EE WATER PUMP FOR COOLER MAIN DRIVE -20 HP

ORISSA SPONGE IRON CLUSTER

BEE, 2010

Detailed Project Report on EE Water Pump – 20 HP

Sponge Iron SME Cluster, Rourkela, Orissa (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No.: **SPONGE/PUMP/01**

For more information

Bureau of Energy Efficiency (BEE)

(Ministry of Power, Government of India)

4th Floor, Sewa Bhawan

R. K. Puram, New Delhi – 110066

Telephone +91-11-26179699

Fax+91-11-26178352

Websites: www.bee-india.nic.in

Email: jsood@beenet.in/ pktiwari@beenet.in

Acknowledgement

APITCO Limited places on record its sincere gratitude to Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India for giving us opportunity for implementation of energy efficiency improvement at Sponge Iron Manufacturing Cluster, Orissa" under BEE-SME Program. We express our gratitude to the below mentioned BEE officials for their support and guidance for successful completion of cluster manual.

Dr. Ajay Mathur - Director General
Smt. Abha Shukla - Secretary
Shri Jitendra Sood - Energy Economist
Shri Pawan Kumar Tiwari – Advisor (SME)
Shri Gaurav Kumar - Project Engineer
Shri Rajeev Kumar Yadav – Project Economist

APITCO Limited is also thankful to "Orissa Sponge Iron Manufacturers Welfare Association (OSIMA)", for their valuable inputs, cooperation, support and identification of the units for Energy use and technology audit studies and in preparation of cluster manual

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. 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.

We assure you, always, of our best services.

[V Ramchander]

Managing Director

Contents

List of Annexure

List of Table

List of Figures

I. LISTS OF ABBREVATIONS

- BEE - Bureau of Energy Efficiency
- DPR - Detailed Project Report
- DSCR - Debt Service Coverage Ratio
- GHG - Green House Gases
- HP - Horse Power
- IRR - Internal Rate of Return
- MoP - Ministry of Power
- MoSME - Micro Small and Medium Enterprises
- NPV - Net Present Value
- ROI - Return On Investment
- SIDBI - Small Industrial Development Bank of India
- SME - Small and Medium Enterprises

EXECUTIVE SUMMARY

APITCO Ltd. is executing the BEE-SME program in Orissa Sponge Iron Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Orissa State is renowned for Sponge iron manufacturing business and is a big hub for sponge iron supply. There are about 107 sponge iron units in cluster and majority of industries located in Sundargarh District area and engaged in production of sponge iron.

The major Energy consumption in sponge Iron cluster is of thermal energy which is derived from coal and electrical energy from which is used from grid. Electricity is used for supplying energy for motor driven drives like kiln main drive, cooler main drive, crushers, bag filters, pumps, ESPs etc. and lighting purpose which are essential during the operation of sponge Iron plants. If the percentage share of the total energy consumption is considered then the electrical is not more than 2% where as the remaining 98% is the thermal energy requirement. HSD is used as fuel in DG sets for generation of electricity during the power failure from Electricity board.

In Sponge Iron plants, it is observed Cooled water is supplied to the Cooler main drive to cool the finished product from sponge Iron Plant. The cooled water pumped from the sedimentation tank and this water is re circulated. Some make up water is added to the sump due to evaporation during the cooling and heat transfer. The water pumping to the cooler main drive is continuously operation during the process.

The installed water pumps efficiency is very low due to higher temperature, dirty water and rated efficiency of the pump and motor. Now a days Energy efficient pumps are available in market from few manufacturers with higher temperature and dirty water applications.

By Installation of EE Water pump in the sponge iron plant for the use of Cool water supply to the cooler main drive can save 7603 kWh per year for 12 hours operation and 300 days per year.

The DPR highlights the details of study conducted for assessing the potential for reducing electrical Energy Consumption during operation by installing EE Water Pumps in cooler Main Drive in various units in the cluster, possible energy 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.

Total investment required and financial indicators calculated such as debt equity ratio, monetary saving, IRR, NPV, DSCR and ROI etc for proposed technology is furnished in Table below:

S. No.	Particular	Unit	Value
1	Project cost	(in Lakh)	0.70
2	Energy Savings	kWh/Year	7603
3	Monetary benefit	(in Lakh)	0.27
4	Simple payback period	Years	2.57
5	NPV	(in Lakh)	0.42
6	IRR	%age	26.51
7	ROI	%age	25.83
8	Average DSCR	Ratio	2.27

The projected profitability and cash flow statements indicate that the project i.e. EE Water Pump for cooler main drive will be financially viable and technically feasible solution for the cluster.

ABOUT BEE'S SME PROGRAM

Bureau of Energy Efficiency (BEE) is implementing a BEE-SME Program to improve the energy performance in 29 selected SMEs clusters. Bhimavaram Ice Making Units Cluster is one of them. The BEE's SME Program 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

Rourkela is one of a town in Sundargarh District in Orissa state, India. It is located 413 kilometers East of state capital, Bhubaneswar. Sundargarh is renowned for the Sponge Iron business. They even export the finished product to various countries throughout the world. There are about 107 sponge iron industries are established and majority of industries are located in near by area of Rourkela.

The major Energy consumption in Sponge Iron cluster is thermal energy which is from coal and electricity from State Grid. Electricity is used for driving the prime movers used in the plants i.e. Kiln main drive, Cooler Kiln main, air compressors, pumps, and other drives and even for lighting purpose. The majority of energy share is in the form of thermal energy (98%) which is burning the coal and remaining is by the electrical energy.

1.1.1 Production process

The process of sponge iron manufacturing involves removal of oxygen from iron ore. Sponge Iron also called as Direct-Reduced Iron (DRI) is produced from direct reduction of iron ore (in the form of lumps, pellets or fines) by a reducing gas using fuel i.e. natural gas or coal. The reducing gas is a mixture majority of Hydrogen (H2) and Carbon Monoxide (CO) which acts as reducing agent. This process of directly reducing the iron ore in solid form by reducing gases is called direct reduction. In this process coal will be used for producing reducer gas and the process will be carried out in a Horizontal Rotary Kiln. The finished product i.e. sponge Iron observed under a microscope, resembles a honeycomb structure, which looks spongy in texture. Hence the name is called sponge iron.

The reduction of Iron Ore can be achieved by using either carbon bearing material, such as non-coking coal or a suitable reducing gas in the form of reformed natural gas. The processes employing coal are known as solid-reluctant of coal-based processes while those employing reducing gases are known as gas-based processes.

The basic reactions in this process are as follows:

$$C + O2 = CO2$$
$$CO2 + C = 2CO$$
$$Fe2O3 + CO = Fe2O3 + CO2$$
$$Fe3O4 + CO = FeO + CO2$$
$$FeO + CO = Fe + CO2$$

Process

Non-coking coal and iron ore along with limestone in the required size range and quantity are continuously fed into the feed – end of the inclined rotary kiln through a feed pipe. The materials move along the length of the kiln due to its inclination and rotation. Air is blown in through required number of air tubes suitably located along the length of the kiln. At the feed-end of the kiln air is blown in through nozzles for drying and pre heating of the charge. Initial heating of the kiln is carried through a central oil burner located at the discharge feed end. As the charge moves through the kiln, it is heated by the hot gases, which flow in the opposite direction to the charge (i.e. counter current flow). The initial part of the kiln (about 30%) is called the pre heating zone, where moisture in the charge and volatiles in the coal are removed / burnt off as waste gases. The required heat in this zone is provided by the combustion of the feed coal. The remaining portion of the kiln is called as the reduction zone. In this zone, oxygen in the iron ore is removed leaving metallic iron as per the following chemical reaction.

3FeO3 + CO --------------------→ 2 Fe204 + CO2

Fe2O4 + CO --------------------→ 3FeO + CO2

FeO + CO --------------------→ Fe + CO2

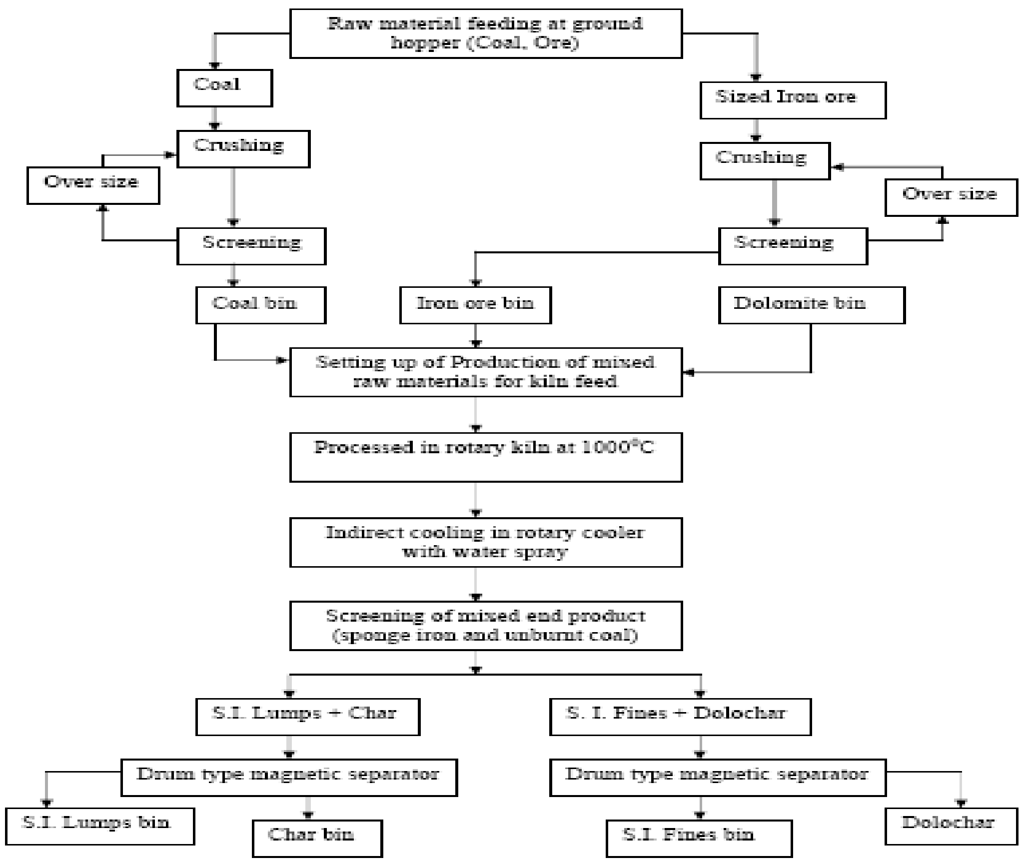
The CO is generated for the above reaction according to CO2 + C --→ 2CO, at temperature above 900 deg. C, carbon monoxide will combine with the oxygen in the iron ore forming carbon dioxide and thus reduce the ore to metallic state.

Higher the temperature, the faster would be the oxygen removal. After the removal of oxygen and grater is the metallization of sponge iron. Metallization levels can roughly be checked by density of the sponge iron. It can also be judged by the metallic luster if a sample is rubbed against a rough surface.

After the iron ore has been metallic to the desired level, sponge iron and residual char are discharged from the kiln into a rotary drum type cooler. In the cooler sponge iron is cooled to below 250 deg. C before the material is discharged on to a belt conveyor. If the sponge iron were exposed to air at high temperatures (i.e. above 250 deg C) it would tend to re oxidize. It is therefore, necessary that the temperature of the product at the point of discharge from the cooler is as close as possible to the ambient temperature. The reduction process occurs in solid state. The crucial factor in this reduction process is the controlled combustion of coal and its conversion to carbon monoxide to remove oxygen from the iron ore.

The overall process extends to a period of 10 to 12 hours inside the kiln. During this time, iron ore is optimally reduced and the hot reduced sponge iron along with semi-burnt coal is discharged to a rotary cooler for indirect cooling to a temperature of around 120°C. Sponge iron being magnetic in nature, the discharge from cooler main drive consisting of sponge iron, chars & other contaminations are routed through electromagnetic separators, to separate other impurities from sponge iron. The product is then screened in size fractions of lump (+3mm) and fines (0-3 mm). Separate bins are installed to preserve its quality, reduce re oxidation and facilitate faster loading on to the trucks. Detailed of process flow chart are finished in Figure 1.1 below:

Figure 1.1: General process flowchart of a typical Sponge Iron Plant



1.2 Energy performance in existing situation

1.2.1 Fuel and electricity consumption of a typical unit in the cluster

The main energy used in a typical sponge iron industry is thermal energy derived from coal and rest is electrical energy from grid supply. Electricity is used for drive the prime movers like kiln drives, compressors, pumps, Bag filters, Crushers, FD and ID fans etc.

and also for lighting. The details of different types energy consumption typical units in the cluster are presented below in Table 1.1 :

Table 1.1: Energy consumption of typical units have 100 TPD kiln

S. No	Name of Industries	TPD	Annual Production	Electricity consumption (millions of kWh/Yr)	Coal Consumption (Tons/annum)
1	Bajrang Ispat Limited	100	29900	2.89	40210
2	Maa Tarani Industries Private Ltd	100	27400	3.47	36848
3	Meta Sponge Private Limited	100	26400	3.25	35503
4	Pavan jay Sponge Limited	100	27200	3.14	36579
5	Shri Balaji Metallics Pvt Ltd	100	28900	3.48	38533
6	Utkal Metallic Limited	100	25689	3.12	34547

1.2.2 Average production by a typical unit in the cluster

The average production in sponge iron unit is depends on the no of kilns installed and each kiln Capacity. A single 100 TPD kiln production varies in between 29000 to25000 tons per annum depending upon the duration of campaign period per year and raw material quality.

1.2.3 Specific Energy Consumption

In sponge iron plants, both thermal and electrical energy are required to produce sponge iron from Iron Ore. The major share of energy is in the form of thermal energy (97%) and remaining 3% is electrical energy.

1.3 Existing technology/equipment

1.3.1 Description of existing technology

There are about 2 water pumps for each cooler main drive for supply of cool water from the sedimentation tank. One pump is operated for 10-12 hrs continuously and another one is operated remaining time during the process. The pumps are mono block, horizontal and split case type used in the industries. The temperature of water from the cooler main drive after heat transfer is higher than the supplied cool water and the water is dirty in nature. The detailed studies undertaken in various units of the cluster, the efficiency of the pumps is found to be in the range of 35 to 45% only due to rated efficiency is low and further the temperature of water is high and also the out put of water from kiln main drive is dirty. Further, the output of the pumps deteriorates fast due to above reasons and hence consuming more power. The existing pumps installed for cool water pumping to the cooler main drive are furnished in Table 1.2 below:

Table 1.3 Pump Specifications

S.No	Details	Unit	Cooler Main Drive Water Pump
1	Flow	LPS	54
2	Head	meters	60
3	Overall Efficiency of pump	%	41
4	Power Consumption	*kW*	15

1.3.2 Its role in the whole process

The Cool water is required to cool the raw material coming from the main drive by in direct heat transfer. The finished products i.e. Sponge Iron from the rotary kiln main drive having the temperature of 900-800C. The temperature of the sponge Iron from main drive passed to cooler main drive for further reduction of product temperature i.e. 120 C by supplying the cool water in top of the cooler main drive by indirect cooling. Thus water pumps are required to pass the cool water in the cooler main drive for cool the sponge iron from 900-120 C.

1.4 Establishing the baseline for the equipment to be changed

1.4.1 Design and operating parameters power consumption per year

The present power consumption of a water pumps for cooling applications is 15 kW. There are two same rated capacity of pumps are used for pumping the cool water and operated one pump is for 12 hrs and second one is stand by.

1.4.2 Electricity consumption

The electricity consumption of various Cooler main drive water pumps in Sponge Iron cluster is furnished in table 1.3 below

Table 1.3 Unit wise – pumps efficiency in three typical units in the cluster

S. No	Name of Industries	TPD	Production (MT/Yr)	Cooler drive water pump (kWh /Year)
1	Bajrang Ispat Limited	100	29900	54000
2	Maa Tarani Industries Private Ltd	100	27400	51769

3	Meta Sponge Private Limited	100	26400	53052

1.4.2 Operating efficiency of the existing pumps

The detailed energy audits studies had been undertaken in various units of the cluster to evaluate the pump efficiencies for cooler main drive water pumps. The operating efficiency of the present pumps is found to be in the range of 35% to 45% only. The details of operating efficiency calculations of various pumps installed in a typical unit are furnished in annexure

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

1.5.1 Technological Barriers

The major technical barriers that prevented to implementation the Raw material pre heating system in the cluster are:

- Lack of awareness of Raw material pre heating system
- Lack of information on technology providers
- Some of the bigger plants are installed the raw material pre heating system but is not working due to technical problems. Due to this doubt on technology, many kiln operators are not installed.

1.5.2 Financial Barrier

Implementation of Raw material pre heating system in Sponge Iron manufacturing requires higher investment. Hence, many owners don't show interest due to high initial investment. Further, lack of awareness on successful of raw material pre heating in sponge iron plants also one of the major factors for implementing the technology.

Energy Efficiency Financing Schemes such as SIDBI's, if focused on the cluster, will play a catalytic role in implementation of identified energy conservation projects & technologies. The cluster has significant potential for implementing the raw material pre heating system.

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 of energy efficient pumps, 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 existing Water pump with new energy efficient pumps. The new pumps will have overall efficiency of 60%. The efficient pumps will have critically designed impellers, volute, eye and casing for higher temperature and dirty water applications. The impeller is of SS material and are resistant to corrosion and scale formation. In Sponge Iron Manufacturing Cluster, Orissa the pumps installed have efficiencies in the range of 35 % to 45% only due to inferior design of pumps and mismatch selection and application.

Considering the above facts and for reducing electricity consumption of cool water pumping to the cooler main drive, it is suggested to install energy efficient pumps. The details technical specification of energy efficient pumps is provided in section 1.4.2.

2.1.2 Technology /Equipment specifications

The detailed specifications of the pump suggested is furnished in table 2.1

Table 2.1: Pump Specifications

S. No.	*Parameter*	*Unit*	*Detail*
1	Pump Type	Name	Mono Block-Horizontal-Split Case
2	Discharge	m3/hr	54
3	Head	M	60
4	Motor	Name	SIMENS
5	Speed	Rpm	2910
6	Overall of Efficiency of pump	%	68.5

2.1.3 Justification of the technology selected & Suitability

The Cooler main drive pumps are one of major energy consuming equipment in sponge Iron plants due to continuous operation during the process. The detailed energy audits conducted for various pumps installed in cooler main drive applications, the efficiency of the pumps are found to be in the range of 35 % to 45%. Whereas, the new energy efficient pumps will have overall efficiency of 68.5% for the same discharge and pressure of the existing pumps. The following are the reasons for selection of this technology

- Pumps are major energy consuming equipments in sponge Iron plants for cooler main drives
- The energy consumption by the pumps reduced and it will reduce the total operating energy cost of the plant.

- It reduces the GHG emissions

2.1.4 Superiority over existing technology/equipment

The new energy efficiency pumps are superior over the existing pumps for the following:

- Will have constant flow and pressure throughout the life of the pump
- Lower break downs due to special mechanical sealing
- Low operation and maintenance cost
- Life of the equipment is multifold than the present pumps
- Even work at higher temperature and dirty fluid applications

2.1.5 Availability of the proposed technology/equipment

The energy efficient pump suppliers are available in cluster and nearby Cities. Even the supplier has taken initiative and interacting with sponge Iron Plant owners for creating the awareness of use of energy efficient pumps. The details of the suppliers is provided in Annexure 6

2.1.6 Source of technology/equipment for the project

The energy efficient pumps were already implemented and in operation in most of the industrial applications and running successfully. The unit owners had realized the benefit of the energy efficient pumps if implemented in the units by achieving the energy savings.

2.1.7 Service/technology providers

Details of energy efficient pumps supplier located in the cluster had been furnished in Annexure -6.

2.1.8 Terms of sales

The terms and conditions of the equipment supplier for supply of energy efficient pumps are furnished in the quotation.

2.1.9 Process down time during implementation

The process down time for installation of energy efficient pump is considered at maximum seven days for dismantling the existing pump and installation of new pumps and providing electrical connections to the motor.

2.2 Life cycle assessment and risks analysis

The life of the Energy efficient pumps is considered at 15 years. There is no risk involved as the pumps are technology proven and are successfully in operation in other industries of the country.

2.3 Suitable unit/plant size in terms of capacity/production

The normal pump size required for the all 100 TPD Sponge Iron plants are 20 HP, 60 m head and 54 m3/hr capacity.

3. ECONOMIC BENEFITS OF NEW ENERGY EFFICIENT TECHNOLOGY

3.1 Technical benefits

3.1.1 Fuel savings per year

The project activity installation of energy efficient pumps will reduce electricity consumption and doesn't have any effect on fuel savings.

3.1.2 Electricity savings per year

The operating efficiency of new energy efficiency is more than the existing pumps and hence reduces electricity consumption. The power savings due to installation of new energy efficient pumps for cooler main drive is 2.11 kWh and annual saving is 7603 kWh.

3.1.3 Improvement in product quality

The product quality may improve, as the pump will give required flow and pressure, where as in present pumps; the pump parameters are not assured.

3.1.4 Improvement in production

There is no significant impact on production.

3.1.5 Reduction in raw material consumption

No significant impact on the raw materials consumption.

3.1.6 Reduction in other losses

There is no other reduction loss

3.2 Monetary benefits

The monetary benefit due to installation of new energy efficient pumps for cooler main drive is estimated as Rs. 0.27 lakhs per annum due to reduction in electricity consumption.

S. No.	Parameter	Unit	Value
1	Present electricity consumption	kWh/annum	54000
2	Energy saving due to installation of new energy efficient pump	kW	2.11
3	Electricity saving	kWh/annum	7603
4	Monetary saving @ Rs 3.60/kWh	Rs./annum (In lakh)	0.27

3.3 Social benefits

3.3.1 Improvement in working environment in the plant

The installation of new efficient pumps may lessen the breakdowns and leakages hence working environment may improve.

3.3.2 Improvement in skill set of workers

The technology selected for the implementation is new and energy efficient. The technology implemented will create awareness among the workforce and improves skills of the workers with respect to the energy efficient pumps.

3.4 Environmental benefits

3.4.1 Reduction in effluent generation

The project activity will reduce effluent generation, as with new pumps, the leakages may reduce.

3.4.2 Reduction in GHG emission such as CO2, NOx, etc

The major GHG emission reduction source is CO_2. The technology will reduce grid electricity consumption and CO_2 emission reductions due to implementation of the project activity.

3.4.3 Reduction in other emissions like SOx

No significant impact on SOx emissions.

4. INSTALLATION OF NEW ENERGY EFFICIENT TECHNOLOGY/EQUIPMENT

4.1 Cost of technology/equipment implementation

4.1.1 Cost of technology/equipments

The total cost for 20 HP pump is estimated at Rs.0.70 lakhs, which includes motor, pump and base coupling.

4.1.2 Other costs

Other charges include cabling and panel modification. Project cost details are furnished in Table 4.1 below:

Table 4.1: Project detail cost

S.No	*Particular*	*Unit*	*Value*
1	Pump, Motor and Base coupling	(Rs. in lakh)	0.70
2	Panel, switch & cabling, Elec. modifications etc	(Rs. in lakh)	0.01
3	Total Investment	(Rs. in lakh)	0.71

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 Rs. 0.18 lakhs.

4.2.2 Loan amount

The term loan is 75% of the total project, which is Rs.0.53 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 efficiency related projects. The loan tenure is 4.00 years

4.3 Financial indicators

4.3.1 Cash flow analysis

Considering the above discussed assumptions, the net cash accruals starting with Rs.0.16 lakhs in the first year operation and increases to Rs.0.36 at the end of fourth year.

4.3.2 Simple payback period

The total project cost of the proposed technology is Rs.0.71 lakhs and monetary savings due to reduction in electricity consumption is Rs. 0.27 lakhs and the simple payback period works out to be 2.57 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10.00 % interest rate works out to be Rs.0.02 lakhs

4.3.4 Internal rate of return (IRR)

The after tax Internal Rate of Return of the project works out to be 11.36%. 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 35.65 %. the average DSCR is 1.67

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 power savings or decrease. For the purpose of sensitive analysis, two scenarios are considered are.

- Increase in power savings by 5%
- Decrease in power 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.

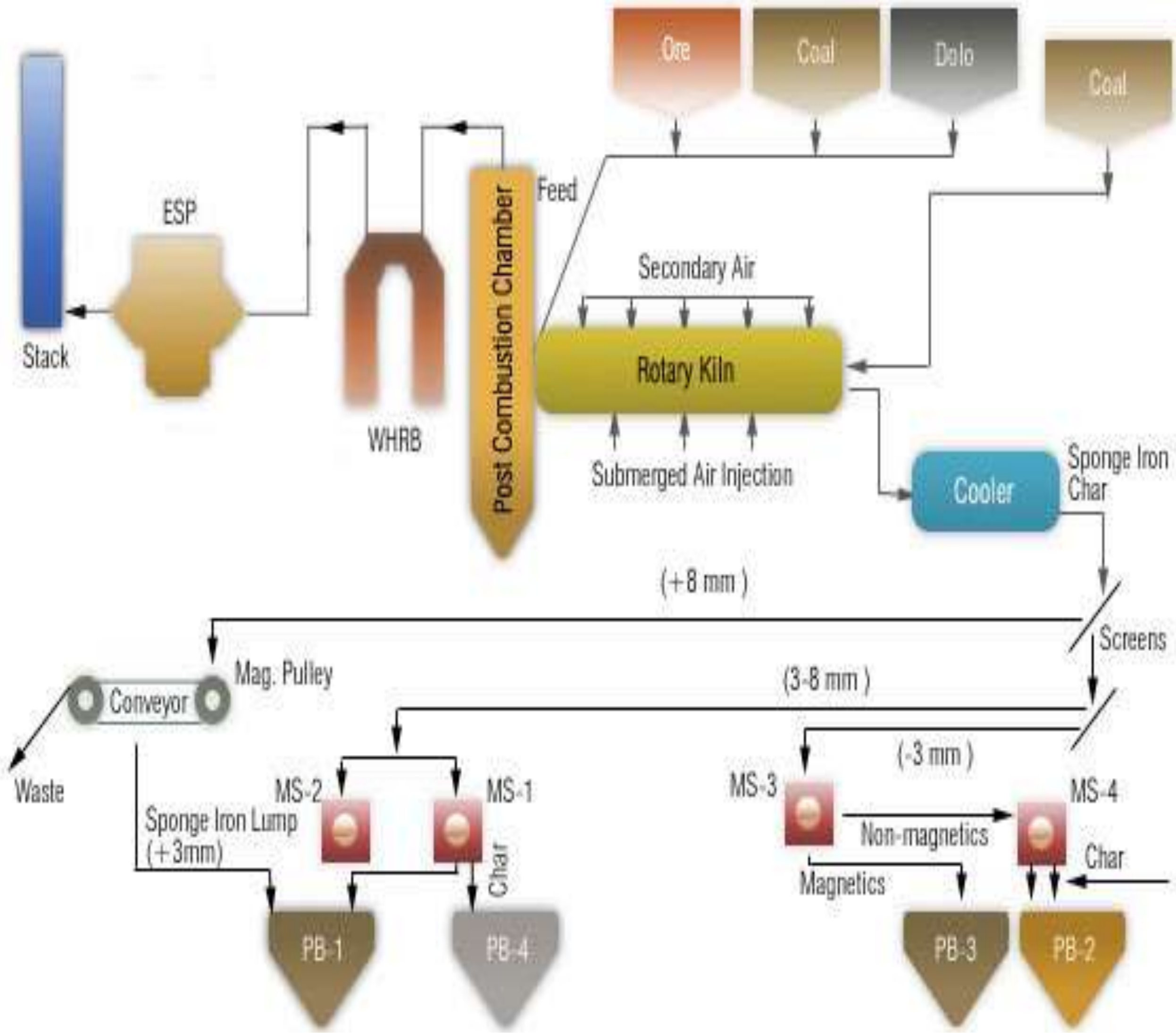
Particulars	***DSCR***	***IRR%***
Normal	1.67	11.36
5% increase in power savings	1.74	13.75
5% decrease in power savings	1.59	8.93

4.5 Procurement and implementation schedule

The project is expected to be completed in 1 week from the date of release of purchase order. The detailed schedule of project implementation is furnished in Annexure 5.

ANNEXURE 1: PROCESS FLOW DIAGRAM

Process flow diagram will remain the same after implementation of proposed energy efficient pumps.



ANNEXURE 2: DETAILED TECHNOLOGY ASSESSMENT REPORT – PUMPS

S.No	Parameters	Units	Existing Pump	EE Pump
1	Installed Capacity	kW	18.65	14.92
2	Input Power	kW	21.44	17.15
3	Head	m	60	60
4	Flow	lps	15	15
5	Flow	m3/hr	54	54
6	Efficiency of motor	%	87	93
7	Constant		367	367
8	Water power	kW	8.83	8.83
9	measured Power	kW	15.00	12.89
10	Efficiency of Pump & Motor	%	41.18	68.50
11	No of Hours operation	Hrs/day	12	12
12	No of Days operation	Days/Year	300	300
13	Power Savings	kW	2.11	
14	Annual power savings	kWh/year	7603	
15	Power Tariff	Rs/kWh	3.60	
16	Cost of Power Saving (in Lakh)	Rs/Year	0.27	
17	Investment Cost	Rs. Lakhs	0.70	
18	Payback period	Years	2.57	

ANNEXURE 3: DRAWINGS FOR PROPOSED CIVIL WORKS REQUIRED

ANNEXURE 4: DETAILED FINANCIAL CALCULATIONS &

Assumptions

Details	Unit	Values	Basis
Name of the Technology	**Energy Efficient Water pump for Cooler Main Drive**		
Rated Capacity	**20HP**		
Installed Capacity	**HP**	20	
No of working days	**Days**	300	
No of Shifts per day	**Shifts**	3	
Capacity Utilization Factor	**%**		
Proposed Investment			
Plant & Machinery	**Rs. in lakhs**	0.70	
Civil Work	**Rs. in lakhs**	0.00	
Erection & Commissioning (1%)	**% on Plant & Equip**	0.01	
Investment without IDC	**Rs. in lakhs**	0.71	
Subsidy	**Rs. in lakhs**	0.00	
Misc. cost	**Rs. in lakhs**	0.00	
Total Investment	**Rs. in lakhs**	0.70	
Financing pattern			
Own Funds (Internal Accruals)	**Rs. in lakhs**	0.18	
Loan Funds (Term Loan)	**Rs. in lakhs**	0.53	
Loan Tenure	**Years**	5.00	
Moratorium Period	**Months**	6.00	
Repayment Period	**Months**	66.00	
Interest Rate	**%**	10.00%	**SIDBI Lending rate**
Estimation of Costs			
O & M Costs	% on Plant & Equip	1.00%	
Annual Escalation	**%**	1.00%	
Estimation of Revenue			
electricity saving	**Kwh/Annum**	**7603**	
Cost	**Rs. / kWh**	**3.75**	
St. line Depn.	**%**	5.28%	Indian Companies Act
IT Depreciation i.e. WDV	**%**	80.00%	Income Tax Rules
Income Tax rate	**%**	33.99%	Income Tax

Estimation of Interest On Term Loan (Rs.in lakhs)				
Years	**Opening Balance**	**Repayment**	**Closing Balance**	**Interest**
1	0.53	0.06	0.47	0.06
2	0.47	0.12	0.35	0.04
3	0.35	0.12	0.23	0.03
4	0.23	0.09	0.14	0.02
5	0.14	0.00	0.14	0.01
6	0.14	0.00	0.14	0.01
		0.39		

WDV Depreciation (Rs.in lakhs)		
Particulars / years	**1**	**2**
Plant and Machinery		
- Cost	0.70	0.14
- Depreciation	0.56	0.11
- WDV	0.14	0.03

Projected Profitability					
Particulars / Years	**1**	**2**	**3**	**4**	**Total**
Revenue through Savings (Rs.in lakhs)					
Fuel savings	0.29	0.29	0.29	0.29	**1.14**
Total Revenue	**0.29**	**0.29**	**0.29**	**0.29**	**1.14**
					0.00
EXPENSES					**0.00**
O & M Expenses	0.01	0.01	0.01	0.01	**0.03**
Total Expenses	**0.01**	**0.01**	**0.01**	**0.01**	**0.03**
PBDIT	**0.28**	**0.28**	**0.28**	**0.28**	**1.11**
Interest	0.06	0.04	0.03	0.02	**0.15**
PBDT	**0.22**	**0.24**	**0.25**	**0.26**	**0.96**
Depreciation	0.04	0.04	0.04	0.04	**0.15**
PBT	0.18	0.20	0.21	0.22	**0.81**
Income tax	0.00	0.04	0.08	0.09	**0.22**
Profit after tax (PAT)	**0.18**	**0.16**	**0.13**	**0.13**	**0.60**

Computation of Tax

Particulars / Years	1	2	3	4
Profit before tax	0.18	0.20	0.21	0.22
Add: Book depreciation	0.04	0.04	0.04	0.04
Less: WDV depreciation	0.56	0.11	-	-
Taxable profit	(0.34)	0.12	0.25	0.26
Income Tax	-	0.04	0.08	0.09

<u>Projected Balance Sheet</u>				
Particulars / Years	**1**	**2**	**3**	**4**
<u>LIABILITIES</u>				
Share Capital	0.18	0.18	0.18	0.18
Reserves & Surplus	0.18	0.34	0.46	0.60
Term Loans	0.47	0.35	0.23	0.14
TOTAL LIABILITIES	**0.82**	**0.86**	**0.87**	**0.91**
<u>ASSETS</u>				
Gross Fixed Assets	0.70	0.70	0.70	
Less : Accm.depreciation	0.04	0.07	0.11	
Net Fixed Assets	0.67	0.63	0.59	
Cash & Bank Balance	0.16	0.23	0.28	
TOTAL ASSETS	**0.82**	**0.86**	**0.87**	
Net Worth	0.36	0.51	0.64	
Debt Equity Ratio	2.66	1.98	1.29	

Projected Cash Flow:					
Particulars / Years	**0**	**1**	**2**	**3**	**4**
Sources					
Share Capital	0.18	-	-	-	-
Term Loan	0.53				
Profit After tax		0.18	0.16	0.13	0.13
Depreciation		0.04	0.04	0.04	0.04
Total Sources	**0.70**	**0.22**	**0.19**	**0.16**	**0.17**
Application					
Capital Expenditure	0.70				
Repayment Of Loan	-	0.06	0.12	0.12	0.09
Total Application	**0.70**	**0.06**	**0.12**	**0.12**	**0.09**
Net Surplus	-	0.16	0.07	0.04	0.08
Add: Opening Balance	**-**	**-**	**0.16**	**0.23**	**0.28**
Closing Balance	**-**	0.16	0.23	0.28	0.36

Calculation of Internal Rate of Return (Rs.in lakhs)					
Particulars / months	**0**	**1**	**2**	**3**	**4**
Profit after Tax		0.18	0.16	0.13	0.13
Depreciation		0.04	0.04	0.04	0.04
Interest on Term Loan		0.06	0.04	0.03	0.02
Salvage / Realisable value					-
Cash outflow	(0.70)	-	-	-	-
Net Cash flow	(0.70)	0.28	0.24	0.19	0.19
IRR	**11.36%**				

Break Even Point					
Particulars / Years		**1**	**2**	**3**	**4**
A. Variable Expenses					
Oper. & Maintenance Exp (75%)		0.01	0.01	0.01	0.01
Sub Total		**0.01**	**0.01**	**0.01**	**0.01**
B.Fixed Expenses					
Oper.& Maintenance Exp (25%)		0.00	0.00	0.00	0.00
Interest on Term Loan		0.06	0.04	0.03	0.02
Depreciation		0.04	0.04	0.04	0.04
Sub Total		**0.10**	**0.08**	**0.07**	**0.06**
C.Sales		0.29	0.29	0.29	0.29
D.Contribution		0.28	0.28	0.28	0.28
E.Break Even Point (B/D)		35.50%	28.65%	24.37%	20.18%
F.Cash Break Even		22.23%	15.38%	11.10%	6.91%
G.BREAK EVEN SALES		0.10	0.08	0.07	0.06

Return on Investment						
Particulars / Years		**1**	**2**	**3**	**4**	**Total**
A.Net Profit Before Taxes		0.18	0.20	0.21	0.22	0.81
B.Net Worth		0.36	0.51	0.64	0.78	2.29
Debt Service Coverage Ratio						
Particulars / Years		**1**	**2**	**3**	**4**	**Total**
CASH INFLOW						
Profit after Tax		0.18	0.16	0.13	0.13	0.60
Depreciation		0.04	0.04	0.04	0.04	0.15
Interest on Term Loan		0.06	0.04	0.03	0.02	0.15
TOTAL		**0.28**	**0.24**	**0.19**	**0.19**	**0.90**
DEBT						
Interest on Term Loan		0.06	0.04	0.03	0.02	0.15
Repayment of Term Loan		0.06	0.12	0.12	0.09	0.39
TOTAL		**0.12**	**0.16**	**0.15**	**0.11**	**0.54**
		2.31	1.46	1.30	1.76	1.67
Average DSCR		**1.67**				

ANNEXURE 5: DETAILS OF PROCUREMENT AND IMPLEMENTATION PLAN

Project Implementation Schedule

S.No	Activity	Days						
		1	2	3	4	5	6	7
1	Placement of Orders for Equipment							
2	Supply of Pump's							
3	Installation of the pump							
4	Trial Runs							

Process down Time

S.No	Activity	Days	
		1	2
1	Dismantling of the existing pump		
2	Electricity connections and modification of the pipe lines		
3	Installation of the pump		
4	Trial runs		

The process down time is considered for only two days.

ANNEXURE 6: DETAILS OF TECHNOLOGY/EQUIPMENT AND SERVICE PROVIDERS

Equipment details	*Source of technology*	*Service/technology providers*
Energy Efficient Pumps		DERAZ ENGINEERS 6-3-1177/90, Deraz house, BS Maktha, Begumpet India-500016 E-mail: deraz@deraz.in Mobile:+91 9948353601 Telefax:+040 23412165

ANNEXURE 7: TECHNO-COMMERCIAL BIDS FOR NEW TECHNOLOGY/EQUIPMENT

Our Ref No –DQH/2K1203125/MMN/RB, Dated – 16/03/2012.

M/s. APITCO LTD
8th Floor, Parisrama Bhavan,
Bhasheerbagh, Hydrabad (A.P)-500004
Tel:040-23237333,23237981,23243611, Fax:040-23298945
Email: ayan.ganguly@apitco.org
web: www.apitco.org

Kind Attn: Mr. Ayan Ganguly (Consultant)-9618881042

Dear Sir,

Sub –Quotation for KSB Make Pumps & SIEMENS Make NFLP Motors
Ref – Your Mail Enquiry, dt.13.03.2012

With reference to the above, we are pleased to submit our offer as given below.

S.NO	DESCRIPTION	QTY In Nos	UNIT PRICE IN RS.	TOTAL PRICE IN RS.
1	KSB Make centrifugal pump Type: Mega G 50-200 (Q:54m3/Hr , H:60Mtrs) Pump Price	1	16742	**16742**
2	SIEMENS Make NFLP Motor,15kw/20hp,2910rpm	1	34083	**34083**
3	Common Base frame & coupling suitable for above pump and motor	1	10147	**10147**
	Total			**60971**

Technical Data Sheet Enclosed

TERMS & CONDITIONS:

1. PRICES - F.O.R DERAZ Godown-Hyderabad.
In case of site delivery Minimum charges of Rs.500/- Extra
Or 3% of PO Value whichever is higher.
2. DUTIES - **E.D.@5.15%** Extra on Mega Pumps/ **E.D.@10.30%** Extra on Motors,
ED not applicable on Base Frame & coupling,
Gate pass for Modavat will be provided.
3. TAXES - **VAT@5%** Extra On Pumps, Accessories & up to 10HP Motor.
4. DELIVERY - **Ex Stock subject to prior sale.**
Non Stock Within 6 Weeks after receipt of your PO
5. PAYMENT - 25% Advance balance against Proforma invoice Prior to dispatch/
In case of delayed payment OD interest @18% p.a will be charged.
6. VALIDITY - 15 days.
7. P & F - **@3%** Extra.
9. INSURENCE - NOT IN OUR SCOPE.

We now request you to kindly place your valuable order on us.
Thanking you and assuring you of our best services at all times.

Yours faithfully,
For DERAZ ENGINEERS,

(TECHNICAL DEPT.) **(COMMERCIAL DEPT.)**

Note: For further clarification please contact - 9948353603 / 9948353616 / 9948353601