DETAILED PROJECT REPORT
ON
ENERGY EFFICIENT VERTICAL AGITATOR (32000 LITER)

(AHMEDABAD CHEMICAL CLUSTER)











ENERGY IS LIFE
BEE
CONSERVE IT

Bureau of Energy Efficiency

Prepared By

WINROCK INTERNATIONAL INDIA

Reviewed By

ISTSL

ENERGY EFFICIENT VERTICAL AGITATOR (32000 LITER)

AHMEDABAD CHEMICAL CLUSTER

BEE, 2010

Detailed Project Report on Energy Efficient Vertical Agitator (32000 Liter)

Chemical SME Cluster, Ahmedabad, Gujarat (India)

New Delhi: Bureau of Energy Efficiency;

Detail Project Report No. ***AMD/CHM/EAS/10***

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

We are sincerely thankful to the Bureau of Energy Efficiency, Ministry of Power, for giving us the opportunity to implement the 'BEE SME project in "Ahmedabad Chemical Cluster". We express our sincere gratitude to all concerned officials for their support and guidance during the conduct of this exercise.

Dr. Ajay Mathur, Director General, BEE

Smt. Abha Shukla, Secretary, BEE

Shri Jitendra Sood, Energy Economist, BEE

Shri Pawan Kumar Tiwari, Advisor (SME), BEE

Shri Rajeev Yadav, Project Economist, BEE

Winrock International India(WII) is also thankful to "Green Environment Co-operative Society, Vatva" for their valuable inputs, co-operation, support and identification of the units for energy use and technology audit studies and facilitating the implementation of BEE SME program in Ahmedabad Chemical Cluster.

We take this opportunity to express our appreciation for the excellent support provided by Chemical Unit Owners, Local Service Providers, and Equipment Suppliers for their active involvement and their valuable inputs in making the program successful and in completion of the Detailed Project Report (DPR).

WII is also thankful to all the SME owners, plant in charges and all workers of the SME units for their support during the energy use and technology audit studies and in implementation of the project objectives.

Winrock International India

New Delhi

Contents

List of Annexure

List of Tables

List of Figures

List of Abbreviations

MT	Metric Tonne
kWh	kilo Watt Hour
GoI	Government Of India
MoMSME	Ministry of Micro Small and Medium Enterprises
GHG	Green House Gas
BEE	Bureau of Energy Efficiency
DPR	Detailed Project Report
O&M	Operational & Maintenance
NPV	Net Present Values
ROI	Return on Investment
IRR	Internal Rate Of Return
DSCR	Debt Service Coverage Ratio
PBT	Profit Before Tax
PAT	Profit After Tax
ID	Induced Draft
FD	Forced Draft
DBT	Dry Bulb Temperature
SIDBI	Small Industries Development Bank of India

EXECUTIVE SUMMARY

Winrock International India is executing BEE-SME program in Ahmedabad chemical Cluster, supported by Bureau of Energy Efficiency (BEE) with an overall objective of improving the energy efficiency in cluster units.

Ahmedabad chemical cluster is one of the largest chemical 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 chemical clusters in India.

The main energy forms used in the cluster units are wood. Wood is used as fuel in hot air generator for drying process. The cost incurred in the drying process constitutes major portion in the overall energy cost in majority of chemical industries in Ahmedabad cluster.

Agitator System in chemical industry is situated in the reaction vessel for the uniform stirring of chemicals considering the viscosity, specific gravity of the material etc. Stirring consumes around 45% of the total energy and is the most time consuming process being slow in nature. Apart from time and energy, final product quality is also matter of concern.

During technology use and energy audit studies in various chemical industries in Ahmedabad Chemical cluster, it was observed that most of the Chemical units are using energy consuming horizontal agitator system for stirring of raw material and it is found to have more losses and low efficiency

Energy Efficient Vertical Agitator are fixed at the top part of the tank and there shaft is inserted for vertically for use. As it is direct driven the transmission losses are zero. Thus reduces the operating and capital cost. Implementation of proposed machine would save about 71625 kWh of electricity per year.

This DPR highlights the details of the study conducted for assessing the potential for replacement of conventional horizontal agitator machine by new vertical agitator machine , 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 below:

S.No	Particular	Unit	Value
1	Project cost	₹(in Lakh)	4.61
2	Electricity saving	kWh/year	71625
3	Monetary benefit	₹(in Lakh)	3.87
4	Debit equity ratio	Ratio	3:1
5	Simple payback period	years	1.19
6	NPV	₹(in Lakh)	9.81
7	IRR	% age	64.46
8	ROI	% age	28.02
9	DSCR	Ratio	3.46
10	Process down time	Days	7
11	CO_2 reduction	Tons/year	60

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

ABOUT BEE'S SME PROGRAM

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

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

Activity 1: Energy use and technology audit

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

Activity 2: Capacity building of stake holders in cluster on energy efficiency

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

Ahmedabad city and its surrounding areas have various types of chemical SME units like dyes, dye Intermediates and pigments manufacturing units. All these chemical manufacturing units are located at Vatva, Naroda and Odhav industrial areas. There are about 500 chemical units in Vatva, 60 units in Naroda and 40 units in Odhav. Most of manufacturing units in these areas are in operation from last 10 to 15 years.

Ahmedabad chemical cluster like many other SME clusters, were in a dire state in regard to the energy efficiency and conservation. In almost all units, whether big or small, there had been no conscious efforts to take up energy conservation and energy efficiency measures as a part of day to day operations. In majority of cases, the small scale entrepreneur are not even aware of the measures that could bring down the energy cost, which will automatically have positive bearing on the overall manufacturing cost. Some of the bigger units had experimented with few parameters to improve the energy efficiency in the units, but the results and outcome were confined to them only. All the units in cluster have been operating in traditional conditions and most of the equipments in cluster were procured from the local suppliers, who are fabricating / manufacturing the equipments on basis of their age old expertise / technology.

These units are using various types of raw material such as Sulphuric acid, Hydrochloric acid, Acetylic acid, Chlorine gas, Benzene, Sodium nitrate, Ethylene, Ammonia, Disulphonic-acid, Copper, Chlorine, Ammonia and Potassium sulphate etc, The nature of raw material depends on their final product manufactured in the unit. All these raw materials are being procured from local suppliers/traders or bought from neighboring states. There are various types of chemical products manufacturing in cluster, few of them are DASDA, Alpha & Beta Pigment, Reactive dyes, Acid dyes, and direct dyes. In fact majority of the chemical units in these clusters manufacture two or three different types of chemical related products as per the market requirements.

1.1.1 Existing production process

The main production process used in chemical industry which is followed in the entire cluster with minor changes according to the requirement are shown in Figure 1.1 below:

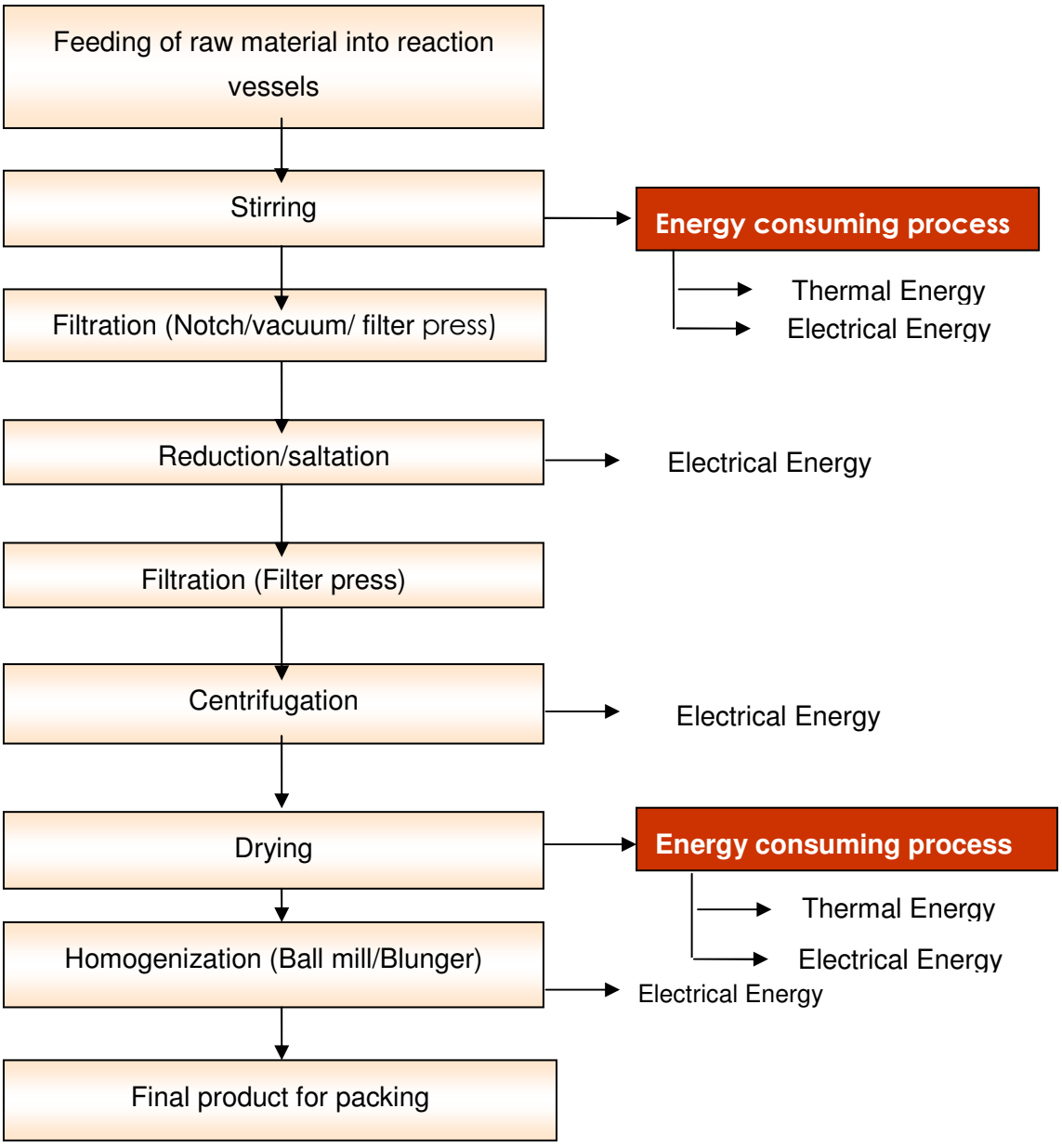


Figure 1.1: Process flow chart

The production process as depicted in the above chart is typical to almost all the chemical units in the Ahmedabad chemical cluster. However, depending on the final product, quality of final product and the attributes of the raw material, the above stated process flow is altered to suit the requirement of the unit.

1.2 Energy Performance in Ahmedabad chemical cluster

Majority of the industries located in Ahmedabad are engaged in manufacturing of different types of chemicals. Different chemical units in the Ahmedabad chemical cluster is using the different types of energy sources including electricity and fuels such as wood, natural gas, biomass & coal depending on technology, process requirement, availability, economic and safety point of view. There are two forms of energy used in manufacturing of chemicals in typical chemical units in Ahmedabad cluster; electrical and thermal energy. Electrical energy is being used in operation of equipment & other electrical utilities and thermal energy is being used in process and drying applications. Energy cost is representing around 10-15 percent of manufacturing cost in a typical manufacturing unit, out of which thermal energy costs around 60 percent of the total energy cost and remaining accounts for electrical energy. In majority of the units in the Ahmedabad chemical cluster wood is used for thermal energy generation due to its easy availability at economical cost.

Annual energy consumption and average production of a typical chemical manufacturing unit are given in Table 1.1 below:

Table 1.1 Annual Energy consumption and production

S.No	Particular	Unit	Value
1	Electricity consumption	kWh	130000
2	Wood consumption	MT	350
3	Production	kg	110

1.2.1 Specific energy consumption

Specific electrical and thermal energy consumption in chemical unit is varying on the final product manufactured in that unit. Specific electrical and thermal energy consumption in a typical chemical is shown in Table 1.2 below:

Table 1.2 Specific energy consumption of a typical unit

S.No.	Particular	Unit	Value
1	Electricity	kWh/kg of product	1.2
2	Fuel	Kg of wood/kg of product	3.0

1.3 Identification of existing technology/ equipment

1.3.1 Description of equipment

During technology use and energy audit studies in various chemical industries in Ahmedabad Chemical cluster, it was observed that most of the Chemical units are using energy consuming horizontal agitator system for stirring of raw material and it is found to have more losses and low efficiency. Performances of various agitator systems were evaluated and analysed in Ahmedabad Chemical units.

Figure1.2 Conventional Horizontal Agitator System at Typical Chemical Unit

From energy use and technology gap audit studies in various chemical units of Ahmedabad chemical cluster, the following were observed/ identified:

- Energy efficiency improvement opportunities
- Environment and safety improvement of workers
- Design flaws in the conventional agitator
- Operational & maintenance practices in conventional agitator

1.3.2 Technical gap in conventional horizontal agitaor system

Technology gaps/design flaws in conventional horizontal agitator system are identified and described in details below:

- **High transmission losses**

In horizontal agitator system almost 20% of energy is wasted in the transmission system. This can be avoided by using energy efficient direct drive transmission system instead of

belt driven gear system in horizontal agitator system. This automatically reduces the size of the motor that in turn reduces the operational and capital cost of drive.

- **Long mixing time of chemicals in Reaction vessels:**

Due to poor design of impeller system in agitator system mixing time of chemicals in reaction vessels is more.

- **Poor quality of final product:**

Poor mixing of various chemicals in reaction vessels causes the inferior quality of final product.

- **Poor heat & mass transfer of material in Reaction vessel:**

Conventional agitator systems are not designed for specific viscosity and specific gravity of particular material; this causes the poor heat & mass transfer in conventional agitator system.

- **Poor efficiency of gear system:**

Conventional gears being used in horizontal agitator system has poor efficiency compared planetary gear system.

- **Poor design of drive system**:

Majority of the industries being used bigger size of drives in reaction vessel, this can be reduced by proper selection of suitable impeller in agitator system, material of impeller system, reduction of transmission losses, use of energy efficient gear system and vertical mounting of drive system.

1.3.3 Technical Specification of existing system

Technical specification of existing horizontal agitator system is furnished in Table 1.3 below:

Table 1.3 Technical Specification of horizontal agitator

S. No	Details	Units	Value
1	Capacity of agitator	Liters	7000
2	Diameter of impeller	inch	2.5
3	Radius of impeller	inch	1.25
4	Height of agitator	m	3.2
5	Speed of impeller	RPM	100

6	Motor rating	HP	15
7	Rated Speed	RPM	200
8	Input power of motor	kW	8.5
9	Power delivered by motor to impeller	kW	7.04

1.3.4 Role in the process

The conventional horizontal agitator system in chemical industry is situated in the reaction vessel for the uniform stirring of chemicals considering the viscosity, specific gravity of the material etc. Stirring consumes around 45% of the total energy and is the most time consuming process being slow in nature. Apart from time and energy, final product quality is also matter of concern.

1.3.4 Need for up gradation of existing equipment

From the above sections it is clear that stirring cost is one of the major costs in the overall production process of chemicals, in typical chemical industry which comes out to be 5.4 ₹/kWh, this is approximately 45% of overall energy cost. Apart from the energy cost, stirring time is one of the major time consuming area in overall production process of chemicals, in typical chemical industry this would be around 2 hours.

Advantages of replacing the conventional agitator system with Energy Efficient agitator system are:

- Reduction in electric energy consumption
- Improved productivity and product quality
- Reduction in production cost
- Saving in stirring time, it automatically leads to energy savings
- Saves energy in replacing the conventional motors with energy efficient ones
- Improved drive transmission efficiency (Directly connected instead of belt drive)
- Saves energy in replacing the conventional truck gear system with energy efficient planetary gear system.
- Improved percentage loading of the motors, this will improves the efficiency
- Improved power factor

1.4 Baseline energy consumption of existing equipment

Energy consumption in agitator system would depend on below mentioned things:

- Stirring time and temperature
- Critical parameter's like viscosity, specific gravity of material
- Operational and maintenance practices in agitator system.
- Unit of electric power

Energy use and technology audit studies were conducted in various units of Ahmedabad chemical cluster to establish the baseline energy consumption of agitator and the reports of same are attached in annexure 1.

1.4.1 Design and operating parameters

Major operating parameters to improve agitator system performance are:

- Gear Box system
- Motor unit
- Size of storage and drive
- Temperature of liquor.
- Size of impeller

1.4.2 Energy consumption in existing agitator

The electrical energy consumed by the existing horizontal agitator machine in process of total 7000 liters is 8.5 kW and operated for 12 hours in a day.

Performance of various agitators system was evaluated and same is presented in Annexure 1.

1.4.3 Energy audit methodology

Predefined methodology was adopted to evaluate the performance of agitator system, same was furnished below:

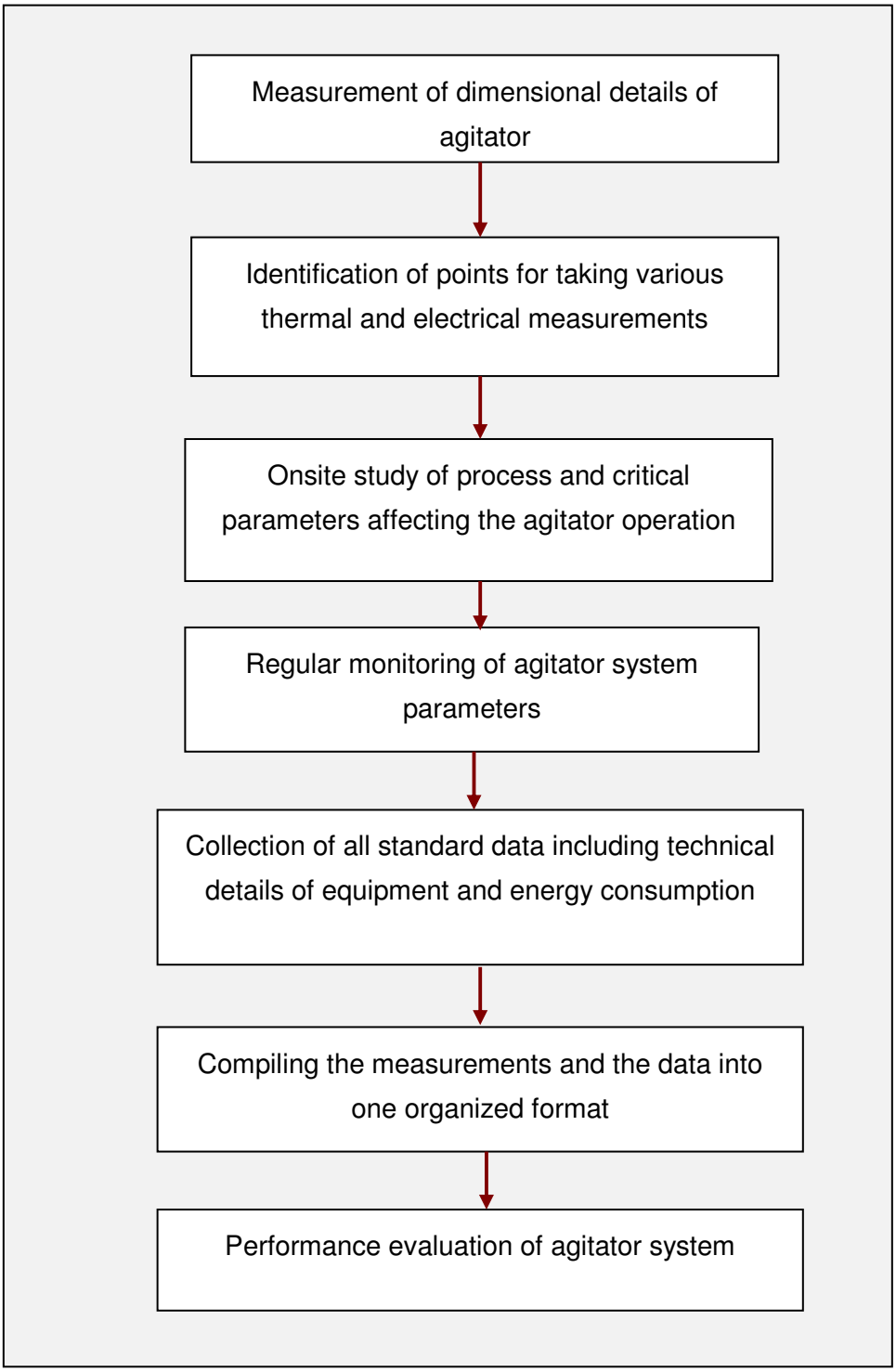


Figure1.3 Energy Audit Methodology

1.5 Barriers in adoption of proposed technology/equipment

The processes to do with technology and innovations in SMEs are different from those that take place the large firm context. Technology in the SME sector has an increasingly complex or combinative characters, most of the SMEs units in cluster are regarded for their labour intensive and the capability to work with local resources. In the past, SME entrepreneurs have stressed less emphasis on technology due to cut the initial cost of plant /machinery. Major barriers in the up gradation of technology in the cluster are non availability of technology; distrust on technology supplier, lack of information about energy efficiency among small and medium enterprises still persists, preventing increased adoption of efficient technologies and non availability of skilled manpower and cost of new technologies. Details of the other barriers in the implementation of energy efficient technologies/equipments in the Ahmedabad Chemical cluster are presented in following sections:

1.5.1 Technological Barrier

Majority of the Chemical units entrepreneurs in Ahmedabad chemical cluster do not have any in-depth technical expertise and knowledge on energy efficiency, and are dependent on local technology suppliers or service companies, which normally also rely on established and commonly used technology. The lack of technical know-how made it also impossible for the chemical unit owners to identify the most effective technical measures.

One of the main barriers that prevented implementation of energy efficiency measures/technology up gradation projects in the Ahmedabad Chemical cluster are lack of awareness and information on the energy efficiency & energy efficient technologies. Most of chemical units in Ahmedabad chemical cluster have been established several years ago when energy efficiency was not important issue for the operation of a plant and therefore operating with outdated technology and low end technologies. Since around 15-20 years same technologies in various processes/utilities are continuing in most of the chemical industries in Ahmedabad Chemical cluster.

Core business of the SME owners is focused on uninterrupted production of the plant by conducting necessary repair work at lowest costs, than on investing in new technology. From the point of view of the operators the direct effect on income from a constant or increased production is much more important for the economic viability of the plant, than benefits in form of future savings due to efficiency measures. Maintaining the equipment requires additional efforts, organizational capacity and technical know-how not related to the core business, all together resulting in additional costs. Therefore, even if they were aware of the benefits many chemical unit owners are shied away from such measures or

investments. This short term view is strongly influenced by uncertainties described under the barrier of limited financial resources. Investments in replacing single still operational equipment are therefore seen as a rather unnecessary expenditure, and short-term planning has higher priority than sustainable long-term issues.

As the majority of the Entrepreneurs in cluster are not aware of the energy losses in the plant, there may be a strong feeling that the energy efficiency initiatives in manufacturing facility can have a cascading or domino effect of failure in critical production areas directly or indirectly connected if the intended performance of the replaced / retrofitted equipment falls below design values.

There is a strong feeling in the owners, that energy efficiency initiatives is a challenge to take the risk of such as business interruption due to production loss against the drive to save energy. These are however can be overcome by motivating them to attend the awareness programs and detailed report on the benefits of the measures identified and cost benefit analysis. Further, sourcing of expertise on maintenance service provider or training by the equipment supplier will definitely overcome the barriers.

1.5.2 Financial Barrier

Significant amount of investment is not commonly seen in SME industry sectors in India. Further, from the business perspective for any industry owner, it is more viable, assured and convenient to invest on project expansion for improving the production capacity or quality, rather than make piecemeal investment in retrofit and replace options for energy savings. Investment returns on large capacity addition or technology adoption shows up prominently in terms of savings and helps in benchmarking operations. Further, there is a strong feeling among the industry owners that, energy conservation-initiatives of replacement and retrofit nature is not a common practice as it involves large capital investment against low returns. In view of this and given the limited financial strength of the chemical units it is clear that the industry owners would not have taken up the risks and invest in energy efficiency measures.

1.5.3 Skilled manpower

The availability of the skilled manpower in the industry is one of the major barriers in the Ahmedabad chemical cluster. Though, the skilled manpower is available in the cluster, they are not aware of the energy conservation and efficiency and its importance, their prime responsibility is for zero machine down time and uninterrupted production as per the targets set by the management.

Specialized training with the local service providers for better operation and maintenance of the equipments, importance of the energy and its use will create awareness among workforce and these programs to be organized with the equipment suppliers.

2 IMPLEMENTATION OF PROPOSED TECHNOLOGY

2.1 Description of proposed equipment

Energy efficient vertical agitator are fixed at the top part of the tank and there shaft is inserted for vertically for use. It is available in three and two bladed hydrofoil impeller. It provides a combination of performance characteristics and high flow efficiency not available from other types of axial flow and process results at a lower power compared to horizontal agitator system. As it is direct driven the transmission losses are zero. Thus reduces the operating and capital cost.

Figure 2.1 Energy efficient vertical agitators

2.1.1 Comparison of conventional horizontal with new vertical agitaor

Technical, economic, Environmental, safety aspects of conventional agitator and energy efficient agitator are compared on life cycle of equipment, same is presented in Table 2.1 below:

Table 2.1 Comparison of conventional equipment and proposed equipment

S. No	*Details*	*conventional horizontal agitator*	*Energy efficient vertical agitator*
1	Power consumption	High	Low
2	Safety of workers	Poor	Good
3	Maintenance	High	Low

4	Operational cost	High	Low
5	Availability of local service providers	Yes	Yes
6	Capacity	Low	High
7	Speed Control	No	Yes
8	Temperature monitoring & control	Yes, Conventional	Yes, Digital
9	Transmission losses	More	Less

From the above table it is clear that Energy efficient vertical agitator system has significant advantage in Energy, Environmental, Economic & safety aspects. It is justifiable to install energy efficient agitator system in place of conventional agitator system.

2.1.2 Equipment specification

Complete information about the new machine along with specification is placed at Annexure 8.

2.1.3 Suitability over existing system

The proposed equipment is completely replaced the existing system and suitable with the existing process.

2.1.4 Technical specifications

Design specifications of proposed Energy Efficient agitator is presented in Table 2.2 below:

Table 2.2 Technical specifications

S.No	*Details*	*Units*	*Value*
1	Name of equipment	NA	Energy efficient vertical agitator system
2	Model	NA	XTD-15@45
3	Vessel Capacity	Liters	32000
4	Shell ID	mm	3200
5	Power	HP/RPM	15/44
6	Design Temperature	°C	80
7	T.L to T.L Height	mm	4000
8	Operating volume	liters	25600
9	Design Density	kg/m^3	1330

10	Design viscosity	Cp	100
11	Mixing Scale	-	10
12	Impeller Type		2 Nos. – Turbo foil 1 No. – PBT-2
13	Shaft Diameter	mm	100mm & ext. 90 mm

2.1.5 Superiority over existing system

The new system has better flow efficiency than existing system and hence would yield better result in productivity as well as operating cost.

2.1.6 Availability of proposed equipment

The technology identified for implementation is available locally and are indigenously produced. The technology/ equipments will be procured from local equipment suppliers. The proposed equipment is locally manufactured by well known vendor in Ahmedabad chemical cluster for making energy efficiency equipments in cluster.

The technology identified is available in the state of Gujarat (Ahmedabad) and implemented successfully in few units in cluster. The investment required for implementation of the identified measures has good financial returns and the proposed measure is technically and financially viable.

2.1.7 Equipment providers

Technology/service provider selected for implementation of the proposed energy efficiency project is well experienced in mixing systems. This technology/service provider is having in house R&D team to develop the new products, which are energy & eco friendly. Recommended supplier having the trust in cluster on products developed by them. They design and manufacture the agitator at Karamsad, Gujrat factory. Details of equipment suppliers are furnished in Annexure 7.

2.1.8 Terms and conditions in sales of Energy efficient Agitator

The technology/service provider will provide performance guarantee for the products supplied and warranty for a period of one year for any manufacturing defects. The terms of sales from the proposed supplier is given at Annexure 8.

2.2 Process down time during implementation

The process down time for implementing the replacement of conventional horizontal agitator with the energy efficient vertical agitator system will take around week. The

implementation can be taken up during weekly holiday, or other holidays, so that the process down time can be reduced.

2.3 Suitable unit for proposed equipment

The suitability of proposed unit depends upon client confirmation about the vessel dimensions and also the physical properties of mixture.

3 ECONOMIC BENEFITS OF ENERGY EFFICIENT AGITATOR

Energy use and technology audit studies were conducted in various units of the Ahmedabad chemical cluster to evaluate the performance of existing agitator machine, technical gaps in existing machine and analyzed energy, economic, environmental and social advantages of energy efficient agitator over conventional horizontal agitator.

3.1 Energy & monetary benefits

3.1.1 Fuel Saving

No fuel saving ***directly or indirectly.***

3.1.2 Electricity saving

Electricity saving due to installation of New Energy Efficient Vertical Agitator System would lead to electricity saving of 71625 kWh per year.

3.1.2 Monetary benefit

Annual monetary savings of implementation of energy efficient agitator in place of conventional agitator is thus ₹ 3.87 lakh per annum. Details of monetary saving calculation are furnished at Annexure 3.

3.2 Environmental benefits

3.2.1 Reduction of power consumption

There is no major environmental impact by agitator system. Though, by the replacing conventional horizontal agitator system with energy efficient vertical agitator system helps in reduction electrical energy consumption which saves the power. Indirectly or directly safe guards the environment.

3.2.2 CDMability of the project

The proposed project saves about 71.62 MWh per year for one unit of agitator system. This roughly corresponds to 60 tonnes of CO_2 emission reduction or 63 CERs. Suppose at the cluster level 200 units apply this technology then the total savings would be about 12000 CERs per annum which can be a suitably sized small scale CDM project.

3.3 Social benefits

3.3.1 Impact on working environment

Replacement of conventional agitator systems with energy efficient fired agitator systems will reduce skin temperature as energy efficient vertical agitator is well insulated and

temperature monitoring of agitator systems, will improves the working condition & safety of workers near to agitator system.

3.3.2 Impact on manpower skills

Proposed energy efficient agitator system components were procured from other companies and also generate employment during installation and commissioning. As training will be provided by equipment suppliers will improve the technical skills of manpower required for operation of the equipment.

3.3.3 Impact on wages/emoluments

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

3.4 Other benefits (If any)

3.4.1 Productivity improvements

Due to improved design of agitator system will improves stirring time; this automatically improves productivity of chemical units in Ahmedabad chemical cluster.

3.4.2 Quality improvements

Most of the chemicals manufactured in Ahmedabad chemical industries are temperature sensitive. As already discussed in above chapters that inbuilt design of digital temperature monitors system in energy efficient agitator system help in control temperature and saves stirring time of product, this automatically improves quality of material.

3.4.3 Easy operation& maintenance

In energy efficient agitator system was designed such way that easy access to regular operational and maintenance in agitator system.

4 ECONOMICS & IMPLEMENTATION OF ENERGY EFFICIENT AGITATOR

4.1 Cost of project implementation

4.1.1 Equipment cost

Technical and financial quotations of proposed Energy Vertical Agitator are collected from reputed vendors in cluster. Cost of Vertical Agitator System of 32000 litres of volume of capacity is ₹ 4.16 lakh only as per the quotation provided at Annexure 8.

4.1.2 Other cost

Erection & commissioning cost of vertical agitator system in place of horizontal agitator is ₹ 0.41 lakh only. Adding about 10% for contingencies the costs come out to be ₹ 0.04 lakh only. Details of project cost are furnished in Table 4.1 below:

Table 4.1 Details of proposed equipment installation cost

S.No	*Particular*	*Unit*	*Value*
1	Equipment cost	₹ (in Lakh)	4.16
2	Erection & Commissioning cost	₹ (in Lakh)	0.41
3	Other misc. cost	₹ (in Lakh)	0.04
4	Total cost	₹ (in Lakh)	4.61

4.2 Arrangement of funds

Proposed financing for the replacement of conventional agitator with energy efficient hot air generator is made considering a debt equity ratio of 3:1, which is normally allowed by financial institutions for financing energy efficiency projects. On the basis of debt equity ratio of 3:1 the promoter's contribution works out to 25% of the project cost and the balance would be term loan from the Bank / FIs.

4.2.1 Entrepreneurs contribution

Total cost (Equipment and erection& commissioning) of project works out to be ₹4.61 lakh. Out of which entrepreneur's contribution is 25%, which work out to be ₹ 1.15 lakh.

4.2.2 Loan amount

75% of the project cost would be available as term loan from the banks/financial institutions, which works out to be ₹ 3.46 lakh.

4.2.3 Terms & conditions of loan

The interest rate is considered at 10% which is SIDBI's rate of interest for energy efficient 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, being period, with in which the entire term loan would be repaid. The financials have been worked out on the basis of certain realistic assumptions, which are outlined below

- The project is expected to achieve monetary savings of ₹ 3.87 lakh per annum.
- The operational and Maintenance cost is estimated at 4% of cost of fixed assets with 5% increase every year to take care of escalations.
- The erection and commissioning charges is estimated at 10% of the total project cost for the plant and machinery
- Interest on term loan is estimated at 10%. The tenure of the loan is considered 5 years and repayment starts after 6 months from the first date of disbursement of loan in 60monthly installments.
- Depreciation is provided as per the rates provided in the companies Act.
- Income tax provision is made as per IT Act 1961.
- Based on the above assumptions, profitability and cash flow statements have been prepared.

4.3.2 Simple payback period

Simple payback period of replacing conventional agitator with energy efficient agitator is 1.19 year.

4.3.3 Net Preset Value (NPV)

The Net present value of the investment on project is at @10.00% interest works out to ₹ 9.81 lakh.

4.3.4 Internal rate of return (IRR)

After tax Internal Rate of Return of the project is works out to be 64.46%. 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 28.02%.

Details of all the financial parameters for the replacement of conventional agitator with energy efficient agitator are presented in Table 4.2 below:

Table 4.2 Financial parameters of energy efficient agitator

S. No	Parameter	Unit	Value
1	Simple payback period	Years	1.19
2	NPV	₹ in lakh	9.81
3	IRR	%age	64.46
4	ROI	%age	28.02
5	DSCR	Ratio	3.46

4.4 Sensitivity analysis

In different situation fuel saving may increase or decrease on the basis of this scenarios a sensitivity analysis in realistic, pessimistic and optimistic scenario has been carried out which is as under

- Fuel saving increased by 5%
- Fuel saving decreased by 5%

Table 4.3 Sensitivity analysis

Particulars	IRR	NPV in lakh	ROI	DSCR
Normal	64.46%	9.81	28.02%	3.46
5% increase in fuel savings	68.33%	10.55	28.13%	3.64
5% decrease in fuel savings	60.58%	9.07	27.89%	3.28

Assuming all provision and resource input would remain same during sensitivity analysis

4.5 Procurement and implementation schedule

Total time required for implementation of proposed project is about 13 weeks from the date of financial closure. Detailed procurement and implementation schedules are furnished at Annexure 6.

ANNEXURE

Annexure-1 Energy audit reports of conventional agitator

Energy audit report of agitator report at Unit-1:

Stirring is the one of the major energy consuming equipments in production process of chemicals in Unit-1. Detailed Performance assessment of the agitator at Unit-1 is presented in the tables below.

Agitator structure study:

Horizontal agitator is installed at Unit-1. The following table shows the dimensional details of agitator, impeller size, impeller speed, motor rating and other some important parameters of agitator at Unit-1 are furnished in table below:

S. No	Details	Units	Value
1	Capacity of agitator	Litre	7000
2	Diameter of impeller	inch	2.5
3	Radius of impeller	inch	1.25
4	Height of agitator	m	3.2
5	Speed of impeller	RPM	100
6	Motor rating	HP	15
7	Rated Speed	RPm	200
8	Input power of motor	kW	8.5
9	Power delivered by motor to impeller	kW	7.04

Efficiency Calculation

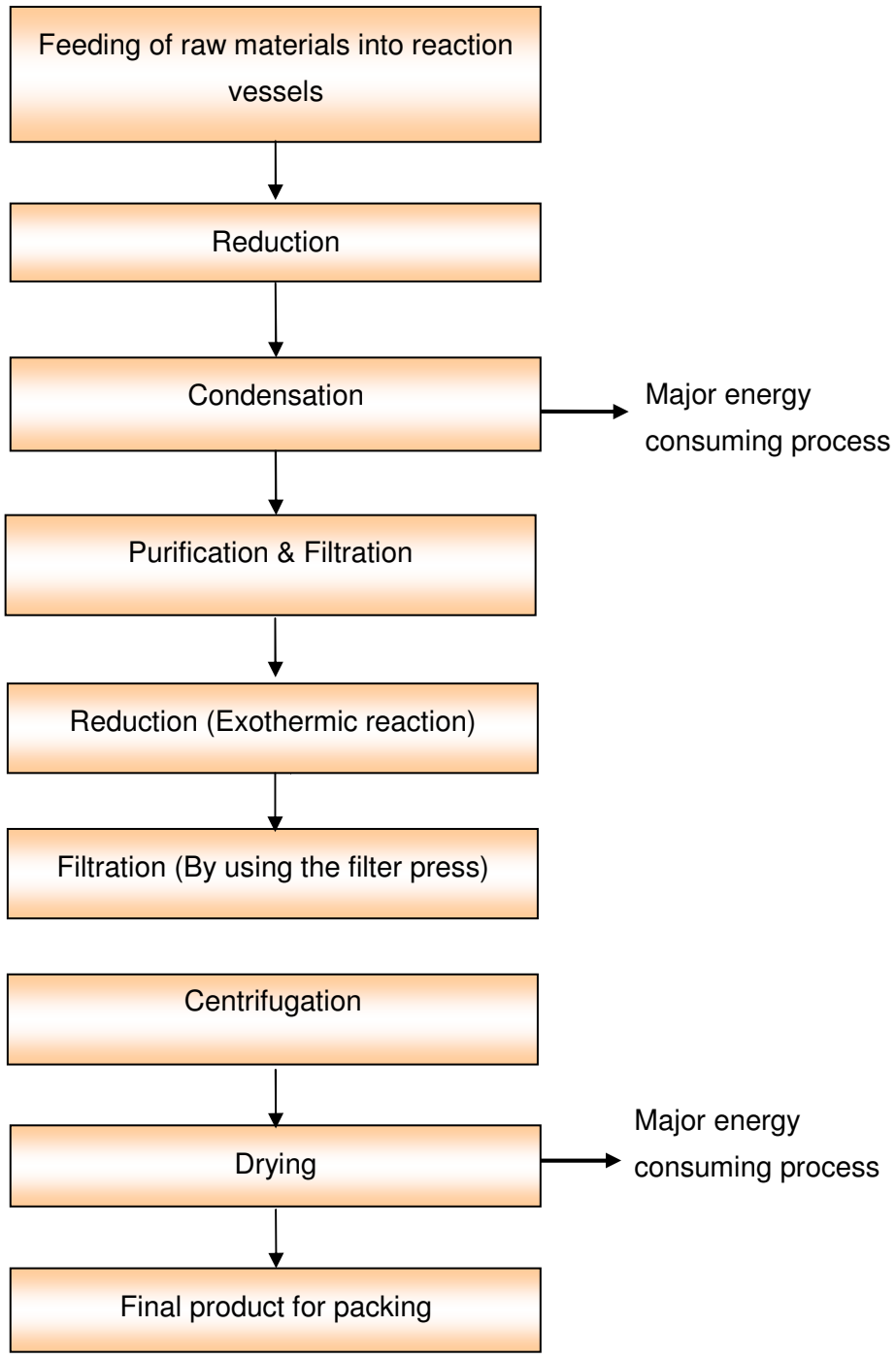
Application of agitator	***For mixing and blending of raw material***	
Input power to impeller	kW	7.04
Volume flow rate	m^3/sec	7
Power at shaft of impeller	kW	3.73
Efficiency of system	% age	53

Observations

- High transmission losses are observed in the Horizontal agitator leading to high losses of impeller.
- Motor Losses are observed as 2 motors are employed to rotate the impeller.
- Poor operational maintenance practices.
- Poor designing of drive and impeller

Annexure 2 Process flow diagram

Process flow diagram of chemical industry in Ahmedabad Chemical cluster is furnished in figure below



Annexure-3 Detail technical assessment report

Most of the chemical industries in Ahmedabad chemical cluster are in unorganized sector with low engineering, limited technology innovation and poor R&D base as well as low level of human resource on knowledge of technology, operational skill etc. This sector also faces deficiencies such as the lack of access to technology and technology sharing and the inadequacies of strong organizational structure, professional attitude etc.

Comprehensive Study conducted at various chemical units in Ahmedabad Chemical cluster to assess the technology gap in different processes and utilities. Following technical gaps are observed during our study:

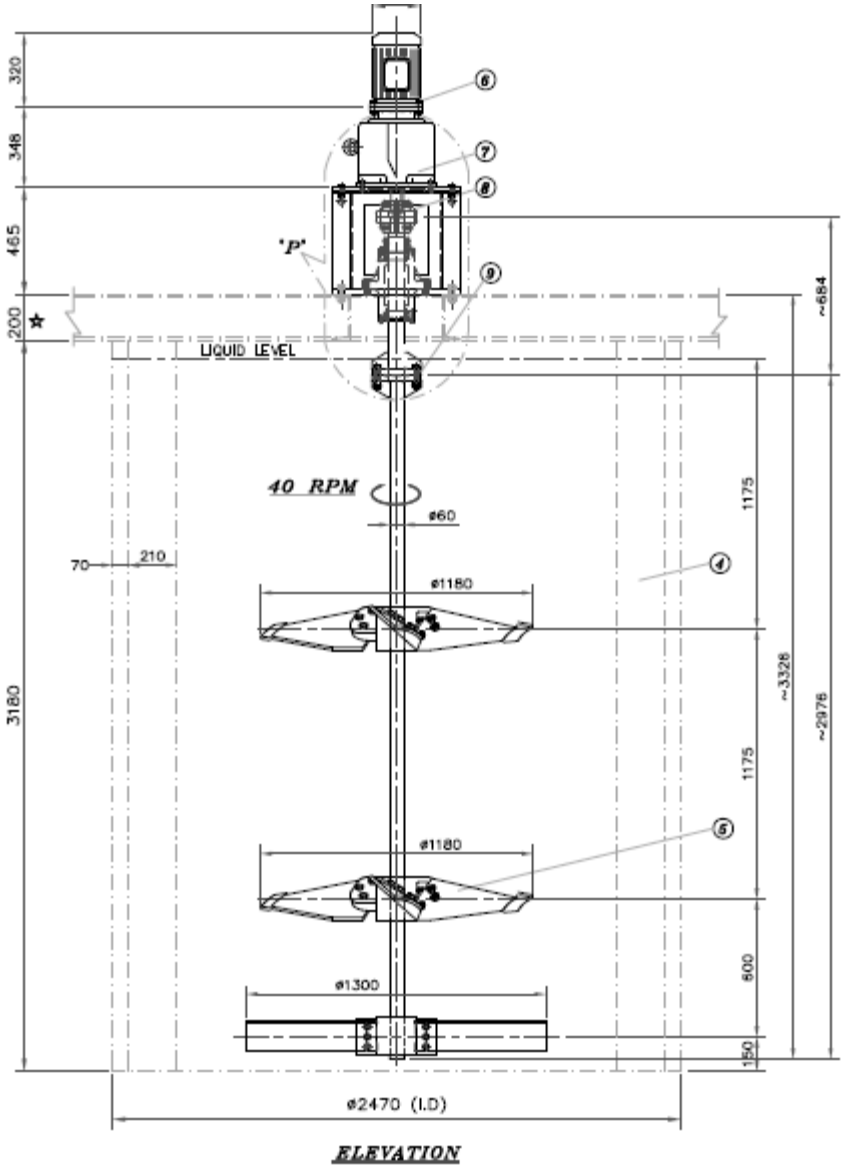
- The technology of the unit for some of the equipments installed is poor as compared to technologies available in market. Various technological gaps were identified in chemical units and these may be due to lack awareness on the technologies available, quantum of energy loss and its monetary benefit, lack of awareness among the workforce etc.
- There is a tremendous need for this cluster to modernize/upgrade its technology and adopt energy efficient technologies in some of their operational areas. Further, the management based on discussions, are interested in improve the efficiency of the plant by adopting this type of technology instead of going for retrofit options in the existing equipments.

The various factors which influence the management towards implementation of energy efficiency and energy conservation projects in chemical units in Ahmedabad Chemical cluster are:

- Energy efficiency and energy conservation is a low cost investment option which reduces energy consumption
- Low capital investment
- The energy efficiency improvement will enhance the plant management to be competitive in local and global markets by reducing production cost
- To conserve depleting fossil fuels
- The energy efficiency and conservation reduces GHG emissions because of low carbon dioxide and particulate emissions
- Energy efficiency and conservation is a viable strategy to meet future energy needs of the expanding plans in the industry
- The return on investment is attractive with lower pay back periods.

S. No	Parameter	Unit	Value
1	Capacity of agitator	Liter	7000
2	Present electricity consumption of existing agitator	kWh	8.5
3	Operational hours	hours	12
4	Total electricity consumption	kWh/day	102
5	Specific electricity consumption in existing agitator	kWh/Liter	0.015
6	Rated capacity of proposed agitator motor	HP	15
7	Electricity consumption in proposed agitator	kWh/day	134.28
8	Total mixture of chemical processing	Liter/day	25600
9	Specific electricity consumption in proposed agitator	kWh/liter	0.0052
10	Specific electricity saving	kWh/liter	0.0093
11	Annual mixture of chemicals processing	Kiloliter/year	7680
12	Total electricity saving	kWh/year	71625
13	Total monetary benefit @ ₹ 5.4/kWh	₹ in lakh	3.87
14	Total investment	₹ in lakh	4.61
15	Simple payback period	Years	1.19

Annexure-4 Electrical & civil works drawing of energy efficient Agitator



	(1) THIS DRAWING IS NOT TO SCALE
MILLIMETRES	(2) DIMENSIONS ARE IN
EN—8 IS: 2062 Gr.A	(3) SHAFT IMPELLER
4	(4) TANK BAFFLES (BY CLIENT)
40 AX—308 AX—308 AX—20	(5) IMPELLER SPEED (REV/MIN) NUMBER OF BLADES (TYPE) UPPER IMPELLER MIDDLE IMPELLER LOWER IMPELLER
142	CRITICAL SPEED(REV/MIN)
 ±100 ±100 +50	IMPELLER ADJUSTMENT UPPER IMPELLER MIDDLE IMPELLER LOWER IMPELLER (IMPELLER HUBS ARE KEYED TO SHAFT AND BLADES ARE BOLTED TO HUBS.)
2.2 KW 1440 100L 415/3/50	(6) MOTOR—TEFC/IP55/VERTICAL FLANGE MOUNTED/STD SPEED (REV/MIN) CGL MAKE FRAME RATING (V/ph/Hz)
HELICAL	(7) GEAR BOX: M0820/35.54:1/P100/V1/PBL MAKE
RB 178	(8) FLEXIBLE COUPLING : PIN & BUSH TYPE.(LOVEJOY MAKE)
M.S.	(9) RIGID COUPLING(RVSL DESIGN)
7.65 KN. 0.801 KNm. 1.24 KNm.	(10) DESIGN DATA DOWNWARD LOAD TORQUE BENDING MOMENT DESIGN LOADS ARE GREATER THAN ACTUAL LOADS BY A SUITABLE FACTOR CONSISTENT WITH CONSTRUCTION CODES AND RVSL EXPERIENCE RVSL DOES NOT WAIRRANT, GUARANTEE OR ASSUME RESPONSIBILITY FOR THE DESIGN OR CONSTRUCTION OF THE MOUNTING STRUCTURE FOR THE MIXER
426 N.	FORCE ON EACH BAFFLE FOR BAFFLE DESIGN CALCULATED LOAD TO BE CONSIDERED AS A POINT LOAD ACTING AT THE INNER EDGE OF THE BAFFLE OPPOSITE THE IMPELLER CENTRE LINE. THE LOAD IS A LIVE LOAD & FLUCTUATING COMPONENT BE CONSIDERED TO BE ACTING ABOUT THE SAME POINT AS DETAILED ABOVE.THE MAGNITUDE OF THIS FLUCTUAING COMPONENT IS TO BE CONSIDERED AS 50% OF THE CALCULATED LOAD. BAFFLE DESIGN IS THE RESPONSIBILITY OF THE VESSEL MANUFACTURER.
 73 kg 32 kg 285 kg 390 kg	(11) MIXER WEIGHT GEAR BOX MOTOR SHAFT/IMPELLERS/COUPLING/LAINTERN/BRG. HSG. TOTAL

Annexure-5 Detailed cash flow evaluations of energy efficient agitator

Name of the Technology	***Energy Efficient Agitator***		
Rated Capacity	***32,000 Liter***		
Details	***Unit***	***Value***	***Basis***
Installed Capacity	Liter	32,000	
No of working days	Days	300	
Total operating hours per day	Hrs.	12	
Proposed Investment			
Cost of plant & Machinery	₹(in lakh)	4.16	Feasibility Study
Erection & Commissioning (10% of plant machinery)	₹(in lakh)	0.41	Feasibility Study
Other charges(Contingency)	₹(in lakh)	0.04	Feasibility Study
Total Investment	₹(in lakh)	4.61	Feasibility Study
Financing pattern			
Own Funds (Internal Accruals)	₹(in lakh)	1.15	Feasibility Study
Loan Funds (Term Loan)	₹(in lakh)	3.46	Feasibility Study
Loan Tenure	Years	5	Assumed
Moratorium Period	Months	6	Assumed
Repayment Period	Months	66	Assumed
Interest Rate	%	10.00	SIDBI Lending rate
Estimation of Costs			
O& M Costs	%(on Plant & Equip)	4.00	Feasibility Study
Annual Escalation	%	5.00	Feasibility Study
Estimation of Revenue			
Energy savings	kWh/Annum	71625	-
Cost	₹/kWh	5.4	-
St. line Depreciation	%	5.28	Indian Companies Act
IT Depreciation	%	80.00	Income Tax Rules
Income Tax	%	33.99	Income Tax Act 2008-09

Estimation of Interest on term loan ***₹(in lakh)***

Years	Opening Balance	Repayment	Closing Balance	Interest
1	3.46	0.24	3.22	0.40
2	3.22	0.48	2.74	0.30
3	2.74	0.60	2.14	0.25
4	2.14	0.72	1.42	0.18
5	1.42	0.88	0.54	0.10
6	0.54	0.54	0.00	0.02
		3.46		

WDV Depreciation ***₹ (in lakh)***

Particulars / years	*1*	*2*
Plant and Machinery		
Cost	4.61	0.92
Depreciation	3.69	0.74
WDV	0.92	0.18

Projected Profitability ***₹ (in lakh)***

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Revenue through Savings									
Fuel savings	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	30.94
Total Revenue (A)	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	30.94
Expenses									
O & M Expenses	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	1.76
Total Expenses (B)	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	1.76
PBDIT (A)-(B)	3.68	3.67	3.66	3.65	3.64	3.63	3.62	3.61	29.18
Interest	0.40	0.30	0.25	0.18	0.10	0.02	-	-	1.25
PBDT	3.28	3.37	3.42	3.47	3.54	3.62	3.62	3.61	27.93
Depreciation	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1.95
PBT	3.04	3.13	3.17	3.23	3.30	3.37	3.38	3.36	25.99
Income tax	-	0.90	1.16	1.18	1.20	1.23	1.23	1.23	8.13
Profit after tax (PAT)	3.04	2.23	2.01	2.05	2.09	2.14	2.15	2.14	17.86

Computation of Tax **₹ (in lakh)**

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Profit before tax	3.04	3.13	3.17	3.23	3.30	3.37	3.38	3.36
Add: Book depreciation	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Less: WDV depreciation	3.69	0.74	-	-	-	-	-	-
Taxable profit	(0.40)	2.64	3.42	3.47	3.54	3.62	3.62	3.61
Income Tax	-	0.90	1.16	1.18	1.20	1.23	1.23	1.23

Projected Balance Sheet

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Liabilities								
Share Capital (D)	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
Reserves & Surplus (E)	3.04	5.28	7.29	9.34	11.43	13.57	15.72	17.86
Term Loans (F)	3.22	2.74	2.14	1.42	0.54	0.00	0.00	0.00
TOTAL LIABILITIES (D)+(E)+(F)	7.41	9.17	10.58	11.91	13.12	14.72	16.87	19.01
Assets								
Gross Fixed Assets	4.61	4.61	4.61	4.61	4.61	4.61	4.61	4.61
Less Accm. depreciation	0.24	0.49	0.73	0.97	1.22	1.46	1.70	1.95
Net Fixed Assets	4.37	4.12	3.88	3.64	3.39	3.15	2.91	2.66
Cash & Bank Balance	3.04	5.04	6.70	8.27	9.73	11.57	13.96	16.35
TOTAL ASSETS	7.41	9.17	10.58	11.91	13.12	14.72	16.87	19.01
Net Worth	4.19	6.43	8.44	10.49	12.58	14.73	16.87	19.01
Debt Equity Ratio	2.79	2.38	1.85	1.23	0.47	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	1.15	-	-	-	-	-	-	-	-
Term Loan	3.46								
Profit After tax		3.04	2.23	2.01	2.05	2.09	2.14	2.15	2.14
Depreciation		0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Total Sources	4.61	3.28	2.48	2.26	2.29	2.34	2.39	2.39	2.38
Application									
Capital Expenditure	4.61								
Repayment Of Loan	-	0.24	0.48	0.60	0.72	0.88	0.54	-	-
Total Application	4.61	0.24	0.48	0.60	0.72	0.88	0.54	-	-
Net Surplus	-	3.04	2.00	1.66	1.57	1.46	1.85	2.39	2.38
Add: Opening Balance	-	-	3.04	5.04	6.70	8.27	9.73	11.57	13.96
Closing Balance	-	3.04	5.04	6.70	8.27	9.73	11.57	13.96	16.35

IRR **₹ (in lakh)**

Particulars / months	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Profit after Tax		3.04	2.23	2.01	2.05	2.09	2.14	2.15	2.14
Depreciation		0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Interest on Term Loan		0.40	0.30	0.25	0.18	0.10	0.02	-	-
Cash outflow	(4.61)	3.68	2.78	2.50	2.47	2.44	2.40	2.39	2.38
Net Cash flow		3.04	2.23	2.01	2.05	2.09	2.14	2.15	2.14
IRR	64.46%								

NPV	9.81

Break Even Point

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Variable Expenses								
Oper. & Maintenance Exp (75%)	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.19
Sub Total*(G)*	0.14	0.15	0.15	0.16	0.17	0.18	0.19	0.19
Fixed Expenses								
Oper. & Maintenance Exp (25%)	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06
Interest on Term Loan	0.40	0.30	0.25	0.18	0.10	0.02	0.00	0.00
Depreciation *(H)*	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Sub Total (I)	0.69	0.59	0.54	0.48	0.40	0.32	0.31	0.31
Sales (J)	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87
Contribution (K)	3.73	3.72	3.72	3.71	3.70	3.69	3.68	3.67
Break Even Point (L= G/I)	18.48%	15.90%	14.55%	12.88%	10.92%	8.63%	8.29%	8.39%
Cash Break Even {(I)-(H)}	11.95%	9.36%	8.00%	6.32%	4.34%	2.04%	1.68%	1.77%
Break Even Sales (J)*(L)	0.71	0.61	0.56	0.50	0.42	0.33	0.32	0.32

Return on Investment **₹ (in lakh)**

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Net Profit Before Taxes	3.04	3.13	3.17	3.23	3.30	3.37	3.38	3.36	25.99
Net Worth	4.19	6.43	8.44	10.49	12.58	14.73	16.87	19.01	92.74
									28.02%

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

Particulars / Years	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Total*
Cash Inflow									
Profit after Tax	3.04	2.23	2.01	2.05	2.09	2.14	2.15	2.14	13.57
Depreciation	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	1.46
Interest on Term Loan	0.40	0.30	0.25	0.18	0.10	0.02	0.00	0.00	1.25
Total (M)	3.68	2.78	2.50	2.47	2.44	2.40	2.39	2.38	16.28

DEBT

Interest on Term Loan	0.40	0.30	0.25	0.18	0.10	0.02	0.00	0.00	1.25
Repayment of Term Loan	0.24	0.48	0.60	0.72	0.88	0.54	0.00	0.00	3.46
Total (N)	0.64	0.78	0.85	0.90	0.98	0.56	0.00	0.00	4.71
Average DSCR (M/N)	3.46								

Annexure-6 Details of procurement and implementation plan

Procurement and implementation schedule of energy efficient agitator in place of conventional agitator are presented below.

Activity	***Weeks***												
	1	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***
Energy data reconfirmation													
Technical discussion & finalization													
Collection of vendor quotes													
Order placement													
Material receipt													
Installation & Commissioning													
Measurement of savings													
Certification of savings													

Annexure-7 Details of equipment and service providers

Name of company	GMM Pfaudler Limited
Name of contact person	Sanjay Mehta
Address of company	1001, Peninsula Towers, Peninsula Corporate Park, G.K Marg, Lower Parel, Mumbai – 400 013

Annexure 8 Quotations of energy efficient agitator

ANNEXURE - I: AGITATOR TECHNICAL SPECIFICATION & COMMERCIAL PROPOSAL						
OFFER# 201: 191A: GMM: 08: 09 DT: 06/10/2010		CUSTOMER: Winrock International India				
		TECHNICAL DETAILS				
SR. NO.	DESCRIPTION	TAG / UNITS	R1	R2	R3	R4
A.	VESSEL & PROCESS DETAILS					
1	Vessel Capacity	Liters	18000	32000	35000	3000
2	Shell ID	mm	2400	3200	2800	1500
3	T.L. to T.L. Height	mm	3500	4000	5600	1750
4	Operating Vol.	Liters	14400	25600	28000	2400
5	Vessel Top / Bottom	-	Dish/ Dish	FLAT / Dish	Dish/ Dish	Dish/ Dish
6	Design Temperature	Deg. C	80	80	80	80
7	Operating Pressure	kg/cm2	atm	atm	atm	atm
8	Design Desnsity	kg/m3	1700	1330	1250	1250
9	Design Viscosity	Cp	700	100	100	100
10	Design Solid Content	%	20	20	20	?
B.	AGITATOR IMPELLER & SHAFT DETAILS					
1	AGITATOR - Model		XTA - 10@ 56	XTD - 15 @ 45	XTA - 15@ 50	XTA - 2@ 68
2	Power / Agitator RPM	HP/ RPM	10 | 56	15 | 45	15 | 50	2 | 68
3	Shaft Diameter	mm	75 mm	100 mm/ 90	90 mm | 75 mm	50 mm
4	Impeller Type	-	2 Nos. of TURBOFOIL 1 No. of PBT - 2	2 Nos. of TURBOFOIL 1 No. of PBT-2	3 Nos. of TURBOFOIL 1 No. of PBT-2	2 Nos. of TURBOFOIL 1 No. of PBT-2
5	MixingScale	-	9	10	10	10
C.	MECHANICAL DETAILS					
1	WP MOC	-	CS	SS 304	SS 304	SS 316
2	Non- WP Parts MOC	-	CS	CS	CS	CS
3	Mounting Flange	-	CS	CS	CS with SS 304 Clad	CS with SS 304 Clad
4	Shaft Seal	-	Stuffing Box	OPEN (No seal)	Stuffing Box	Stuffing Box
5	Shaft Seal/ Motor Class		NFLP	NFLP	FLP	NFLP
6	Quantity	No.(s)	1	1	1	1
	Unit Price	Rs.	192,500	416,250	520,000	132,500

TECHNICAL DISCUSSION:

BLADES:

TURBOFOIL provides all of the benefits of more efficient agitation with very few design limitations. Improved agitation efficiency and greater process flexibility are now available with a practical, fabricated impeller.

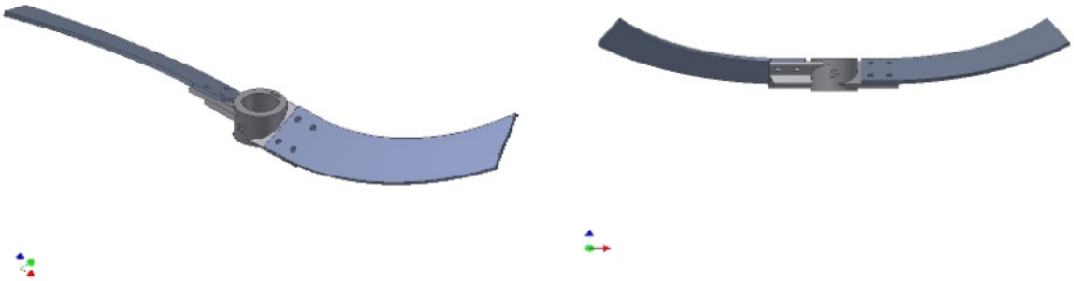
The **Turbofoil** is a result of extensive testing, and is supported by new technology for proper process application.

These impellers have three specially designed blades, mounted at a shallow angle, to provide a high degree of axial flow with minimal power requirements. Thus, the **Turbofoil** is able to create more fluid motion with less energy input.

The offered **Turbofoil** have the power number of 0.27 compared to 1.25 to 5 of a conventional agitator. It is evident that it would consume much less power when compared with conventional agitator for same duty. Hence the system offer you better pay out period coupled with state of the art mixing system.

PBT-2

The Pitched Blade Turbine (PBT) is axial flow impeller with 2 nos. of blades, reasonably cost -effective impeller in both turbulent and laminar flow. The pitched blade impeller is used for low level mixing.



The bottom P-2 Pitched Impeller is provided for handling lower level mixing. It is designed and manufactured in the contour of bottom -dished end. The bottom impeller, due to pitching, it helps in renewing the thick mass and does not move the mass along with it like vertical blade anchor agitator. The bottom impeller is designed with sufficient Hydraulic Service factor to handle the viscous mass. The higher hydraulic factor means higher thickness of shaft and blades to take care of uneven load.

The impeller is widely used for the process like crystallization, solid suspension with sufficiently high concentration of solids.

MIXING SCALE:

We use term **Mixing Scale** to define level of mixing within the vessel. It is a systematic and quantitative method for specifying desired agitation intensity. It directly corresponds to overall bulk fluid velocity in the vessel. It is set from scale 1 to 10 for most application where scale of 1 equ ivalent to bulk fluid velocity of 6ft/min.

TERMS & CONDITIONS	
ORDER CONFIRMATION	All orders placed on us will be binding only after receipt of a Purchase Order, Advance Payment and issue of our Order Acceptance.
PRICE BASIS	All prices quoted are Ex-works Karamsad, Gujarat
SALES TAX	As applicable at the time of dispatch. • Current rate is 2% against form C. • VAT is 5% for Gujarat Sales.
EXCISE DUTY **PACKING AND FORWARDING**	As applicable at the time of dispatch. The Current rate is 10% + 2% Educational Cess and 1% Higher Education Cess on Excise 3% of Order value payable by Purchaser.
FREIGHT, TRANSIT INSURANCE AND OCTROI	• All Equipment will be dispatched on FREIGHT TO PAY basis. • Transit Insurance shall be arranged by purchaser. • Octroi if applicable will be paid by the Purchaser.
TERMS OF PAYMENT	• 30% of Total Order Value as advance along with Purchase Order. • 70% of Total Order Value along with applicable taxes against Proforma Invoice before dispatch. • Irrespective of the Commissioning the dues should be paid. • Delay in payment will be charged @ 18% per annum on the outstanding amount.
VALIDITY OF QUOTATION	30 days from the date of quotation.
DELIVERY PERIOD **INSPECTION**	• Delivery of the equipment will be 12 - 14 weeks from the drawingapproval. • The delivery period will begin after receipt of technically and commercially clear Purchase Order and Advance. • The Delivery Period will be extended if the GA Drawings are not approved within 7 working days from date of Submission. • Any changes required by the Purchaser after the drawings have been approved or after the commencement of manufacturing activities may result in the delivery period being extended. All additional charges incurred including engineering man days will be borne by the Purchaser. • In case of Third Party Inspection delivery period will be extended by 2 weeks. • All our equipments are subjected stringent Quality Control tests prior to despatch. • If mutually agreed during order finalization the equipment shall be offered for visual inspection and run out test our works. • If the Inspector nominated by the Purchaser requires to stay overnight at our guest house, a charge of Rs. 1000 per night will charged. Alternatively a variety of hotel accommodations can also be arranged.

	• Third Party Inspection is not included. • The date of inspection will be given 14 days in advance. If the Purchaser fails to carry out inspection by the date advised by us, we shall be free to dispatch the equipment.
WARRANTY	• The equipment is guaranteed for faulty design, material or workmanship for a period of 18 months from the date of dispatch or 12 months from the date of commissioning whichever is earlier.
DISPATCH	• In case we do not receive the payment within 30 days of date of Proforma Invoice we will be forced to consider the order as cancelled and all the advance payment received against it will be forfeited. • GMM Pfaudler Ltd reserves the right to divert the equipment if the Purchaser fails to fulfil the contractual obligations within the stipulated time frame.
COMMISIONING	Installation of the equipment shall be the sole responsibility of the Purchaser. If required Erection and Commissioning Support can be provide at an additional charge of Rs.5000 per man day. • All assistance required during commissioning will be provided by the Purchaser. • All commissioning related expenses including Lodging and boarding, To & Fro travel expenses will be borne by Purchaser. • The Purchaser will inform GMM Pfaudler Limited of the commissioning date at least 14 Days in advance. • The Purchaser will be responsible for site readiness prior to the arrival of our commissioning engineer.
ORDER CANCELLATION	If the Purchaser unilaterally cancels the order: • Before commencement of manufacturing, 30% of the basic contract value shall be forfeited • After commencement of manufacturing, 100% of the basic contract value shall be forfeited

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

Winrock International India

788 Udyog Vihar, Phase V
Gurgaon – 122 001, Haryana
Tel: +91-124-4303868
Fax: +91-124-4303862
Website: www.winrockindia.org

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

Website: www.techsmall.com