of Return ***(₹ in lakh)***

Particulars / months	***0***	***1***	***2***	***3***	***4***
Profit after Tax		0.37	0.27	0.26	0.26
Depreciation		0.02	0.02	0.02	0.02
Interest on Term Loan		0.03	0.02	0.01	0.00
Salvage/Realizable value					
Cash outflow	(0.53)	-	-	-	-
Net Cash flow	(0.53)	0.43	0.32	0.29	0.28
IRR	176.04%				

NPV	0.55

Break Even Point ***(₹ in lakh)***

Particulars / Years	1	2	3	4
Variable Expenses				
Oper. & Maintenance Exp (75%)	0.01	0.01	0.02	0.02
Sub Total *(G)*	0.01	0.01	0.02	0.02
Fixed Expenses				
Oper.& Maintenance Exp (25%)	0.00	0.00	0.01	0.01
Interest on Term Loan	0.03	0.02	0.01	0.00
Depreciation *(H)*	0.02	0.02	0.02	0.02
Sub Total (I)	0.06	0.05	0.04	0.03
Sales (J)	0.45	0.45	0.45	0.45
Contribution (K)	0.44	0.44	0.43	0.43
Break Even Point (L= G/I)	14.41%	12.59%	9.85%	7.14%
Cash Break Even {(I)-(H)}	8.69%	6.87%	4.12%	1.40%
Break Even Sales (J)*(L)	0.06	0.06	0.04	0.03

Return on Investment ***(₹ in lakh)***

Particulars / Years	1	2	3	4	Total
Net Profit Before Taxes	0.37	0.38	0.39	0.40	1.55
Net Worth	0.50	0.78	1.03	1.29	3.60
					42.99%

Debt Service Coverage Ratio ***(₹ in lakh)***

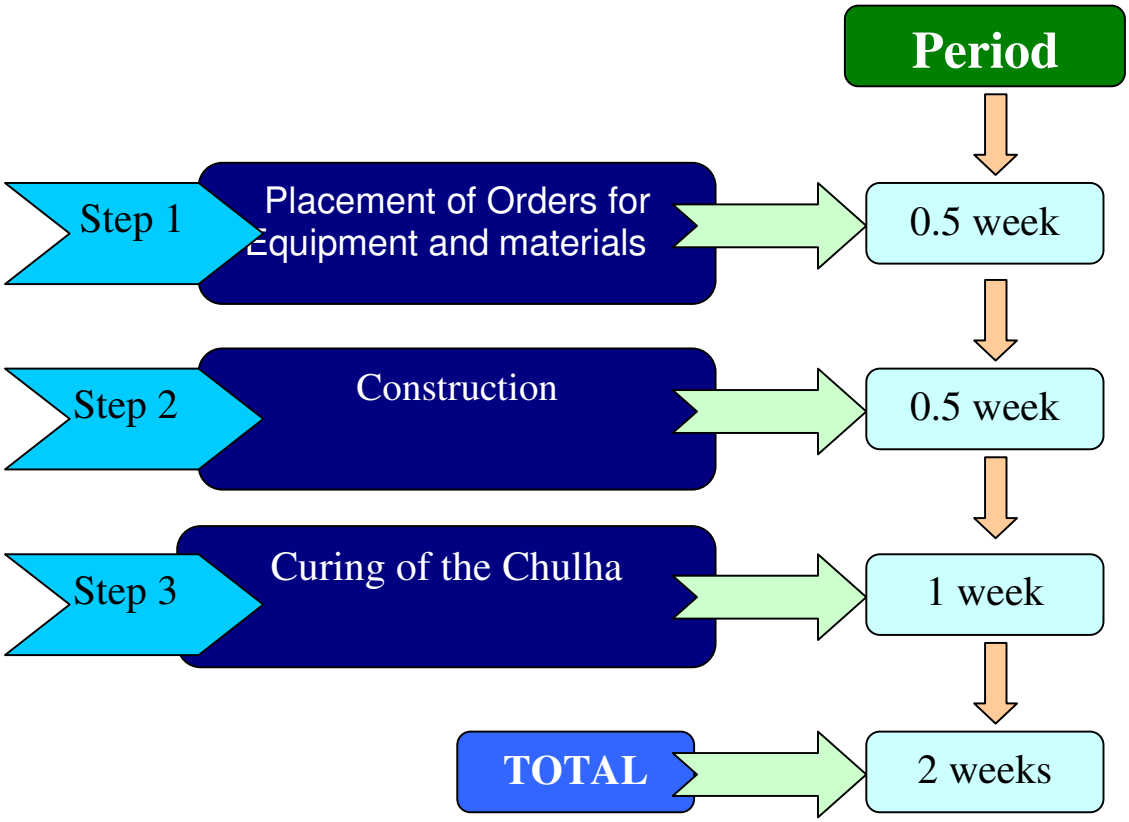
Particulars / Years	1	2	3	4	Total
Cash Inflow					
Profit after Tax	0.37	0.27	0.26	0.26	1.16
Depreciation	0.02	0.02	0.02	0.02	0.10
Interest on Term Loan	0.03	0.02	0.01	0.00	0.07
Total (M)	0.43	0.32	0.29	0.28	1.33

DEBT

Interest on Term Loan	0.03	0.02	0.01	0.00	0.07
Repayment of Term Loan	0.09	0.12	0.15	0.03	0.39
Total (N)	0.12	0.14	0.16	0.03	0.46
Average DSCR (M/N)	2.88				

Annexure 6 Details of procurement and implementation plan

Project Implementation Schedule



Annexure 7 Details of equipment and service providers

Name of company	**Zenith Energy Services Pvt Ltd**
Name of contact person	Dhanraj Mahal
Address of company	10-5-6/B, My Home Plaza, Masab Tank, Hyderabad 500 028
Contact no & Fax no	Ph.No. 040 23376630/31 9440234294

Annexure 8 Quotations of proposed equipment

RAMESH, MASONRY, SOLAPUR
Mobile: 09623412132

QUOTATION FOR IMPROVED CHULHA

Capacity of the Chulha	:	600 Ltrs/day
Output temperature	:	80-90 °C
Fuel Used	:	Wood

Details of bill of Materials & Cost

S.No	Material	Quantity (No's)	Rate (Rs)	Amount (Rs.)
1	Fire bricks	200	25	5000
2	Normal bricks	700	3	2100
3	Cement bags	5	300	1500
4	Fire brick cement (clay)	2	450	900
5	Iron bars	25	400	10000
6	Chimney (MS)	1	5000	5000
7	Door (MS)	1	3000	3000
8	Damper (MS)	1	1000	1000
9	Water tank (SS)*	1	10000	10000
10	Labour Charges		5000	5000
11	Miscellaneous Charges		1500	1500
	Total Amount			**45000**

Chimney Material : MS Steel
Water tank material : SS Steel
***Water tank specifications : 58 cm*36 cm*164 cm**

Terms of payment

-100% advance for the materials
- labour charges after completion

Ramesh
Authorised Signatory

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