DETAILED PROJECT REPORT
ON
POWER FACTOR IMPROVEMENT BY INSTALLATION OF CAPACITOR BANKS (BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER)











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POWER FACTOR IMPROVEMENT BY INSTALLATION OF CAPACITOR BANKS

BATALA, JALANDHAR, LUDHIANA FOUNDRY CLUSTER

BEE, 2011

Detailed Project Report on Power Factor Improvement with Installation of Capacitor Banks

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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List of Abbreviations

BEE	Bureau of Energy Efficiency
SME	Small and Medium Enterprises
DPR	Detailed Project Report
GHG	Green House Gases
PF	Power Factor
DSCR	Debt Service Coverage Ratio
NPV	Net Present Value
IRR	Internal Rate of Return
ROI	Return on Investment
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.

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 a severely lagging power factor. This means loss and wastage of energy and due to which heavy penalties imposed by state electricity boards. Control of power factor would be possible by installation of some additional capacitor and automatic power factor control (APFC) in the unit.

Improvement in power factor near to unity with the installation of some additional capacitors helps in reducing the electricity bill amount by availing the benefit of incentive on improving the power factor from the Punjab State Electricity Board.

Project implementation will lead to reduction in electricity bill by ` 0.39 Lakh per year however; this intervention will not have any effect on the existing consumption pattern of electricity.

This DPR highlights the details of the study conducted for assessing the potential for installation of capacitor, possible rebate in electricity bill, 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)	0.167
2	Monetary benefit	`(in lakh)	0.39
3	Debit equity ratio	Ratio	3 : 1
4	Simple payback period	Months	6
5	NPV	`(in lakh)	1.07
6	IRR	%age	206.41
7	ROI	%age	36.53
8	DSCR	Ratio	7.36
9	Process down time	Days	Nil

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:

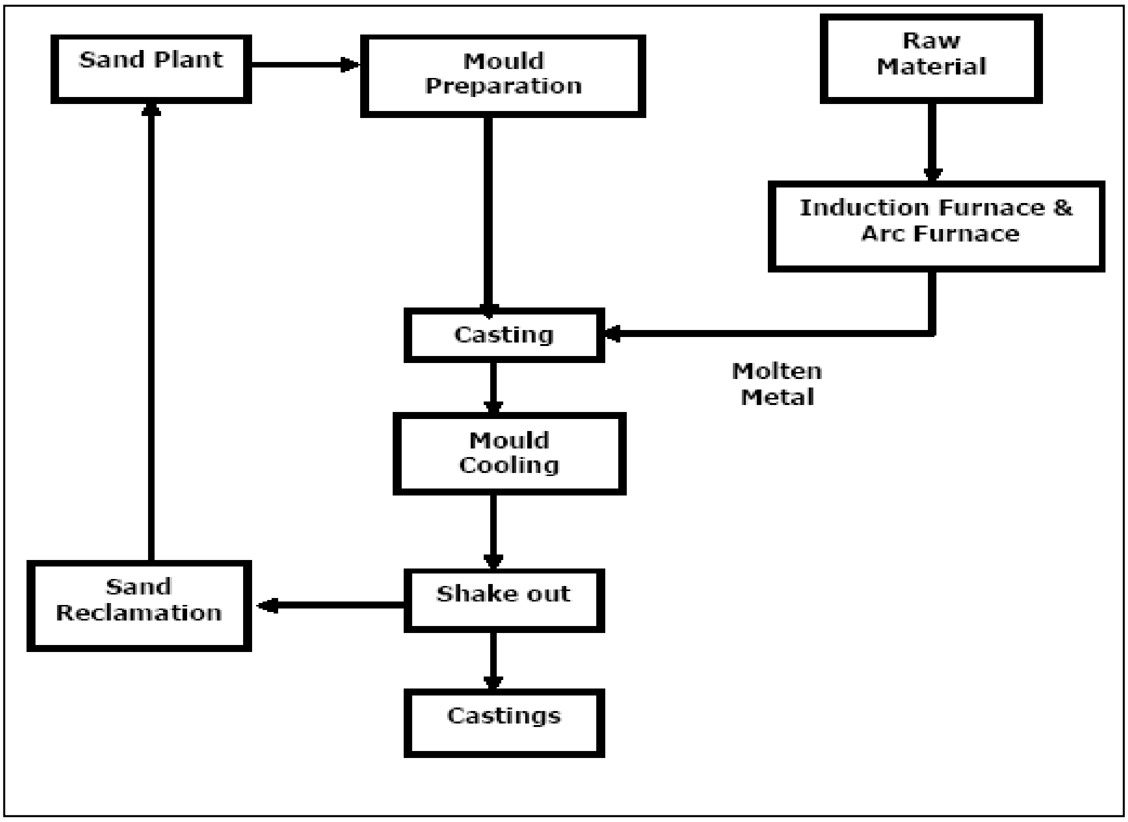

Figure 1.1: Process Flow diagram of a Foundry Cluster

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;

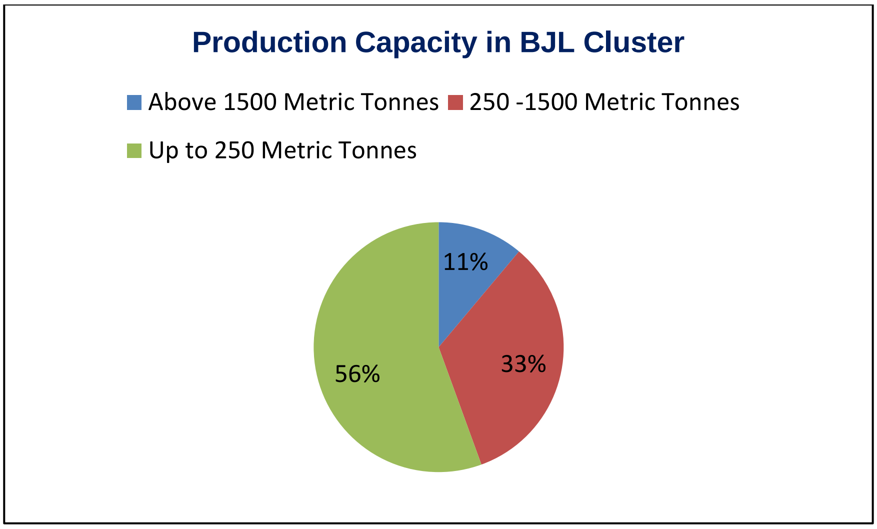

Figure 1.2: Production Capacity BJL Foundry cluster

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	0.6 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

Foundry Industry had taken the electricity connection from the Punjab State Electricity Board. The electricity supply coming to the industries is of High Tension (HT) category where Induction furnaces are installed and Low Tension (LT) where Cupola or Rotary furnaces are used for casting. In HT connection, electricity bill is to be paid on the basis of two part tariff. This means that the industries have to pay the charges for the maximum demand and the electricity consumption (units) for that month. Other taxes are paid as applicable. State electricity board is providing incentive on improvement of power factor. Electricity is supplied from the generating station in the form of kVA. Power factor is the ratio of active power (kW) to apparent power (kVA). If the power factor is near the unity, this means that consumers are utilizing the power receiving from the state electricity board as the active power. Punjab State Electricity Board provides the incentives on the demand and energy charges to the consumers for maintaining the power factor above 0.90. The percentage of incentive increases with every increase in power factor above 0.90. If the power factor falls less than 0.80 then consumer has to pay the penalty according to the applicable tariff.

1.4 Establishing the Baseline for the Proposed Technology

Presently almost all the Foundry plants at Batala, Jalandhar and Ludhiana are operating at power factor 0.96. They are not getting the full benefit of incentive at this power factor from the PSEB. If the power factor falls less than 0.80 then they have to pay the penalty according to the applicable tariff.

Table 1.4: Base line for proposed technology

S.No	Parameters	Details
1	Total Electrical load	550 kW
2	Existing power factor	0.96
3	Operating hours in a day	10 hrs
4	Annual Operating days	300
5	Monthly Electricity Bill (Shiv Forgings)	` 4.3 Lakh

1.5 Barriers in adoption of propose technology

1.5.1 Technological Barrier

- Lack of awareness and information of the available benefits in terms of incentives on the total electricity bill as per the tariff provided by PSEB
- Due to lack of technical knowledge and expertise, power factor is not properly monitored in the Foundry plants even after the installation of the required number of capacitors.
- 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 ` 0.17 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

Existing scenario of power factor in Foundry units of Batala, Jalandhar and Ludhiana is not poor but units are not getting the full benefit of incentive at this power factor from the PSEB. Even they have installed some capacitors for the improvement of power factor but maintenance and monitoring of the capacitors is not good. In this cluster unit various process working under different load condition so that it is not easier to maintain power factor with the help of those installed capacitor. In different type of loading condition, improvement in power factor to unity can be achieved with the installation of some additional capacitors if required and the installation of APFC panel which will helps in reducing the electricity bill amount by availing the benefit of incentive on improving the power factor. In the foundry units, presently some capacitors are already installed during the plant setup, but with the rise in load to increase the production capacity, the plant owner has not installed the additional required capacitors. It is difficult for the technicians to maintain the power factor at unity in absence of required number of capacitor and APFC panel. If the reactive power is provided in excess than the requirement, then the plant has to pay penalty for that to state electricity board. Therefore, it is very important to provide the reactive power to the unit according to the load conditions of the plant. For that the implementation of capacitors with APFC panel is very important. APFC panel switches ON and OFF the capacitors according to the requirement and maintain the power factor to unity. So that by installing APFC panel, plant can maintain the power factor for respective lagging load. It will not require manual operation as it automatically select capacitor bank as per requirement.

In a purely resistive AC circuit, voltage and current waveforms are in step (or in phase), changing polarity at the same instant in each cycle. All the power entering the loads is consumed where reactive loads are present, such as with capacitors or inductors, energy storage in the loads result in a time difference between the current and voltage waveforms. During each cycle of the AC voltage, extra energy, in addition to any energy consumed in the load, is temporarily stored in the load in electric or magnetic fields, and then returned to the power grid a fraction of a second later in the cycle. The "ebb and flow" of this nonproductive power increases the current in the line. Thus, a circuit with a low power factor will use higher currents to transfer a given quantity of real power than a circuit with a high power factor. A linear load does not change the shape of the waveform of the current, but may change the relative timing (phase) between voltage and current.

Circuits containing inductive or capacitive elements (electric motors, solenoid valves, lamp ballasts, and others) often have a power factor below unity.

Power factor is the ratio of actual power (kW) to the apparent power (kVA). The apparent power (kVA) is defined by the following formula,

Apparent power = Sqrt (kW^2 + $kVAR^2$)

kVAR is the reactive power; from the above formula if less power factor indicates that supply of the reactive power is high compared to active power, which contributes useful work of the system. High reactive power indicates that higher reactive current and increases the I^2R losses of the network. Capacitor is a device that generates reactive current and consumes very less power. Installing capacitor will improve the power factor and will also reduce the KVA demand of the system and will increase the capacity of the network that is the network cables can be loaded further. Reduction in reactive current will result in reduction of I^2R losses and efficiency of the system will improve.

As per electricity board, with increase in Power factor above 0.90 gives incentives of 0.25% on monthly electricity bill on every 1% increase of power factor. Since power factor proposed to be improving from 0.96 to 0.99 hence, total incentive would be 0.75% in electricity bill.

Since unit have already installed some capacitor and APFC panel which is not sufficient to maintain the power factor near to unit. Hence, only some additional capacitor would be required because unit have already installed sufficient capacity of APFC panel. Required capacity of capacitor is calculated by following formula;

Required KVAR = Load (kW) x [{tan ($\cos^{-1}$ PFi)} – {tan ($\cos^{-1}$ PFf)}]

Where,
PFi is initial power factor maintained by the unit
PFf is final power factor proposed for the unit

Table 2.1: Capacity of proposed technology

S.No	Parameters	Details
1	Total Electrical load	550 kW
2	Existing power factor	0.96
3	Proposed power factor	0.99
4	Required additional kVAR	83 kVAR

2.1.2 Technology Specification

For implementation of the proposed project, additional capacitors only have to be put. APFC panel is already installed in the foundry plant.

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 all the industries.

Punjab State Electricity Board provides incentives for good power factor (PF>0.90) and penalty for bad PF (PF<0.80). For units with Induction Furnaces the power factor has to be maintained above 0.95. Most of the plants have scope for improving power factor. Power factor is improved by the installation of capacitors and replacement of the existing de-rated capacitors. This technology is;

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

2.1.4 Availability of Technology

Suppliers of the capacitors along with APFC panel are easily available at the Punjab. Local service providers are also available at Punjab. More details of service provider are given in annexure 5.

2.1.5 Source of Technology

The main source which has taken the initiative to create the awareness for implementation of this project by providing the benefit to the consumers in terms of rupees is the State Electricity Distribution Board. By providing incentive on improving the power factor to the consumers the State Electricity Distribution Board is promoting the awareness on importance of power factor improvement.

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 capacitors 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

Proposed technology can be implemented in any units where power factor is less than unity. For estimation of the saving potential on implementation of this project, here the Foundry plant engaged in producing castings having present power factor of about 0.96 is considered.

3 ECONOMIC BENEFITS FROM PROPOSED TECHNOLOGY

3.1 Technical Benefits

3.1.1 Electricity savings per year

Improvement in power factor to unity will not result in savings in electricity consumption in foundry plant. But it helps to get the savings in the electricity bill as a rebate of about 0.75% on total electricity bill by improving the power factor to from 0.96 to 0.99.

3.1.2 Improvement in product quality

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

3.1.3 Increase in production

This project is not contributing for increasing in production in Foundry plant.

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	Existing power factor	0.96
2	Proposed power factor	0.99
3	Total percentage rebate	0.75%
4	Present monthly electricity monthly bill	` 4.3 lakh
5	Average annual electricity bill	` 51.6 lakh
5	Annual saving in electricity bill after project implementation	` 38700

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 operator will definitely improve. Training on the regular maintenance and checking of the capacitors to maintain the unity power factor helps in improving the technical understanding of the workers.

3.4 Environmental Benefits

If PF is improved it reduces KVA consumption of the plant (due to reduced KVAR consumption) which is provided by the capacitor banks and hence reduced kVA generation by the power plant, leading to reduced fuel consumption and hence leading to overall GHG reduction.

4 INSTALLATION OF THE PROPOSED TECHNOLOGY

4.1 Cost of Technology Implementation

4.1.1 Technology Cost

Cost of the equipment is about ` 10375 (@ ` 125/kVAR) which includes the cost of the capacitors only as per the quotation provided by the vendors at Annexure 6.

4.1.2 Other Cost

Other costs required will be ` 2300 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 (`)
1	Equipment cost	10375
2	All applicable taxes	1300
3	Misc	5000
4	Total Cost	16675

4.2 Arrangements of Funds

4.2.1 Entrepreneur's Contribution

Entrepreneur will contribute 25% of the total project cost which is ` 0.04 Lakh.

4.2.2 Loan Amount

Remaining 75% cost of the proposed project will be borrowed from bank which is ` 0.13 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 6 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 2 % 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 ` 0.167 Lakh and monetary savings due to reduction in electricity consumption is ` 0.39 Lakh hence, the simple payback period works out to be 6 months.

4.3.3 Net Present Value (NPV)

The Net present value of the investment at 10% works out to be ` 1.07 Lakh.

4.3.4 Internal Rate of Return (IRR)

The after tax Internal Rate of Return of the project works out to be 206.41%. 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 36.53%.

Table 4.2 Financial Indicators of Proposed Technology

S No	Particular	Unit	Value
1	Simple Payback	Months	6
2	NPV	` In Lakh	1.07
3	IRR	%age	206.41
4	ROI	%age	36.53

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 monetary savings by 5%)
- Pessimistic scenario (Decrease in monetary 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	195.14	1.01	36.47	6.99
Base	206.41	1.07	36.53	7.36
Optimistic	217.70	1.13	36.58	7.73

4.5 Procurement and Implementation Schedule

Procurement and implementation schedule required for implementation of this technology is about 7 weeks and 2 to 3 hours required as a process break down. 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	Total Electrical load	550 kW
2	Existing power factor	0.96
3	Operating hours in a day	10 hrs
4	Annual Operating days	300
5	Monthly Electricity Bill (Shiv Forgings)	` 4.3 Lakh

Annexure -2: Detailed Technology Assessment Report

S. No.	Particular	Details
1	Existing power factor	0.96
2	Proposed power factor	0.99
3	Total percentage rebate	0.75%
4	Present monthly electricity monthly bill	` 4.3 lakh
5	Average annual electricity bill	` 51.6 lakh
6	Annual saving in electricity bill after project implementation	` 38700
7	Total investment required	` 16675
8	Simple payback period	6 months

Annexure -3: Detailed Financial Calculations

Assumptions

Name of the Technology	Power factor Improvement		
Rated Capacity	83 kVAR		
Details	**Unit**	**Value**	**Basis**
Installed Capacity	kVAR	83	
No of working days	Days	300	
Proposed Investment			
Equipment cost	` (in lakh)	0.104	
Taxes	` (in lakh)	0.013	
Other cost	` (in lakh)	0.05	
Total Investment	` (in lakh)	0.167	
Financing pattern			
Own Funds (Equity)	` (in lakh)	0.04	Feasibility Study
Loan Funds (Term Loan)	` (in lakh)	0.13	Feasibility Study
Loan Tenure	Years	3.00	Assumed
Moratorium Period	Months	3.00	Assumed
Repayment Period	Months	39.00	Assumed
Interest Rate	%age	10.00%	
Estimation of Costs			
O & M Costs	% on Plant & Equip	2.00	Feasibility Study
Annual Escalation	%age	5.00	Feasibility Study
Estimation of Revenue			
Rebate in electricity bill	` (in lakh)	0.387	
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	0.13	0.02	0.10	0.01
2	0.10	0.05	0.05	0.01
3	0.05	0.05	0.01	0.00
4	0.01	0.01	-0.01	0.00
		0.13		

WDV Depreciation **` (in lakh)**

Particulars / years	1	2
Plant and Machinery		
Cost	0.05	0.01
Depreciation	0.04	0.01
WDV	0.01	0.00

Projected Profitability `(in lakh)

Particulars / Years	1	2	3	4	5	6
Fuel savings	0.39	0.39	0.39	0.39	0.39	0.39
Total Revenue (A)	0.39	0.39	0.39	0.39	0.39	0.39
Expenses						
O & M Expenses	0.001	0.001	0.001	0.001	0.001	0.001
Total Expenses (B)	0.001	0.001	0.001	0.001	0.001	0.001
PBDIT (A)-(B)	0.386	0.386	0.386	0.386	0.386	0.386
Interest	0.014	0.008	0.003	0.000	0.000	0.000
PBDT	0.372	0.378	0.383	0.386	0.386	0.386
Depreciation	0.003	0.003	0.003	0.003	0.003	0.003
PBT	0.369	0.375	0.380	0.383	0.383	0.383
Income tax	0.000	0.126	0.130	0.131	0.131	0.131
Profit after tax (PAT)	0.369	0.250	0.250	0.252	0.252	0.252

Computation of Tax `(in lakh)

Particulars / Years	1	2	3	4	5	6
Profit before tax	0.37	0.38	0.38	0.38	0.38	0.38
Add: Book depreciation	0.00	0.00	0.00	0.00	0.00	0.00
Less: WDV depreciation	0.04	0.01	-	-	-	-
Taxable profit	0.33	0.37	0.38	0.39	0.39	0.39
Income Tax	-	0.13	0.13	0.13	0.13	0.13

Projected Balance Sheet `(in lakh)

Particulars / Years	1	2	3	4	5	6
Share Capital (D)	0.04	0.04	0.04	0.04	0.04	0.04
Reserves & Surplus (E)	0.37	0.62	0.87	1.12	1.37	1.62
Term Loans (F)	0.10	0.05	0.01	-0.01	-0.01	-0.01
Total Liabilities (D)+(E)+(F)	0.51	0.71	0.92	1.16	1.41	1.66
Assets	**1**	**2**	**3**	**4**	**5**	**6**
Gross Fixed Assets	0.05	0.05	0.05	0.05	0.05	0.05
Less Accm. Depreciation	0.00	0.01	0.01	0.01	0.01	0.02
Net Fixed Assets	0.05	0.04	0.04	0.04	0.04	0.03
Cash & Bank Balance	0.46	0.67	0.87	1.12	1.37	1.63
TOTAL ASSETS	0.51	0.71	0.92	1.16	1.41	1.66
Net Worth	0.41	0.66	0.91	1.16	1.41	1.67
Debt Equity Ratio	2.42	1.27	0.12	-0.17	-0.17	-0.17

Projected Cash Flow

` (in lakh)

Particulars / Years	***0***	***1***	***2***	***3***	***4***	***5***	***6***
Sources							
Share Capital	0.04	-	-	-	-	-	-
Term Loan	0.13						
Profit After tax		0.37	0.25	0.25	0.25	0.25	0.25
Depreciation		0.00	0.00	0.00	0.00	0.00	0.00
Total Sources	0.17	0.37	0.25	0.25	0.25	0.25	0.25
Application							
Capital Expenditure	0.05						
Repayment Of Loan	-	0.02	0.05	0.05	0.01	0.00	0.00
Total Application	0.05	0.02	0.05	0.05	0.01	0.00	0.00
Net Surplus	0.12	0.35	0.20	0.20	0.24	0.25	0.25
Add: Opening Balance	-	0.12	0.46	0.67	0.87	1.12	1.37
Closing Balance	0.12	0.46	0.67	0.87	1.12	1.37	1.63

IRR

` (in lakh)

Particulars / months	***0***	***1***	***2***	***3***	***4***	***5***	***6***
Profit after Tax		0.37	0.25	0.25	0.25	0.25	0.25
Depreciation		0.00	0.00	0.00	0.00	0.00	0.00
Interest on Term Loan		0.01	0.01	0.00	0.00	-	-
Cash outflow	(0.17)	-	-	-	-	-	-
Net Cash flow	(0.17)	0.39	0.26	0.26	0.25	0.25	0.25
IRR	206.41%						
NPV	1.07						

Break Even Point

` (in lakh)

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***
Variable Expenses						
Oper. & Maintenance Exp (75%)	0.001	0.001	0.001	0.001	0.001	0.001
Sub Total*(G)*	0.001	0.001	0.001	0.001	0.001	0.001
Fixed Expenses						
Oper. & Maintenance Exp (25%)	0.000	0.000	0.000	0.000	0.000	0.000
Interest on Term Loan	0.014	0.008	0.003	0.000	0.000	0.000
Depreciation *(H)*	0.003	0.003	0.003	0.003	0.003	0.003
Sub Total (I)	0.017	0.011	0.006	0.003	0.003	0.003
Sales (J)	0.387	0.387	0.387	0.387	0.387	0.387
Contribution (K)	0.386	0.386	0.386	0.386	0.386	0.386
Break Even Point (L= G/I)	4.41%	2.80%	1.56%	0.77%	0.76%	0.77%
Cash Break Even {(I)-(H)}	3.72%	2.12%	0.88%	0.08%	0.08%	0.08%
Break Even Sales (J)*(L)	0.017	0.011	0.006	0.003	0.003	0.003

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

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***Total***
Net Profit Before Taxes	0.37	0.38	0.38	0.38	0.38	0.38	2.27
Net Worth	0.41	0.66	0.91	1.16	1.41	1.67	6.23
							36.53%

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

Particulars / Years	***1***	***2***	***3***	***4***	***5***	***6***	***Total***
Cash Inflow							
Profit after Tax	0.37	0.25	0.25	0.25	0.25	0.25	1.12
Depreciation	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Interest on Term Loan	0.01	0.01	0.00	0.00	0.00	0.00	0.03
Total (M)	0.39	0.26	0.26	0.25	0.25	0.25	1.16

DEBT

Interest on Term Loan	0.01	0.01	0.00	0.00	0.00	0.00	0.03
Repayment of Term Loan	0.02	0.05	0.05	0.01	0.00	0.00	0.13
Total (N)	0.04	0.06	0.05	0.01	0.00	0.00	0.16
	10.12	4.65	5.00	21.18	0.00	0.00	7.36
Average DSCR (M/N)	7.36						

Annexure:-4 Procurement and implementation schedule

Procurement and Implementation Schedule

S. No.	Activities	Weeks						
		1	2	3	4	5	6	7
1	Identification of faulty or less capacitors							
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
Capacitor Banks	ABB Ltd	Mr. Neeraj Verma Contact No: 09878613484
Capacitor Banks	Naac Energy Control (p) Ltd	Mr. Chander M. Kapoor Contact No:09811199085
Capacitor Banks	Havells India	Mr. Chandar Subhash Mall Mandi, Batala Contact No: 01871243110
Capacitor Banks	Dhamija Trading Co	Mr. Manmeet Singh Bhagwan Chowk, Jalandhar

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

STANDARD CAPACITORS
B-70/43, DSIDC complex, Lawrence Road Industrial area, Delhi-110 035
Ph.: 27181490, 27101958, 27151027 Fax: 011-25257151 E mail: standcap @ gmail.com

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SG/S/200/5645
July 28, 2011

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