DETAILED PROJECT REPORT
ON
INSTALLATION OF VFD ON SCREW COMPRESSOR
(BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER)

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Bureau of Energy Efficiency (BEE)

Prepared By

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INSTALLATION OF VFD ON SCREW COMPRESSOR

BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER

BEE, 2011

Detailed Project Report on **Installation of VFD on Screw Compressor**

Foundry SME Cluster, Batala, Jalandhar , Ludhiana (Punjab) (India)

New Delhi: Bureau of Energy Efficiency

Detail Project Report No.: **BJL/CAP/PF/01**

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CII – AVANTHA Centre for Competitiveness for SMEs
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List of Abbreviations

BEE	Bureau of Energy Efficiency
SME	Small and Medium Enterprises
DPR	Detailed Project Report
GHG	Green House Gases
DSCR	Debt Service Coverage Ratio
NPV	Net Present Value
IRR	Internal Rate of Return
ROI	Return on Investment
VFD	- Variable Frequency Drives
ROI	- Return on Investment
MoP	- Ministry of Power
MSME	- Micro Small and Medium Enterprises
MoMSME	- Ministry of Micro Small and Medium Enterprises
SIDBI	- Small Industrial Development Bank of India

EXECUTIVE SUMMARY

Confederation of Indian Industry is executing BEE-SME program in Batala, Jalandhar and Ludhiana Foundry Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Batala, Jalandhar and Ludhiana Foundry cluster, is one of the largest Foundry 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 Foundry clusters in India. The main energy forms used in the cluster units are grid electricity and fuel such as furnace oil, coal, and Diesel.

Most of the Industrial installations in the country have large electrical loads which are severely inductive in nature, such as motors, large machines etc which results in power high consumption. An Induction Furnace is the main energy consumers in any Foundry unit.

In the Foundry industry compressed air is utilized for the pneumatic operations in the core making machines, pneumatic lifts, pneumatic operations and cleaning operations etc. In the compressed air system once the required pressure is achieved the compressor is getting unloaded. The loading unloading pattern indicates the quantity of the compressed air requirement in the plant. During the unload time the compressor does not deliver useful work, but operates only to overcome the internal losses. The compressors should be selected to operate with a minimum unload time.

Implementation of VFD to screw compressor will reduce the idle power consumption of the compressor. This can be achieved by varying the speed of the compressor to match with the compressed air requirement. Installation of the VFD would completely avoid the unloading time and would hence result in tremendous savings of power consumption in compressed air requirement.

This DPR highlights the details of the study conducted for assessing the potential for installation of VFD on screw compressor, possible energy saving, and its monetary benefit, availability of the technologies/design, local service providers, technical features & proposed equipment specifications, various barriers in implementation, environmental aspects, estimated GHG reductions, capital cost, financial analysis, sensitivity analysis for three different scenarios 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.

S. No.	Particular	Unit	Value
1	Project cost	`(in lakh)	1.00
2	Power saving	kW/Year	9375
3	Total monetary benefit	`(in lakh)/year	0.47
4	Debit equity ratio	Ratio	3 : 1
5	Simple payback period	Years	2.13
6	NPV	`(in lakh)	0.71
7	IRR	%age	29.57
8	ROI	%age	25.97
9	DSCR	Ratio	1.91
10	Process down time	Days	Nil
11	CO_2 emission reduction	Tonne/year	7.6

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 energy performance in 29 selected SMEs clusters. Batala, Jalandhar and Ludhiana Foundry Cluster is one of them. The BEE's SME Programme intends to enhance 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 of energy efficiency projects in the clusters.

Activity 3: Implementation of Energy Efficiency Measures

To implement the technology up gradation projects in 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 the Cluster

Indian foundry industry is very energy intensive. The energy input to the furnaces and the cost of energy play an important role in determining the cost of production of castings. Major energy consumption in medium and large scale foundry industry is the electrical energy for induction and Arc furnaces. Furnace oil is used in rotary furnaces. In Small foundry industry, coal is used for metal melting in Cupola furnaces. The energy costs contribute about 25 - 30% of the manufacturing cost in Indian foundry industry.

There are approximately 450 units, engaged in Foundry Cluster (automobile parts, agricultural implements, machine tools, diesel engine components, manhole covers, sewing machine stands, pump-sets, decorative gates and valves) production. The major locations wherein the units are spread are G.T. Road, Industrial area, Focal Point in Batala. In Jalandhar Dada Colony Industrial Area, Focal point, Focal Point Extn, Udyog Nagar, I.D.C, Kapurthala Road & Preet Nagar. In Ludhiana Focal Point Phase 5 to 8, Janta Nagar, Bhagwan Chowk Area & Industrial area – A/B. .

Availability of Electricity in Batala – across Dhir Road, GT Road is an issue; power is available from the grid for maximum 12/14 hours a day. There are some units in Jalandhar and Ludhiana having induction furnace in the range of 500 kg to 1 ton capacity whereas other units which are using local scrap as well as have high melting temperatures are having cupola and rotary furnace and has a capacity of minimum 5 ton per day.

The foundry produces a wide variety of castings such as manhole covers, pipe and pipe fittings, sanitary items, tube well body, metric weights, automobile components, railway parts, electric motor, fan body etc. 90% of the castings produced are from the SSI sector.

Energy Usage Pattern

Major energy sources being used in foundry cluster are electricity and fuels such as Coal, Furnace Oil, and Diesel. Electrical energy is being used in melting of iron in induction furnaces, operation of electrical utilities and thermal energy is being used in cupola furnaces operation.

Classification of Units

Broadly units are classified with respect to production capacity;

- Large Scale Units
- Medium Scale Units
- Small Scale Units

Production wise unit breakup

Foundry cluster at Batala, Jalandhar and Ludhiana can be broken into three categories viz. small, medium and large size unit. Table 1.1 shows that production wise breakup of Foundry cluster.

Table 1.1 production wise unit breakups

S. No.	Type of Unit	Production Capacity
1	Large scale unit	More than 1500 MT
2	Medium scale unit	250 to 1500 MT
3	Small scale unit	Less than 250 MT

Products Manufactured

Foundry SME cluster at Batala, Jalandhar and Ludhiana produces a wide variety of castings such as manhole covers, pipe and pipe fittings, sanitary items, tube well body, metric weights, automobile components, railway parts, electric motor, fan body etc.

A general process flow diagram of foundry cluster is shown in figure below:

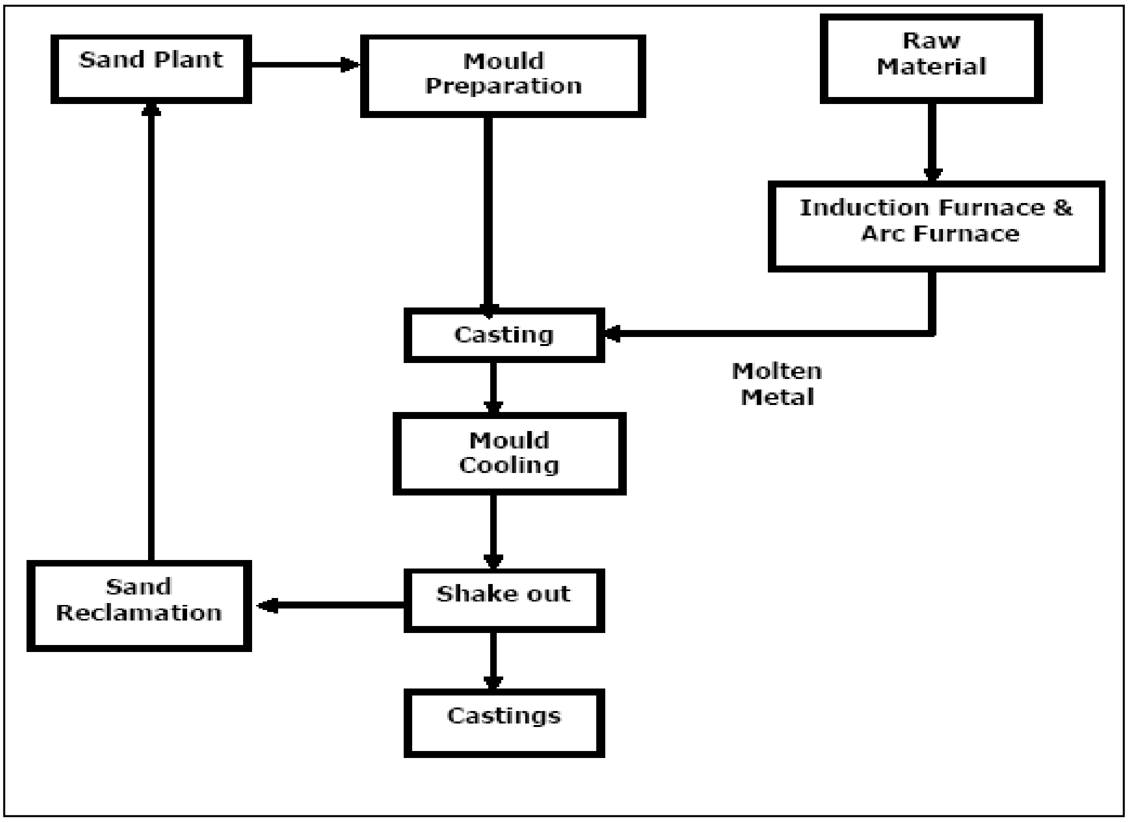

Figure 1.1: Process Flow diagram of a Foundry Cluster

The manufacturing process is described as below;

Melting Section:

The raw material is melted in melting furnace. The melting furnace can be an induction furnace or rotary or arc furnace or cupola furnace. Molten metal from the melting furnace is tapped in Ladles and then transferred to the holding furnaces. Typically the holding furnaces are induction furnaces. The holding furnace is used to maintain the required molten metal temperature and also acts as a buffer for storing molten metal for casting process. The molten metal is tapped from the holding furnace whenever it is required for casting process.

Sand Plant:

Green sand preparation is done in the sand plant. Return sand from the molding section is also utilized again after the reclamation process. Sand Millers are used for green sand preparation. In the sand millers, green sand, additives and water are mixed in appropriate proportion. Then the prepared sand is stored in bunkers for making moulds.

Pattern Making:

Patterns are the exact facsimile of the final product produces. Generally these master patterns are made of aluminum or wood. Using the patterns the sand moulds are prepared.

Mould Preparation:

In small-scale industries still the moulds are handmade. Modern plants are utilizing pneumatic or hydraulically operated automatic molding machines for preparing the moulds. After the molding process if required the cores are placed at the appropriate position in the moulds. Then the moulds are kept ready for pouring the molten metal.

Casting:

The molten metal tapped from the holding furnace is poured into the moulds. The molten metal is allowed to cool in the moulds for the required period of time and the castings are produced. The moulds are then broken in the shake out for removing the sand and the used sand is sent back to the sand plant for reclamation and reuse. The castings produced are sent to fettling section for further operations such as shot blasting, heat treatment etc. depending upon the customer requirements.

1.2 Energy performance in existing situation

Major energy sources being used in foundry cluster are electricity and fuels such as Coal, Furnace Oil, and Diesel. Electrical energy is being used in melting of iron in induction furnaces, operation of electrical utilities and thermal energy is being used in cupola furnaces operation.

1.2.1 Average Production

The Average Production of the Foundry Units is represented in figure 1.2 below during Year 2009-10 are as follows;

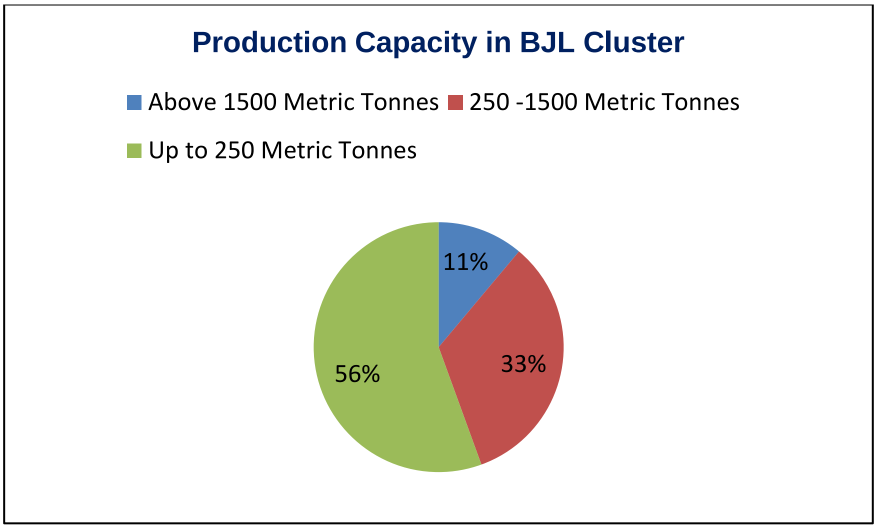

Figure 1.2: Production Capacity BJL Foundry cluster

1.2.2 Energy Consumption

Energy consumption (electrical) in a typical Foundry plant for different types of products is given in Table 1.2 below:

Table 1.2: Annual Energy Consumption

Electricity Consumption Pattern	Unit Consumed in kWh	Total Unit Consumption kWh
Blower Motor for Cupola	962100	26.92 Lakhs
Rotary Motor for Rotary Furnace	330000	
Melting material in Induction Furnace	1400000	

Table 1.3: Annual Thermal Energy Consumption

Thermal Energy Consumption Pattern	Consumption per Year
Coal for Cupola	5000 Metric Tonnes
Furnace Oil for Rotary Furnace	17.8 Lakh Litter

1.2.3 Specific Energy Consumption

Specific energy consumption of Foundry units depends upon the production capacity & their corresponding power consumption. Specific energy consumption also depends on type of furnace. A brief summary of specific energy consumption depending upon type of furnace is shown in below table;

Table 1.3: Annual Thermal Energy Consumption

Sl. No	Types of Furnace	Types of Fuel	Specific Fuel Consumption / One kg Molten Material	In Terms of Rupees
1	Cupola	Coal	0.2 kg	` 3.00
2	Rotary Furnace	Furnace Oil	0.15 Lt	` 4.20
3	Induction Furnace	Electricity	0.72 kWh	` 3.60

*Assuming Coal rate ` 15.0/kg
*Assuming F.O rate ` 28.0 /Lt.
*Assuming electricity rate ` 5.0/kWh

1.3 Proposed Technology/Equipment

1.3.1 Description about the existing technology

In the Foundry industry compressed air is utilized for the pneumatic operations in the core making machines, pneumatic lifts, pneumatic operations and cleaning operations etc. In the compressed air system once the required pressure is achieved the compressor is getting unloaded. The loading unloading pattern indicates the quantity of the compressed air requirement in the plant. During the unload time the compressor does not deliver useful work, but operates only to overcome the internal losses. The compressors should be selected to operate with a minimum unload time. The present system has a 140 CFM Screw Compressor with a 22 kW induction motor for the above requirement.

1.4 Establishing the Baseline for the Proposed Technology

During the unload time, the compressor does not deliver useful work, but operates only to overcome its internal losses. The compressors should be so selected to operate with a minimum unload time. There is a good potential to save energy by minimizing the unload time of the compressor.

This can be achieved by varying the speed of the compressor to match with the compressed air requirement. Speed variation can be carried out by installing a Variable Frequency Drive.

The present system has a 140 CFM Screw Compressor with a 22 kW induction motor. The power consumed by the motor is 22 kW and during unloading is 7.5 kW. On continuous analysis it was observed that the present unloading time of the compressor is about 35% of the load time.

Table 1.4: Base line for proposed technology

S.No	Parameters	Details
1	Compressor rating	140 CFM
2	Total operating hours	3600
3	Unloading hours	5hr/day
4	Loading hours	9.3hr/day
5	Total unloading percentage	35%
6	Loading power consumption	22 kW
7	Unloading power consumption	7.5 kW

1.5 Barriers in adoption of propose technology

1.5.1 Technological Barrier

- Lack of awareness and information about the benefit of VFD.
- Due to lack of technical knowledge and expertise, VFD is not commonly used in the cluster.
- In this cluster, like many others, there is lack of leadership to take up the energy efficiency projects in the plant.

1.5.2 Financial Barrier

Implementation of the proposed project activity requires an investment of ` 1.00 Lakh, which is a significant investment for small industries and not commonly seen in the cluster for the implementation of energy efficiency projects. Also implementation of proposed technology requires regular maintenance and checkups which requires technically skilled and competent workman.

1.5.3 Skilled Manpower

In Foundry cluster at Batala, Jalandhar and Ludhiana, the availability of skilled manpower is one of the limitations; this issue gets further aggravated due to more number of foundry units as compared to the availability of skilled manpower.

2 PROPOSED TECHNOLOGY

2.1 Detailed Description of Technology

2.1.1 Description of Technology

The majority of modern foundry units are heavily involved in cutting costs, and energy awareness should be a key concern. Large electrical cost savings can be achieved by installing a variable speed drive on existing rotary screw compressor or piston machine. The main purpose of Installation of VFD on compressor is to control the speed (RPM) of the compressor as per the requirement, which in turn saves energy compared to a fixed speed equivalent.

The most common form of VSD technology in the Air Compressor Industry is a variable-frequency drive, which converts the incoming AC power to DC & then back to a quasi-sinusoidal AC power using an inverter switching circuit. The variable-frequency drive article provides additional information on electronic speed controls used with various types of AC motors.

In compressed air system once the required pressure is achieved the compressor is getting unloaded. The loading unloading pattern indicates the quantity of compressed air requirement in the plant. The higher unload time of the compressor indicates excess capacity available in the compressor. During the unload time, the compressor does not deliver useful work, but operates only to overcome its internal losses. The compressors should be so selected to operate with a minimum unload time.

There is a good potential to save energy by minimizing the unload time of the compressor. This can be achieved by varying the speed of the compressor to match with the compressed air requirement. Speed variation can be carried out by installing a Variable Frequency Drive.

A Variable Frequency Drive (VFD) with the feedback as the receiver pressure would constantly sense even the slightest increase/decrease in the receiver pressure. Accordingly it would vary the speed of the compressor.

This installation of the VFD would completely avoid the unload time and would hence result in tremendous savings in power consumption.

2.1.2 Technology Specification

Technical specification of proposed VFD is provided by the vendors at Annexure 6.

2.1.3 Suitability or Integration with Existing Process and Reasons for Selection

This is the simplest and widely accepted measure for energy cost reduction in the compressor installed in the plant.

This technology is

- simple in monitoring
- requires less maintenance
- requires no additional manpower
- easy to installed

2.1.4 Availability of Technology

As far as technology is concerned VFD are available in local/ national market. It is well proven technology which is adopted in many of the other similar and dissimilar units. Local vendors can arrange VFD at order. Local service providers are also available in Punjab. More details of service provider are given in annexure 5.

2.1.5 Source of Technology

It is well proven technology which is adopted in many of the other similar and dissimilar units and units are getting benefited from it.

2.1.6 Terms and Conditions after Sale

Warranty period of one year will be provided from the date of invoice against any manufacturing defects.

2.1.7 Process down Time during Implementation

Technology provider will bring the complete setup for the proposed project from their site and make all the arrangements for implementation at the client's site. During the final connection with the main supply of the foundry plant, breakdown period of 2 to 3 hours will be required.

2.2 Life Cycle Assessment

Life of the proposed Spectrometers will be around 1,00,000 hours which depends on the operating conditions and maintenance at client's side.

2.3 Suitable Unit for Implementation of the Identified Technology

For estimation of the saving potential on implementation of this project, here the Foundry plant engaged in producing castings and have air compressor of 140CFM installed in the plant.

3 ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical Benefits

3.1.1 Electricity savings per year

This installation of the VFD on screw compressor would completely avoid the unloading time and would hence result in tremendous savings in power consumption. Total power saving would be around 9375 kW per year.

3.1.2 Improvement in product quality

This project is not contributing to any improvement in product quality.

3.1. Increase in production

This project is not contributing for increasing in production in Foundry plant. But it reduces the power consumption for producing same amount of castings. .

3.1.4 Reduction in raw material consumption

Raw material consumption will be the same after the implementation of the proposed project.

3.1.5 Reduction in other losses

This project does not contribute to any reduction in any loss.

3.2 Monetary Benefits per year

Monetary benefit after implementation of this technology is shown in Table 3.1 below.

Table 3.1: Energy cost saving

S. No.	Particular	Details
1	Power saving per day due to installation of VFD	37.5 kWh
2	Total operating hours	250 days
3	Annual power saving	9375 kWh
4	Rate of electricity	` 5/kWh
5	Total annual monetary benefit	` 0.47 lakh

3.3 Social Benefits

3.3.1 Improvement in Working Environment in the Plant

There is no significant impact of this project in the working environment in the plant.

3.3.2 Improvement in Skill Set of Workers

The technical skills of workers will definitely improve. Training on the regular inspection/maintenance will help in improving the technical understanding of the workers.

3.4 Environmental Benefits

The major GHG reduction would be in Co_2 reduction. The technology will reduce grid electricity consumption and emission reductions are estimated at 7.6 tons of Co_2 per annum.

4 INSTALLATION OF THE PROPOSED TECHNOLOGY

4.1 Cost of Technology Implementation

4.1.1 Technology Cost

Cost of the equipment is ` 0.95 lakh (Considering 40% discount from vendors) which includes the cost of the VFD and panels as per the quotation provided by the vendors at Annexure 6.

4.1.2 Other Cost

Other costs required will be ` 0.0.05 lakh which includes taxes, commissioning, manpower cost, transportation etc. Details breakups are provided in the Table 4.1 below:

Table 4.1 Details of Proposed Technology Installation Cost

S. No.	Particular	Cost (` in Lakh)
1	Equipment cost	0.95
2	Other cost	0.05
3	Total Cost	1.00

4.2 Arrangements of Funds

4.2.1 Entrepreneur's Contribution

Entrepreneur will contribute 25% of the total project cost which is ` 0.25 Lakh.

4.2.2 Loan Amount

Remaining 75% cost of the proposed project will be borrowed from bank which is ` 0.75 Lakh.

4.2.3 Terms & Conditions of Loan

The interest rate is considered at 10% which is normal rate of interest for energy efficiency projects. The loan tenure is 5 years excluding initial moratorium period is 6 months from the date of first disbursement of loan.

4.3 Financial Indicators

4.3.1 Cash Flow Analysis

Profitability and cash flow statements have been worked out for a period of 8 years. The financials have been worked out on the basis of certain reasonable assumptions, which are outlined below.

- The Operation and Maintenance cost is estimated at 4 % of cost of total project with 5 % increase in every year as escalations.
- Interest on term loan is estimated at 10 %.
- Depreciation is provided as per the rates provided in the companies Act.

Based on the above assumptions, profitability and cash flow statements have been prepared and calculated in Annexure-3.

4.3.2 Simple Payback Period

The total project cost of the proposed technology is ` 1.00 Lakh and monetary savings due to reduction in electricity consumption is ` 0.47 Lakh hence, the simple payback period works out to be 2.13 years.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10% works out to be ` 0.71 Lakh.

4.3.4 Internal Rate of Return (IRR)

The after tax Internal Rate of Return of the project works out to be 29.57%. 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 25.97%.

Table 4.2 Financial Indicators of Proposed Technology

S No	Particular	Unit	Value
1	Simple Payback	Years	2.13
2	NPV	` In Lakh	0.71
3	IRR	%age	29.57
4	ROI	%age	25.97
5	DSCR	Ratio	1.91

4.4 Sensitivity analysis in realistic, pessimistic and optimistic scenarios

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different situations like when there is an increase in rupees savings or decrease in rupees savings. For the purpose of sensitive analysis, two following scenarios have been considered.

- Optimistic scenario (Increase in power savings by 5%)
- Pessimistic scenario (Decrease in power savings by 5%)

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

Table 4.3 Sensitivity Analysis in Different Scenarios

Scenario	IRR (%)	NPV (in Lakh)	ROI (%)	DSCR
Pessimistic	27.24	0.62	25.70	1.81
Base	29.57	0.71	25.97	1.91
Optimistic	31.87	0.80	26.21	2.01

4.5 Procurement and Implementation Schedule

Procurement and implementation schedule required for implementation of this technology is about 7 weeks. Further detail breakups of procurement and implementation schedules are shown in Annexure 4.

ANNEXURES

Annexure -1: Energy audit data used for baseline establishment

S.No	Parameters	Details
1	Compressor rating	140 CFM
2	Total operating hours	3600
3	Unloading hours	5 hr/day
4	Loading hours	9.3 hr/day
5	Total unloading percentage	35%
6	Loading power consumption	22 kW
7	Unloading power consumption	7.5 kW

Annexure -2: Detailed Technology Assessment Report

S. No.	Particular	Unit	Value
1	No. of operating days	Days	250
2	Total operating hours	Hrs	3600
3	Total loading hours	Hrs/annum	1260
4	Total unloading hours	Hrs/annum	2340
5	Loading power consumption	kW	22
6	Unloading power consumption	kW	7.5
7	Total power saving	kWh/annum	9375
8	Rate of Electricity	`/ kWh	5
9	Total monetary saving	`in lakh	5.00
10	Total investment required	`in lakh	1.00
11	Simple payback period	Years	2.13

Annexure -3: Detailed Financial Calculations

Name of the Technology	VFD		
Rated Capacity	30 HP		
Details	**Unit**	**Value**	**Basis**
Installed Capacity	Hp	30	
No of Annual working days	Days	250	
Proposed Investment			
Plant & Machinery	` (in lakh)	0.95	
Misc. Cost	` (in lakh)	0.05	
Total Investment	` (in lakh)	1.00	
Financing pattern			
Own Funds (Equity)	` (in lakh)	0.25	Feasibility Study
Loan Funds (Term Loan)	` (in lakh)	0.75	Feasibility Study
Loan Tenure	Years	5.00	Assumed
Moratorium Period	Months	6.00	Assumed
Repayment Period	Months	66.00	Assumed
Interest Rate	%age	10.00%	
Estimation of Costs			
O & M Costs	% on Plant & Equip	4.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Electricity Saving	kWh/Year	9375	
Cost of electricity	`/kWh	5	
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	0.75	0.04	0.71	0.09
2	0.71	0.11	0.60	0.07
3	0.60	0.15	0.45	0.05
4	0.45	0.19	0.26	0.04
5	0.26	0.19	0.08	0.02
6	0.08	0.08	0.00	0.00
		0.75		

WDV Depreciation **`(in lakh)**

Particulars / years	**1**	**2**
Plant and Machinery		
Cost	1.00	0.20
Depreciation	0.80	0.16
WDV	0.20	0.04

Projected Profitability **` (in lakh)**

Particulars / Years	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Electricity savings	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Total Revenue (A)	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Expenses								
O & M Expenses	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06
Total Expenses (B)	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06
PBDIT (A)-(B)	0.43	0.43	0.42	0.42	0.42	0.42	0.42	0.41
Interest	0.09	0.07	0.05	0.04	0.02	0.00	0.00	0.00
PBDT	0.34	0.36	0.37	0.39	0.40	0.42	0.42	0.41
Depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
PBT	0.29	0.31	0.32	0.33	0.35	0.36	0.36	0.36
Income tax	0.00	0.07	0.13	0.13	0.14	0.14	0.14	0.14
Profit after tax (PAT)	0.29	0.24	0.19	0.20	0.21	0.22	0.22	0.22

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

Particulars / Years	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Profit before tax	0.29	0.31	0.32	0.33	0.35	0.36	0.36	0.36
Add: Book depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Less: WDV depreciation	0.80	0.16	-	-	-	-	-	-
Taxable profit	(0.46)	0.20	0.37	0.39	0.40	0.42	0.42	0.41
Income Tax	-	0.07	0.13	0.13	0.14	0.14	0.14	0.14

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

Particulars / Years	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Share Capital (D)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Reserves & Surplus (E)	0.29	0.53	0.72	0.92	1.14	1.36	1.58	1.80
Term Loans (F)	0.71	0.60	0.45	0.26	0.08	0.00	0.00	0.00
Total Liabilities (D)+(E)+(F)	1.25	1.38	1.42	1.44	1.46	1.61	1.83	2.05
Assets	1	2	3	4	5	6	7	8
Gross Fixed Assets	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Less Accumulated Depreciation	0.05	0.11	0.16	0.21	0.26	0.32	0.37	0.42
Net Fixed Assets	0.95	0.89	0.84	0.79	0.74	0.68	0.63	0.58
Cash & Bank Balance	0.30	0.48	0.58	0.65	0.72	0.92	1.20	1.47
TOTAL ASSETS	1.25	1.38	1.42	1.44	1.46	1.61	1.83	2.05
Net Worth	0.54	0.78	0.97	1.17	1.39	1.61	1.83	2.05
Debt Equity Ratio	2.85	2.40	1.80	1.05	0.30	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	0.25	-	-	-	-	-	-	-	-
Term Loan	0.75								
Profit After tax		0.29	0.24	0.19	0.20	0.21	0.22	0.22	0.22
Depreciation		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Sources	1.00	0.34	0.29	0.25	0.25	0.27	0.27	0.27	0.27
Application									
Capital Expenditure	1.00								
Repayment Of Loan	-	0.04	0.11	0.15	0.19	0.19	0.08	0.00	0.00
Total Application	1.00	0.04	0.11	0.15	0.19	0.19	0.08	0.00	0.00
Net Surplus	-	0.30	0.18	0.10	0.07	0.08	0.20	0.27	0.27
Add: Opening Balance	-	-	0.30	0.48	0.58	0.65	0.72	0.92	1.20
Closing Balance	-	0.30	0.48	0.58	0.65	0.72	0.92	1.20	1.47

IRR **` (in lakh)**

Particulars / months	0	1	2	3	4	5	6	7	8
Profit after Tax		0.29	0.24	0.19	0.20	0.21	0.22	0.22	0.22
Depreciation		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Interest on Term Loan		0.09	0.07	0.05	0.04	0.02	0.00	-	-
Cash outflow	(1.00)	-	-	-	-	-	-	-	-
Net Cash flow	(1.00)	0.43	0.36	0.30	0.29	0.28	0.28	0.27	0.27
IRR	29.57 %								
NPV	0.71								

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

Particulars / Years	1	2	3	4	5	6	7	8
Variable Expenses								
O & M Expenses (75%)	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Sub Total(G)	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Fixed Expenses								
O & M Expenses (25%)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Interest on Term Loan	0.09	0.07	0.05	0.04	0.02	0.00	0.00	0.00
Depreciation (H)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sub Total (I)	0.15	0.13	0.12	0.10	0.08	0.07	0.07	0.07
Sales (J)	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Contribution (K)	0.44	0.44	0.44	0.43	0.43	0.43	0.43	0.43
Break Even Point (L= G/I)%	34.13%	29.60%	26.85%	23.23%	19.13%	15.74%	15.45%	15.68%
Cash Break Even {(I)-(H)}%	22.10%	17.52%	14.73%	11.07%	6.91%	3.48%	3.13%	3.30%
Break Even Sales (J)*(L)	0.16	0.14	0.13	0.11	0.09	0.07	0.07	0.07

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

Particulars / Years	1	2	3	4	5	6	7	8	Total
Net Profit Before Taxes	0.29	0.31	0.32	0.33	0.35	0.36	0.36	0.36	2.68
Net Worth	0.54	0.78	0.97	1.17	1.39	1.61	1.83	2.05	10.33
									25.97%

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

Particulars / Years	1	2	3	4	5	6	7	8	Total
Cash Inflow									
Profit after Tax	0.29	0.24	0.19	0.20	0.21	0.22	0.22	0.22	1.36
Depreciation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.32
Interest on Term Loan	0.09	0.07	0.05	0.04	0.02	0.00	0.00	0.00	0.26
Total (M)	0.43	0.36	0.30	0.29	0.28	0.28	0.27	0.27	1.94

DEBT

Interest on Term Loan	0.09	0.07	0.05	0.04	0.02	0.00	0.00	0.00	0.26
Repayment of Term Loan	0.04	0.11	0.15	0.19	0.19	0.08	0.00	0.00	0.75
Total (N)	0.12	0.18	0.20	0.22	0.21	0.08	0.00	0.00	1.01
DSCR (M/N)	3.44	2.01	1.47	1.30	1.38	3.58	0.00	0.00	1.91
Average DSCR	1.91								

Annexure:-4 Procurement and implementation schedule

Procurement and Implementation Schedule

S. No.	Activities	Weeks						
		1	2	3	4	5	6	7
1	Identification of load – unload time and power data recording							
2	Planning and material order							
3	Procurement							
4	Commissioning							

Annexure -5: Details of technology service providers

Energy Conservation measure	Source of product	Details of Local vendor / service provider
1. Variable Frequency Drives	Rockwell Automation	Vijay Asri Area Manager Drives (North) Email: (vkumar3@ra.rockwell.com) Cell: +91-9811504179
2. Variable Frequency Drives	Rockwell Automation	Vijay Kumar Bhat Product Manager Drives (India) Email - (vkbhat@ra.rockwell.com) Cell: +91-9899787392
3. Variable Frequency Drives	Danfoss Industries Pvt Ltd	Sanjeev Kumar Sanju Senior Manager – Industry Sales (Projects) Email – sanju_s@danfoss.com Cell -+91-9810243088

Annexure–6: Quotations/Techno-commercial bids for new technology/equipment

Dear Sir,

Please find the information / quotation attached,

1. **Quotation / tentative pricing of the Variable Frequency Drives for the motors ranging from 15 – 100 HP**

HP Rating	Voltage	Qty	Tentative prices Rs INR	Remark
15	415V	1	85000	Approximate drive prices given. Actual pricing will depend upon the project scope and final Negotiation done
20	415V	1	100000	
25	415V	1	130000	
30	415V	1	160000	
40	415V	1	210000	
50	415V	1	260000	
60	415V	1	320000	
75	415V	1	370000	
100	415V	1	500000	

2. **Name / Details of the concerned person to be included in the DPR and the Cluster manuals.**

Kindly contact

For North
Vijay Asri
Area Manager Drives (North)
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Cell: +91-9811504179

Vijay Kumar Bhat
Product Manager Drives (India)
(vkbhat@ra.rockwell.com)
Cell: +91-9899787392

Rockwell Automation centralised Customer care contacts
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Toll Free: 1 800 2000 121

Bureau of Energy Efficiency (BEE)
(Ministry of Power, Government of India)
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Websites: www.bee-india.nic.in, www.energymanagertraining.com

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