DETAILED PROJECT REPORT
ON
FLUDISED BED DRYER (20 TPD)
(VELLORE RICE MILL CLUSTER)



Bureau of Energy Efficiency

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FLUIDISED BED DRYER
(CAPACITY – 20 TONS PER DAY)

VELLORE RICE MILLS CLUSTER

BEE, 2010

Detailed Project Report on Fluidized Bed Dryer (20 Tonne/Day)

Rice Mills SME Cluster, Vellore, Tamilnadu (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: **VEL/RM/EEB/03**

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Zenith Energy Services Pvt. Ltd.

Hyderabad

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List of Abbreviations

- BEE - Bureau of Energy Efficiency
- DPR - Detailed Project Report
- DSCR - Debt Service Coverage Ratio
- FD - Forced Draft
- GHG - Green House Gases
- HP - Horse Power
- IBR - Indian Boiler Regulation
- IRR - Internal Rate of Return
- ID - Induced Draft
- MSME - Micro Small and Medium Enterprises
- MoP - Ministry of Power
- MoMSME - Ministry of Micro Small and Medium Enterprises
- NPV - Net Present Value
- RBI PLR - Reserve Bank of India Prime Lending Rates
- ROI - Return On Investment
- SIDBI - Small Industrial Development Bank of India

EXECUTIVE SUMMARY

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

There are about 340 rice mills in the cluster spreaded in Arni in Thiruvannamalai District and Arcot in Vellore Districts. These rice mills are engaged in production of boiled, steam and raw rice. The major Energy forms used in the cluster are electricity and fuels like Firewood, GN Shell and Rice husk. Electricity is used for driving the prime movers of rice mill machinery such as paddy cleaners, rice graders, hullers, separators, whiteners, silky etc. The fuels are used in the boilers and dryers.

The cost of energy as a percentage of processing cost of paddy varies anywhere between 4-5%, which includes electrical as well as thermal. Majority of the rice mills in the cluster are producing ponni rice and require thermal energy in the form of steam and hot air.

There are about 340 rice milling units in the Vellore rice mills cluster. Majority of the rice mills are producing steamed and boiled rice. The rice mills are using natural drying and port dryers for drying the paddy. The natural drying is carried out for reducing the moisture content from 30% to 23% and then dried in port dryers. Natural drying of paddy is labour intensive process and costly due to high labour cost.

The new fluidized bed dryer reduces the moisture of parboiled paddy from 30%-9%. The fluidized bed paddy drying system offers several advantages over the conventional dryer in terms of lower utility consumption, reduction in broken rice, increase in equipment life and minimal maintenance.

Installation of proposed equipment i.e. new fluidized bed dryer of 20 Tonnes per day capacity would lead to save about 297 ton solid fuels (Wood) per year.

The DPR highlights the details of the study conducted for assessing the potential for reducing fuel consumption by installing new fluidized bed dryer in various units of the cluster, possible fuel savings and its monetary benefit, availability of the technologies/design, local service providers, technical features and proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, and schedule of Project Implementation.

This bankable DPR also found eligible for subsidy scheme of MoMSME for “Technology and Quality Upgradation Support to Micro, Small and Medium Enterprises” under “National Manufacturing and Competitiveness Programme”. The key indicators of the DPR including the

Project cost, debt equity ratio, monetary benefit and other necessary parameters are given in table below:

S.No	Particular	Unit	Value
1	Project cost	`(in Lakh)	34.85
2	Fuel Savings	Tons/annum	297
3	Monetary benefit	` (in Lakh)	12.05
4	Simple payback period	Years	2.89
5	NPV	` (in Lakh)	11.40
6	IRR	%age	19.37
7	ROI	%age	24.68
8	Average DSCR	Ratio	1.49
9	CO_2 reduction	Ton/annum	478
10	Process down time	Days	5

The projected profitability and cash flow statements indicate that the project implementation i.e. installation of new fluidized bed dryer will be financially viable and technically feasible solution for the cluster units.

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Programme to improve the energy performance in 29 selected SMEs clusters. Vellore Rice Mills 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:

Activity 1: 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.

Activity 2: 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 of energy efficiency projects in the clusters

Activity 3: Implementation of energy efficiency measures

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

Activity 4: 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

1.1 Brief Introduction about cluster

Rice is the staple food of majority of Indians and specifically in Southern Indian. Paddy is the one major crop cultivated in the Southern states especially in the state of Tamilnadu. The Rice comes out of milling of paddy. Hence rice milling is an important activity in the state.

Rice mills are the lifeline for the economic development of rural India. The rice mills are generally located in the rural areas and near to paddy growing area.

There are about 340 rice mills in the cluster spreaded in Arni in Tiruvannamalai District and Arcot in Vellore Districts. These rice mills are engaged in production of boiled, steam and raw rice. The major Energy forms used in the cluster are Electricity and Fuels like Firewood, GN Shell and Rice husk. Electricity is used for driving the prime movers of rice mill machinery such as screeners, paddy cleaners, rice graders, hullers, separators, whiteners, cones etc. The fuels are used in the boilers and dryers.

The cost of energy as a percentage of processing cost of paddy varies anywhere between 4 to 5% of the cost of paddy, which includes electrical as well as thermal. Majority of the rice mills in the cluster are producing ponni rice and require thermal energy in the form of steam and hot air.

1.1.1 Production process

The milling process in larger commercial mills combines a number of operations that produces higher quality and higher yields of rice from paddy. The process involves:

Soaking, Cooking and Drying

The raw paddy procured is directly feeded to the tanks and soaked in normal water for about 12 hours. After completion of the soaking process, the water is drained from the tanks. Then the soaked paddy is cooked by direct injection of steam to the paddy. The cooked paddy is then dried by using natural sunlight or bed dryer for reducing the moisture content from 24 to 18%. The paddy containing moisture content of 18% is dried in the hot air dryer for about 16 to 18 hours and the final moisture content is reduced to 8.5 to 9.0% and then the paddy is taken to the raw mill for further processing.

Pre-cleaning

When paddy comes into the mill it contains foreign material such as straw, weed seeds, soil and other inert material. If this is not removed prior to hulling the efficiency of the huller and the milling recovery are reduced.

Most pre-cleaners separate three groups of materials:

- The first separation is done by scalping or removing the objects that are larger than the grain. Either a flat oscillating screen or a rotary drum screen that allows the grain to pass through but retains straw can do this.
- The second separation retains the grains but allows broken grains, small stones and weed seeds to pass through. An air aspirator may also be incorporated to remove the dust and the light empty grains

Huller

The objective of a hulling/dehusking operation is to remove the husk from the paddy grain with a minimum of damage to the bran layer and, if possible, without breaking the brown rice grain. Since, the structure of the paddy grain makes it necessary to apply friction to the grain surface to remove the husk; it leads to breaking of some of the rice.

The paddy is fed into the center of the machine through a small hopper. A vertically adjustable cylindrical sleeve regulates the capacity and equal distribution of the paddy over the entire surface of the rotating disc, paddy is forced between the two discs and as a result of pressure and friction most of the paddy is dehusked (hulled).

Whitening, polishing & Silky

In the process of whitening, the silver skin and the bran layer of the brown rice are removed. During polishing of the whitened rice, the bran particles still sticking to the surface of the rice are removed and the surface of the rice is slightly polished to give it a glazed appearance. For further whitening if required as per the market demand or for export market, the polished rice is further processed in the silky machine for additional polishing.

Rice grader

After polishing, the white rice is separated into head rice and, large and small broken rice by a sifter. Head rice is normally classified as kernels, which are 75-80% or more of a whole kernel. The sifter is made up of a series of oscillating or cylindrical screens through which the rice passes. The output from the bottom screen is the very fine broken tips and is called the “brewers”.

Elevators

The elevator buckets are made of MS material. Due to heavy weight of the buckets, the elevator motors consume more power.

The detailed process flow diagram of the unit is furnished below.

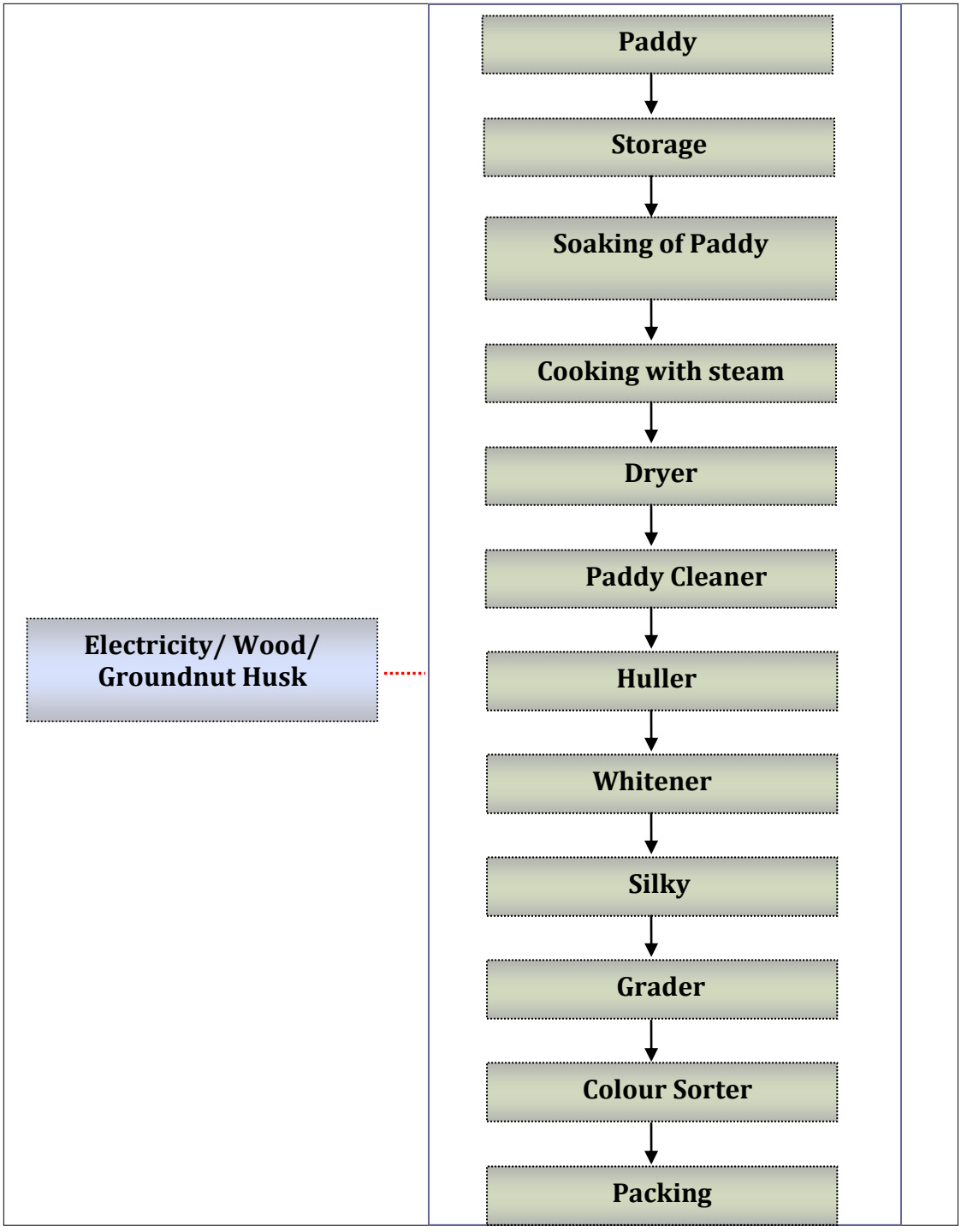


Figure 1: General Process Flowchart of a typical unit

1.2 Energy performance in existing situation

1.2.1 Fuels and electricity consumption

The main energy forms used in a typical rice mill of the cluster are electricity, rice husk, wood

and GN husk. Electricity is used for driving the prime movers of rice mill machinery like fans, paddy cleaner, separator, grader, whitener, huller, silky, sortex and air compressors, lighting etc. Rice husk, GN husk and wood are used as fuels in boiler and hot air dryer. The energy consumption of a typical rice mill in the cluster adopting natural drying to reduce the moisture content from 30% to 23% and production capacity of the unit is 20 TPD is furnished in Table 1.1 below:

Table 1.1: Energy consumption of a typical unit (MVS Modern Rice Mill)

S.No.	Details	Unit	Value
1	Coconut husk	Tonnes/annum	264
2	Grid Electricity consumption	kWh/annum	1,46,940
3	***Wood Consumption***	***Tonnes/annum***	***990***
4	Paddy processing (330 days)	Tonnes/annum	4,950

1.2.2 Average production by a typical unit in the cluster

The average production in a year in a typical rice mill of the cluster is 4,950 tonnes/annum of paddy processing.

1.2.3 Specific Energy Consumption

The specific energy consumption both electrical and thermal energy per tonne of paddy processing are furnished in Table 1.2 below:

Table 1.2: Specific energy consumption for a typical unit (MVS Modern Rice Mill)

S. No.	Type of Fuel	Units	Specific Energy Consumption
1	Coconut husk Consumption	Tonne/ Tonne of production	0.05
2	Grid Electricity consumption	kWh/ Tonne of production	29.68
3	Wood consumption	Tonne/ Tonne of production	0.2

1.3 Existing technology/equipment

1.3.1 Description of existing technology

There are about 340 rice milling units in the Vellore rice mills cluster. Majority of the rice mills are producing steamed and boiled rice. The rice mills are using natural drying and port dryers for drying the paddy. The natural drying is carried out for reducing the moisture content from 30% to 23% and then dried in port dryers. The natural drying of paddy is labour intensive and

hence more production cost.

The detailed energy use and technology audit studies in various rice mills of the cluster, it was observed that the natural drying of paddy is costly due to high labour cost and intensity. The labour cost for natural drying in different rice mils of the cluster were evaluated.

The following disadvantages were identified for natural drying of paddy:

- High production cost due to more labour intensive
- Prone dust and other unwanted materials
- Likely chances of product getting damaged during rainy and un even climatic conditions
- Poor paddy quality

From the above mentioned analysis it is clear that the performance of the existing system of natural drying is costly and results in poor quality. Based on above facts, the present natural drying is to be replaced with fluidized bed dryer for reducing the production cost.

1.3.2 Technical specification of existing system

The natural drying is carried out for reducing the moisture content from 30% to 23% and then for further reduction in port dryers are used. Details of port dryer specification are shown in Table 1.3 below:

Table 1.3: Specification of port dryer

S. No.	Parameters	Details
1	Make	Local make (No Name plate)
2	Capacity	270 bags/day (75 kg/bag)
3	Fuel consumption	3.0 tonnes/18 hours
4	Blower capacity	20 HP

1.3.2 Its role in the whole process

The natural drying and port dryers are one of the important process steps for the rice milling industry and are used for drying the paddy after cooking of the paddy with steam. The moisture content is reduced from 30% to 23% by natural drying and from 23% to 9% is carried out in port dryers. The thermal energy in the form of hot air is used for drying the paddy. There are very few units, where the steam is used in dryers for drying paddy.

1.4 Establishing the baseline

1.4.1 Design and operating parameters

The paddy is dried under natural conditions and port dryers. The port dryer is fabricated locally and doesn't have name plate details. The capacity of the port dryer is 20 tons/Day and wood is used as fuel. The batch time is 18 hours and the temperature is maintained at 80 ^{o}C throughout the drying process.

1.4.2 Fuel Consumption

The major types of fuels used in the dryers are wood. The average fuel consumption for 20 tonnes batch is 3000 kgs. The fuel consumption and labour cost for natural drying for typical unit in the Cluster is furnished table 1.4 below:

Table 1.4 Fuel Consumption and Efficiency of three typical rice mill units

S. No	Name of the unit	Dryer Capacity (Tons/batch)	Fuel consumption (Kgs/batch)	Fuel cost (`/batch)	Labour cost (`/batch)	Total Cost (`/batch)
1	Murthy Modern Rice Mill	20	3000	7500	2000	9500

1.5 Barriers for adoption of new and energy efficient technology / equipment

1.5.1 Technological Barriers

The major technical barriers that prevented the implementation of new system are:

- Lack of awareness and information among the technologies available in the market.
- Dependence on local equipment suppliers for uninterrupted service and hence adopting low end inefficient technologies
- The majority of the owners do not have knowledge or technical expertise and hence adopting in efficient technologies which are locally available
- The lack of technical know-how made it impossible for the owners to identify the most effective technical measures.
- Distrust on technology suppliers and decisions are taken based on successful stories in the cluster units

1.5.2 Financial Barrier

- Lack of awareness of the losses and monetary benefit of new system

- The majority of the unit owners have a feeling that the accruable benefits are more investing in the trading or purchasing of the paddy than in investing in energy efficiency.
- The unit owner in the cluster doesn't approach for the loans, as they have strong feeling that getting loans requires huge documentation and complex.

1.5.3 Skilled manpower

Not applicable

1.5.4 Other barrier(s)

Information on the energy efficient technologies not available among cluster unit owners, though the suppliers are available locally, the information was not disseminated among cluster units.

2 Technology/equipment option for energy efficiency improvements

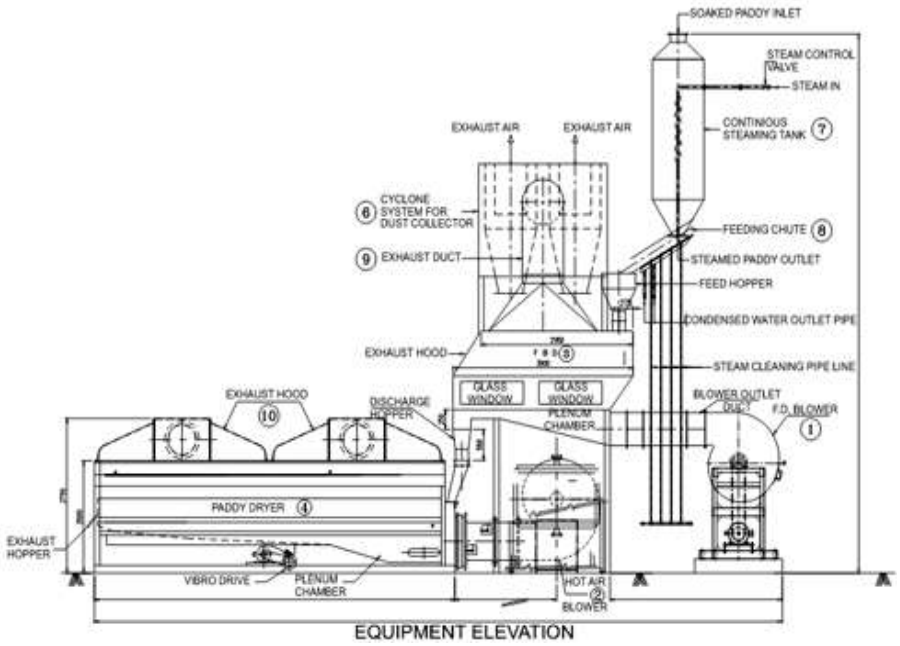
2.1 Detailed description of technology/equipment selected

2.1.1 Description of technology

The project activity is replacement of natural drying and inefficient port dryer with new energy efficient fluidized bed dryer. The new dryer will reduce labour cost and also reduces overall drying cost. The newly designed and manufactured a new Dryer for Pre-Drying of Paddy before LSU Dryer. The new Dryer reduces the moisture of parboiled paddy from 30% to 9%. The fluidized bed paddy drying system offers several advantages over the conventional dryer in terms of lower utility consumption, reduction in broken rice, increase in equipment life and minimal maintenance.

The cleaned and steamed paddy is soaked in the soaking tank at required temperatures for a desired duration. After removal of water from the soaking tank, the soaked paddy is passed through Kilburn continuous steaming vessel for proper gelatinization to ensure minimum breakage of grain. The steaming vessel is provided with controlled feed and discharge mechanism to optimize gelatinization. This steamed paddy at 36% inlet moisture is continuously fed into a Static Fluid Bed Dryer at a uniform feed rate where the surface moisture is instantly removed.

There after the paddy at 32% moisture is fed into first vibrating fluid bed dryer, where the paddy is kept in suspended stage and the moisture is reduced to 22%. This paddy at 22% moisture is fed into second fluid bed dryer where the moisture is reduced to 16% and is then fed into third fluid bed dryer where the moisture is further reduced to 12 to 14%. However, in case of Basmati Rice, the moisture is reduced to 22% using the static and first Vibro Fluid Bed Dryer and further drying is carried out in LSU dryer up to 12%. The static and vibratory fluid bed dryers are supplied complete with inlet air fan, steam heater and exhaust system.



EQUIPMENT ELEVATION

Comparison of present drying system with fluidized bed dryer

The technical, economical, environmental and safety aspects of the present drying system and fluidized bed dryer are presented in table below:

Table -2.1: Comparison of Natural drying/port drying with Fluidized Bed Dryer

S. No	Details	Natural Drying and Port Dryer	Fluidized Bed Dryer
			
1	Fuel consumption	High	Low
	Paddy Processing Cost	High	Low
2	Environment pollution	High (due to more fuel consumption)	Low
3	Quality of paddy	Poor	Good
4	Production	High	Low
5	Operational cost	High	Low
6	Availability of local service providers	NA	Yes in Chennai

2.1.2 Technology/equipment specifications

Technical specification of new Fluidized Bed Dryer (FBD) is furnished in Table 2.2 below:

Table 2.2: Technical specification of new FBD

S. No	Parameters	Unit	Value
1	Material handle	---	Wet paddy
2	Feed rate	kg/hr	5000
3	Inlet moisture	%age	36
4	Outlet moisture	%age	18-20
5	Evaporating load	Kg/hr	1400
6	Hot air temperature	^{0}C	120
7	Heating media(Saturated steam)	Bar g	7-8
8	Forced draft fan*	kW	30
9	Excitation system*	kW	7.4
10	Exhaust system*	kW	11.2

**Combined load (VFBD Moisture remove from 36 – 22 & VFBD-2 Moisture remove from 22% to 16%)*

2.1.3 Justification of the technology selected & its suitability

The present system of paddy drying is costly due to more labour intensive and also low efficiency of port drying. Replacing the present drying system with new fluidized bed dryer will overall drying cost of paddy due to reduction in labour cost and better efficiency of the fluidized bed dryer than the present port dryer.

2.1.4 Superiority over existing technology/equipment

The new fluidized bed dryer is superior over the existing drying system for the following:

- longer life of equipment
- Higher level of production
- Uniform moisture removal
- Improved quality of rice
- Minimum Breakage
- No color variation
- Saving in steam / husk
- Max. moisture reduction from 36% to 16%

- Single pass Drying
- Negligible maintenance cost / down time
- Minimum operating cost as compared to conventional system.
- Shortest payback period

2.1.5 Availability of the proposed technology/equipment

The detail of the fluidized bed dryer suppliers is provided in Annexure 7.

2.1.6 Source of technology/equipment for the project

The technology is locally available in Chennai, which is 120 km from Arni.

2.1.7 Service/technology providers

The service providers are available in Chennai

2.1.8 Terms of sales

A complete detail of term of sale such as performance guarantee, scope of supply, delivery payments etc. are given at the Annexure 8.

2.1.9 Process down time

The installation of fluidized bed dryer requires necessary civil foundations, chimney, electrical cabling, ducting, etc. the actual process down time for implementation of new fluidized bed dryer is five days and its break ups is given in Annexure 6.

2.2 Life cycle assessment and risks analysis

The life of the fluidized bed dryer is considered at 20 years.

2.3 Suitable unit in terms of capacity/production

The present production capacity of the rice mil is 15 tonnes per day and the same production capacity for the fluidized bed dryer is considered. Also, proposed system is suitable for 20 TPD capacity.

3 ECONOMIC BENEFITS OF NEW ENERGY EFFICIENT TECHNOLOGY

3.1 Technical benefits

3.1.1 Fuel savings per year

Based on the detailed studies carried out in a typical rice mill of the cluster, the average wood

consumption in port dryer was 990 tonnes per annum and average wood consumption in new fluidized bed drying system would be about 693 tonnes per year viz. a viz. existing production capacity. Further labours cost also gets reduce in significant quantity.

Though the connected load is high for FBD dryer than the present port dryer, the no. of hours of operation of FBD dryer is only 8 to 12 hours and where as in port dryers, the hours of operation is varies from 12 to 16 hours depending on the final moisture content. Hence, there will not be increase in power consumption of the FBD dryers.

3.1.2 Improvement in product quality

There is no significant impact on product quality.

3.1.3 Increase in production

The drying of paddy for reducing moisture content from 30% to 23% by natural drying takes about 12 hours to 24 hours and drying of paddy in fluidized bed dryer takes less time and hence the production will improve.

3.1.4 Reduction in raw material consumption

No significant impact on the raw materials consumption.

3.1.5 Reduction in other losses

Not applicable

3.2 Monetary benefits

The monetary benefit due to installation of new FBD is estimated ` 12.05 lakh per annum due to reduction in fuel consumption as well as labors cost. Details of total monetary benefit calculation are given at Annexure 4.

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

The replacement of natural drying and present in efficient dryer with fluidized bed dryer will avoids labors working under open atmosphere and hence will improve the work condition and environment.

3.3.2 Improvement in skill set of workers

The technology 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 technology implemented will create awareness among the workforce and improves the skill.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

No impact on effluents generation due to implementation of project activity.

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

The project activity uses wood as fuel, which will save about 478 tonne of CO_2 emission annually.

3.4.3 Reduction in other emissions like Sox

The project activity i.e., installation of new dryer reduces wood consumption and hence no significant impact on SO_x emissions.

4 INSTALLATION OF NEW EQUIPMENT

4.1 Cost of technology/equipment implementation

4.1.1 Cost of technology/equipments

The total cost of the fluidized bed dryer is estimated at ` 34.35 lakh(including taxes), which includes dryer, fabrication, motors and blowers, electrical works and control panel with temperature controllers as quotation provided at Annexure 8.

4.1.2 Other costs

Other cost includes cost of fabrication (and/or) commissioning charges and details of project cost are given in Table 4.1 below:

Table 4.1 Details of Project Cost

S.No.	Details	Cost (` in lakh)
1	Cost of fluidized bed dryer	34.35
2	Civil, Erection and Commissioning	0.50
5	Total Investment	34.85

4.2 Arrangement of funds

4.2.1 Entrepreneur's contribution

The entrepreneur's contribution is 25% of total project cost, which works out at ` 8.71 lakh.

4.2.2 Loan amount

The term loan is 75% of the total project cost, which is ` 26.16 lakhs.

4.2.3 Terms & conditions of loan

The interest rate is considered at 10.0% which is prevailing interest rate of SIDBI for energy efficient projects. The loan tenure is 5 years and the moratorium period is 6 months.

4.3 Financial indicators

4.3.1 Cash flow analysis

Considering the above discussed assumptions, the net cash accruals starting with ` 6.23 lakh in the first year operation and increases to ` 31.98 lakh at the end of eighth year.

4.3.2 Simple payback period

The total project cost of the proposed technology is ` 34.85 lakh and monetary savings due to

reduction in fuel consumption is ` 12.05 lakh and the simple payback period works out to be 2.89 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10.00% interest rate works out to be ` 11.40 lakh

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 19.37%. 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 24.68%. The average DSCR is 1.49.

4.4 Sensitivity analysis in realistic, pessimistic and optimistic scenarios

A sensitivity analysis has been worked out to ascertain how the project financials would behave in different situations like there is an increase in fuel savings or decrease. 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.

Particulars	IRR %	NPV	ROI	DSCR
Normal	19.37%	11.40	24.68%	1.49
5% decrease in fuel savings	20.49%	12.82	24.88%	1.54
5% increase in fuel savings	18.25%	9.98	24.47%	1.45

4.5 Procurement and implementation schedule

The project is expected to be completed in 8 weeks from the date of financial closure. The detailed schedule of project implementation is furnished in Annexure 6.

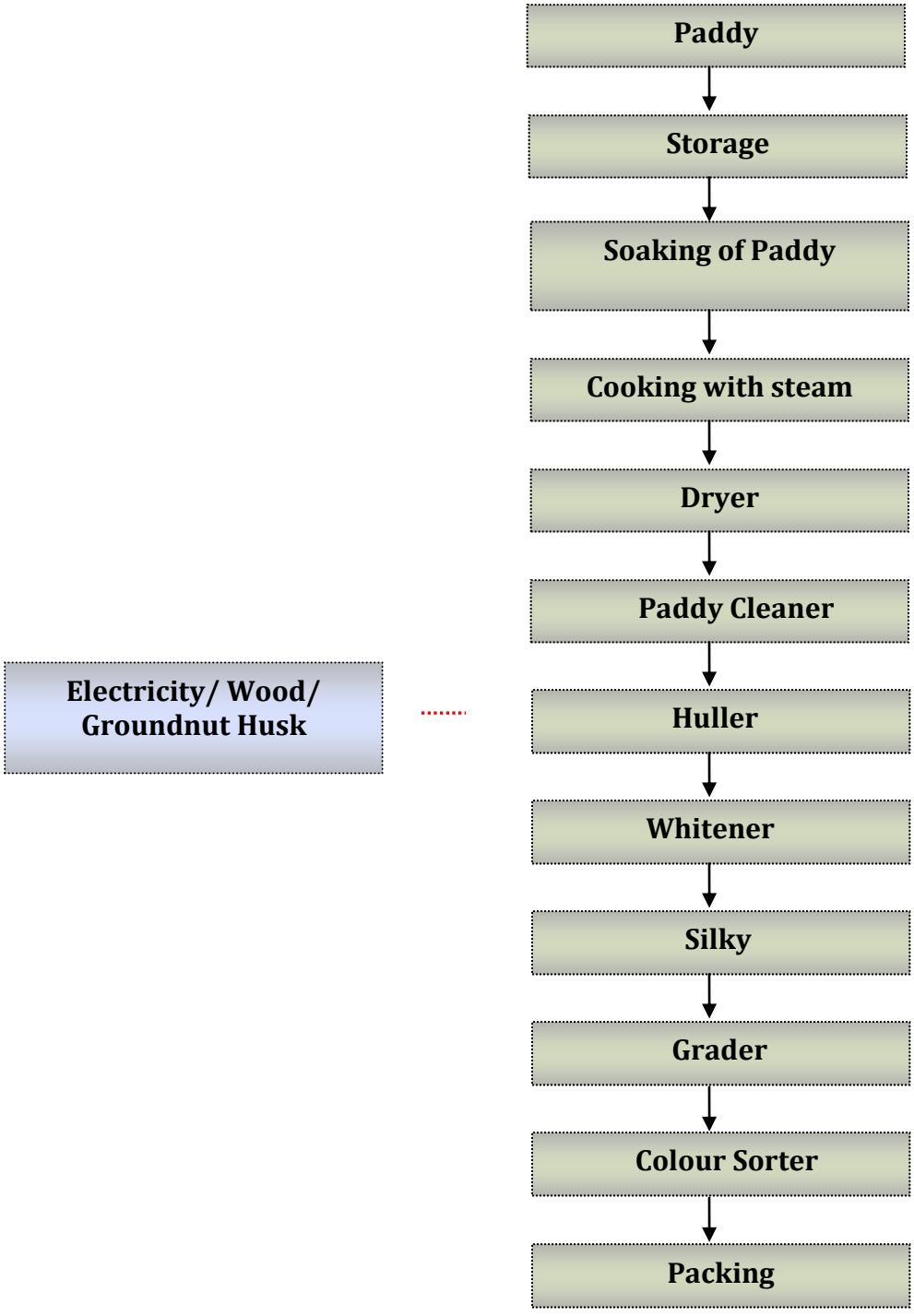
Annexure 1: Port dryer in three Typical Rice Mills

Murthy Modern Rice Mill

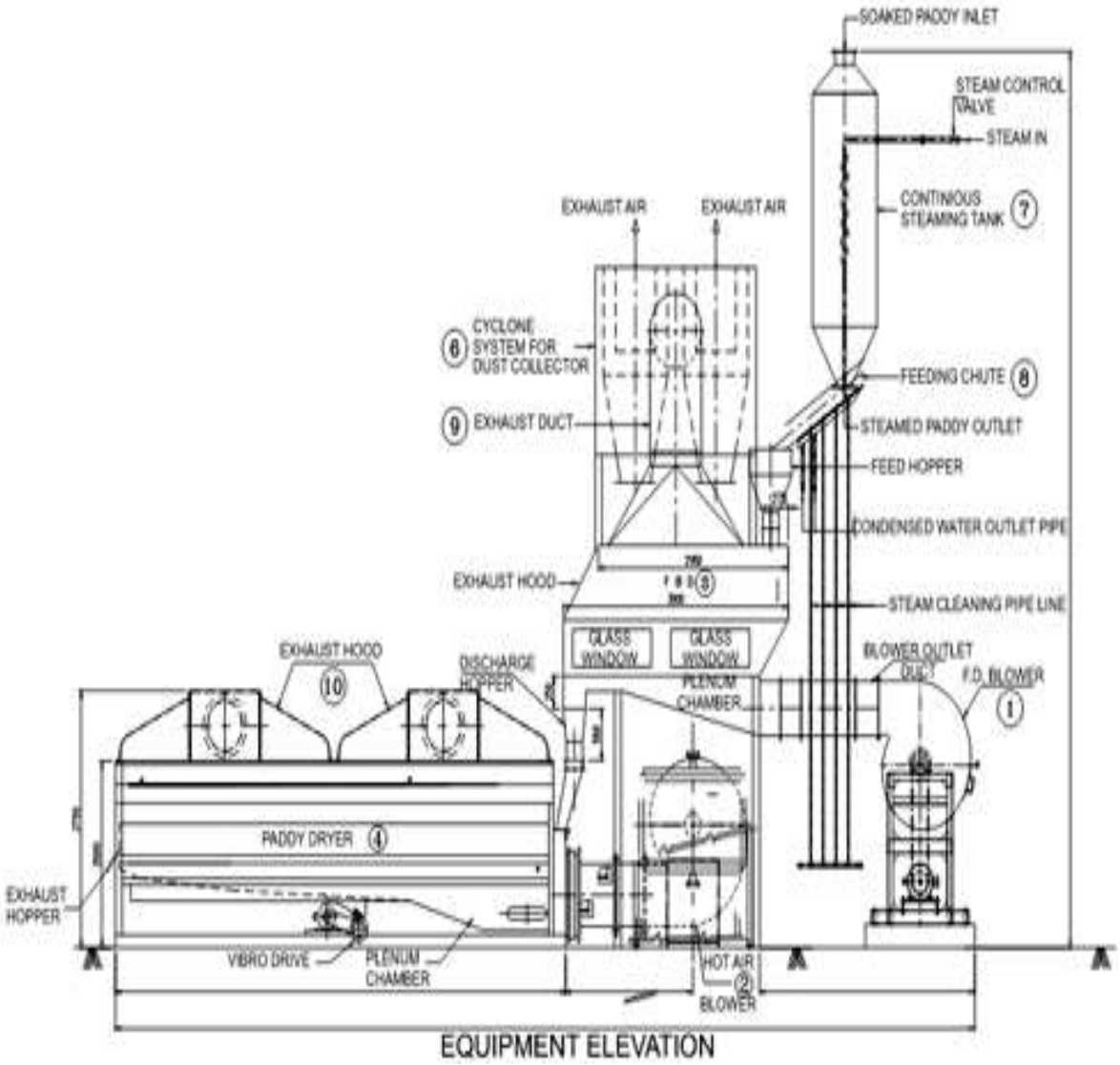
Name of the unit	Murthy Modern Rice Mill
Drying Capacity(Tonnes/Daych `	20 TPD
Fuel used	wood
Fuel consumption (kgs/batch)	3000 kg per batch
Fuel Cost (` per tonne)	`2500
Temperature maintained	115 ^{o}C
Labors required	10 @ ` 200/day
Total labour cost per day in `	2000
Total Wood cost per day in `	7500
Average cost per batch `/batch	9500
Annual production cost `	3135000

Annexure 2 Process flow diagram

Process flow diagram is same even after implementation of new equipment



Annexure 3 Drawings for proposed civil works required



EQUIPMENT ELEVATION

Annexure 4 Detailed technical assessment report

Parameters	*Present Technology*	*Proposed Technology*
Wood Consumption:	3.0 tonne per batch	2.1 tonne per batch
Operating Hours	18	12 (4hoursx3cycles=1batch)
Average flow of Wood required	167 kg/hour	175 kg/hour
Wood Consumption:	990 tons/annum	693 tonnes/annum
Cost of wood	`2500/tonne	`2500/tonne
Manpower required	10 nos per day	3 nos per day
Labour cost/days	` 200	` 200
No. of days	330 days	330 days
Total Labour cost/annum	` 6.60 lakh	` 1.98 lakh
Present wood cost bill	` 24.75 lakh	` 17.33lakh
Total operating cost	` 31.35 lakh	` 19.31lakh
Reduction in wood cost bill		` 7.43 lakh
Reduction in labors cost		` 4.62 lakh
Total monetary benefit		` 12.05 lakh
Total investment		` 34.85 lakh
Simple payback period		2.89years
Proposed dryer capacity		5 TPH / 20 TPD

Assessment based on actual measurement

*****Flow rate of wood is almost same on both the dryers but time varies according to moisture removal. Cycle time decreases in bed dryer because the heat transfer rate is better than port dryer. And according to the FBD manufacturer in 3TPH FBD the cycle repeats twice. In first cycle, moisture reduction of 34% to 22% and in second cycle 22% to 16% and third cycle will reduce moisture about 16% to 12%.***

Present case 3.0 tonnes of wood required for running port dryer in 18 hours.

Proposed case 2.1 tonnes of wood required for running bed dryer in 12 hours = (5tph*4hrs)* 3 cycles

Annexure 5 Detailed financial calculations & analysis

Assumption

Name of the Technology	**FLUDISED BED DRYER**		
Rated Capacity	**20 TPD**		
Details	***Unit***	***Value***	***Basis***
Installed Capacity	Tonnes/Day	20	
No of working days	Days	330	Feasibility Study
No of operating hours	hours	12	4hrs*3cycles=1batch
Proposed Investment			
Fludised Bed Dryer	` (in lakh)	34.35	
Civil works and Electrical works	` (in lakh)	0.50	
Total Investment	` (in lakh)	34.85	
Financing pattern			
Own Funds (Equity)	` (in lakh)	8.71	
Loan Funds (Term Loan)	` (in lakh)	26.14	
Loan Tenure	years	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%age	10.00%	SIDBI Lending rate
Estimation of Costs			
O & M Costs	% on Plant & Equip	4.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Wood saving	tons/annum	297	
Cost	`/tons	2500	
Others	`/tons(Lakhs)	4.62	
St. line Depn.	%age	5.28	Indian Companies Act
IT Depreciation	%age	80.00	Income Tax Rules
Income Tax	%age	33.99	Income Tax

Estimation of Interest on Term Loan

` (in lakh)

Years	***Opening Balance***	***Repayment***	***Closing Balance***	***Interest***
1	26.14	2.10	24.04	3.01
2	24.04	4.20	19.84	2.21
3	19.84	4.80	15.04	1.77
4	15.04	5.40	9.64	1.27
5	9.64	6.20	3.44	0.69
6	3.44	3.44	0.00	0.10
		26.14		

WDV Depreciation **` (in lakh)**

Particulars / years	***1***	***2***
Plant and Machinery		
Cost	34.85	6.97
Depreciation	27.88	5.58
WDV	6.97	1.39

Projected Profitability **` (in lakh)**

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Fuel savings	12.05	12.05	12.05	12.05	12.05	12.05	12.05	12.05
Total Revenue (A)	12.05	12.05	12.05	12.05	12.05	12.05	12.05	12.05
Expenses								
O & M Expenses	0.70	0.72	0.75	0.78	0.82	0.85	0.88	0.92
Total Expenses (B)	0.70	0.72	0.75	0.78	0.82	0.85	0.88	0.92
PBDIT (A)-(B)	11.35	11.32	11.29	11.26	11.23	11.20	11.16	11.13
Interest	3.01	2.21	1.77	1.27	0.69	0.10	-	-
PBDT	8.33	9.11	9.53	9.99	10.54	11.09	11.16	11.13
Depreciation	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
PBT	6.49	7.27	7.69	8.15	8.70	9.25	9.32	9.29
Income tax	-	1.20	3.24	3.39	3.58	3.77	3.79	3.78
Profit after tax (PAT)	6.49	6.07	4.45	4.75	5.12	5.48	5.53	5.51

Computation of Tax **` (in lakh)**

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Profit before tax	6.49	7.27	7.69	8.15	8.70	9.25	9.32	9.29
Add: Book depreciation	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
Less: WDV depreciation	27.88	5.58	-	-	-	-	-	-
Taxable profit	(19.55)	3.53	9.53	9.99	10.54	11.09	11.16	11.13
Income Tax	-	1.20	3.24	3.39	3.58	3.77	3.79	3.78

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

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Liabilities								
Share Capital (D)	8.71	8.71	8.71	8.71	8.71	8.71	8.71	8.71
Reserves & Surplus (E)	6.49	12.56	17.01	21.76	26.88	32.36	37.89	43.40
Term Loans (F)	24.04	19.84	15.04	9.64	3.44	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	39.24	41.11	40.76	40.11	39.03	41.07	46.60	52.11

Assets	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Gross Fixed Assets	34.85	34.85	34.85	34.85	34.85	34.85	34.85	34.85
Less Accm. Depreciation	1.84	3.68	5.52	7.36	9.20	11.04	12.88	14.72
Net Fixed Assets	33.01	31.17	29.33	27.49	25.65	23.81	21.97	20.13
Cash & Bank Balance	6.23	9.94	11.43	12.62	13.38	17.26	24.63	31.98
TOTAL ASSETS	39.24	41.11	40.76	40.11	39.03	41.07	46.60	52.11
Net Worth	15.21	21.27	25.72	30.47	35.59	41.07	46.60	52.11
Debt Equity Ratio	2.76	2.28	1.73	1.11	0.39	0.00	0.00	0.00

Projected Cash Flow

` (in lakh)

Particulars / Years	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Sources									
Share Capital	8.71	-	-	-	-	-	-	-	-
Term Loan	26.14								
Profit After tax		6.49	6.07	4.45	4.75	5.12	5.48	5.53	5.51
Depreciation		1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
Total Sources	34.85	8.33	7.91	6.29	6.59	6.96	7.32	7.37	7.35

Application									
Capital Expenditure	34.85								
Repayment Of Loan	-	2.10	4.20	4.80	5.40	6.20	3.44	-	-
Total Application	34.85	2.10	4.20	4.80	5.40	6.20	3.44	-	-
Net Surplus	-	6.23	3.71	1.49	1.19	0.76	3.88	7.37	7.35
Add: Opening Balance	-	-	6.23	9.94	11.43	12.62	13.38	17.26	24.63
Closing Balance	-	6.23	9.94	11.43	12.62	13.38	17.26	24.63	31.98

IRR **` (in lakh)**

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Profit after Tax		6.49	6.07	4.45	4.75	5.12	5.48	5.53	5.51
Depreciation		1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
Interest on Term Loan		3.01	2.21	1.77	1.27	0.69	0.10	-	-
Cash outflow	(34.85)	-	-	-	-	-	-	-	-
Net Cash flow	(34.85)	11.35	10.12	8.05	7.87	7.65	7.43	7.37	7.35
IRR	19.37 %								

NPV	11.40

Break Even Point **` (in lakh)**

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.52	0.54	0.57	0.59	0.61	0.64	0.66	0.69
Sub Total*(G)*	0.52	0.54	0.57	0.59	0.61	0.64	0.66	0.69
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.17	0.18	0.19	0.20	0.20	0.21	0.22	0.23
Interest on Term Loan	3.01	2.21	1.77	1.27	0.69	0.10	0.00	0.00
Depreciation *(H)*	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
Sub Total (I)	5.03	4.23	3.79	3.31	2.73	2.16	2.06	2.07
Sales (J)	12.05	12.05	12.05	12.05	12.05	12.05	12.05	12.05
Contribution (K)	11.52	11.50	11.48	11.46	11.43	11.41	11.38	11.36
Break Even Point (L= G/I)	43.64%	36.81%	33.05%	28.88%	23.90%	18.89%	18.10%	18.22%
Cash Break Even {(I)-(H)}	27.67%	20.81%	17.02%	12.82%	7.81%	2.76%	1.94%	2.02%
Break Even Sales (J)*(L)	5.26	4.43	3.98	3.48	2.88	2.28	2.18	2.19

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

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***Total***
Net Profit Before Taxes	6.49	7.27	7.69	8.15	8.70	9.25	9.32	9.29	66.16
Net Worth	15.21	21.27	25.72	30.47	35.59	41.07	46.60	52.11	268.05
									24.68%

Debt Service Coverage Ratio

` (in lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***Total***
Cash Inflow									
Profit after Tax	6.49	6.07	4.45	4.75	5.12	5.48	5.53	5.51	32.36
Depreciation	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84	11.04
Interest on Term Loan	3.01	2.21	1.77	1.27	0.69	0.10	0.00	0.00	9.06
Total (M)	11.35	10.12	8.05	7.87	7.65	7.43	7.37	7.35	52.46

DEBT

Interest on Term Loan	3.01	2.21	1.77	1.27	0.69	0.10	0.00	0.00	9.06
Repayment of Term Loan	2.10	4.20	4.80	5.40	6.20	3.44	0.00	0.00	26.14
Total (N)	5.11	6.41	6.57	6.67	6.89	3.54	0.00	0.00	35.20
	2.22	1.58	1.23	1.18	1.11	2.10	0.00	0.00	1.49
Average DSCR (M/N)	1.49								

Annexure 6 Details of procurement and implementation schedule

Project Implementation Schedule

Details of procurement and implementation –FBD

S. No	Activity	Weeks				
		1 - 2	2 - 4	4 - 6	6 - 8	8 - 10
1	Collection of quotations and order finalization					
2	Designing by the supplier as per the requirement					
3	Fabrication at the equipment supplier workshop					
4	Delivery					
5	Commissioning , Trial runs and Insulation					

Break up of process down time.

S. No.	*Activities*	*Days*				
		1	*2*	*3*	*4*	*5*
1	Necessary civil foundations					
2	chimney, electrical cabling, ducting, etc.					
3	Commissioning, & Trial Insulation					

Annexure 7 Details of technology/equipment and service providers

Equipment details	Source of technology	Service/technology providers
Energy Efficient FBD	Indigenous	Kilburn Engineering Limited **M**112, Minerva Industrial Estate, P K Road, Mulund(West) Mumbai – 400080 Phone Number 022 – 25936200/07799221112 Fax Number 022-25917580/7554

Annexure 8 Quotations or Techno-commercial bids

Kilburn Engineering Limited

Regd. Office : Four Mangoe Lane, 3rd Floor, Surendra Mohan Ghosh Sarani, Kolkata - 700 001, India
Phone : (91) 33 2231 3337 / 3450, 4003 5154 / 55, Fax : (91) 33 2231 4768
E-mail : kilbncal@cal2.vsnl.net.in, Web : www.kilburnengg.com

Offer No.: KEL/S/Paddy/0102
Date: 10.01.2011

Zenith Energy Services (P) Limited
10-5-6/B, My Home Plaza, Masab Tank,
Hyderabad - 500 028
Andhra Pradesh, India
Mobile: 9440234294

Kind attn.: Mr. Krishna

Sub: Your requirement for Parboiled Paddy drying system
Capacity – **5 T/Hr.** (Moisture reduction from **36% to 18%**)

Dear Sir,

With reference to the above, we are pleased to submit our offer for Parboiled Paddy drying system (1 no. VFBD) having input capacity of **5 T/hr**. (Moisture reduction of 36% to 18%)) as per the enclosed Technical Specification as under:

	Capacity of dryer
Particulars	**5 Tons / hr.**
Cost of 1 no. paddy drying system (1 no. VFBD). (Price is Ex works Taloja). (P&F, Freight & CST would be extra as mentioned in Terms and Conditioned enclosed with this offer).	Rs.30.00 Lacs

We hope the offer is in line with your requirement.

We now look forward to receive your valued order which on receipt will receive our most prompt attention.

Our all other Terms & Conditions are enclosed for your ready reference.

Thanking you & assuring you of our best attention at all times.

Yours faithfully,
FOR KILBURN ENGINEERING LTD,

TRIPAL MESHRAM
+91 7799 221112
tripal@kilburnengg.com

Encl: Terms and Conditions

Page 1

Terms and Conditions:

1. **Price**: Ex-works Taloja, Distt – Raigad (Maharashtra).
2. **Packing & Forwarding** @ 4.5% of our Ex-works value.
3. **Freight** : To Pay basis
4. **Central Sales Tax / VAT:** Extra at Actual as application at the time of dispatch. Presently the value of VAT is 12.50 %. & CST is 2Y. against form 'c'.
5. **Octroi**: Will be borne by you, if charged at the destination.
6. **Transit Insurance**: Shall be charged extra @ 1 % of Ex-works value, if to be arranged by us.
7. **Delivery:** 16-18 weeks from the date of receipt of order along with advance.
8. **Terms of Payment**: 60% advance along with order and balance against Proforma Invoice prior to dispatch. However, the payment terms can be discussed during final negotiation.
9. **Validity:** 30 days from the date hereof & thereafter subject to our confirmation in writing.
10. **Cancellation & Termination of Order** : In case you desire to cancel / terminate an order for any reasons whatsoever, the cancellation shall be subject to just and adequate compensation to KEL for quantum of work done and commitments made till the receipt of notice / agreement for cancellation. KEL shall not be liable / responsible for any consequential damages / claims. The termination fee equals to 20 % of the order value shall be payable over and above the compensation claim, if an order is cancelled for any reason not attributable to KEL.

Any changes in duties ruling at the time of dispatch shall be applicable.

KILBURN VIBRO FLUID BED DRYER

TECHNICAL SPECIFICATIONS

OF

KILBURN PADDY DRYER

MODEL - 5 T

1.	Material Handled	:	Wet Paddy
2.	Feed Rate	:	5000 Kg./Hr.
		:	175 Kg./Hr. Wood
3.	INLET MOISTURE CONTENT OF PADDY OF PADDY		
	After soaking and steaming	:	36% (Wet basis)
4.	OUTLET MOISTURE CONTENT AFTER THIRD PADDY DRYER	:	12 - 14 % (Wet basis)
5.	TOTAL EVAPORATION LOAD	:	1400 kg/hr.
6.	AIR TEMPERATURE IN VARIOUS ZONES (°C)	:	120 / 80 / 70
7.	HEATING MEDIA	:	STEAM (Saturated steam at 7 - 8 bar g)
7.	MOTOR DETAILS (Installed power in KW)	:	
	VFBD - 1 (Moisture reduction from 34% - 22%)		- Forced Draft Fan : 15 KW - Excitation System : 3.7 KW - Exhaust System : 5.6 KW
	VFBD - 2 (Moisture reduction from 22% - 16%)		- Forced Draft Fan : 15 KW - Excitation System : 3.7 KW - Exhaust System : 5.6 KW
	VFBD - 3 (Moisture reduction from 16% - 12%)		- Forced Draft Fan : 15 KW - Excitation System : 3.7 KW - Exhaust System : 5.6 KW

****

Bureau of Energy Efficiency (BEE)
(Ministry of Power, Government of India)
4th Floor, Sewa Bhawan, R. K. Puram, New Delhi – 110066
Ph.: +91 – 11 – 26179699 (5 Lines), Fax: +91 – 11 – 26178352
Websites: www.bee-india.nic.in, www.energymanagertraining.com

Zenith Energy Services Pvt. Ltd
10-5-6/B, My Home Plaza, Masab
Tank HYDERABAD, AP 500 028
Phone: 040 23376630, 31,
Fax No.040 23322517
Website: www.zenithenergy.com

India SME Technology Services Ltd
DFC Building, Plot No.37-38,
D-Block, Pankha Road,
Institutional Area, Janakpuri, New Delhi-110058
Tel: +91-11-28525534, Fax: +91-11-28525535
Website: www.techsmall.com