MEASURES

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Bureau of Energy Efficiency (BEE)

Ministry of Power, Government of India

Prepared By

Winrock International India

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New Delhi

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About BEE SME Program

Worldwide the Micro, Small and Medium Enterprises (MSMEs) have been accepted as engines of economic growth to promote and accelerate equitable development. The major advantage of this sector is its enormous employment potential at significantly low capital involvement. This can be established from the simple fact that the MSMEs constitute over 90% of total enterprises in most economies and are credited with generating the highest rates of employment growth and also account for a major share of industrial production and exports. In the Indian context, MSMEs play a pivotal role in the overall industrial economy. In recent years the sector has consistently registered higher growth rate as compared to the overall industrial sector. With its agility and dynamism, the sector has shown admirable innovativeness and adaptability to survive the recent economic downturn and recession.

As per available statistics (the 4th Census of MSME sector), this sector employs an estimated 59.7 million persons spread over 26.1 million enterprises. It is estimated that in terms of value, MSMEs have a 40% share in total industrial output at a huge volume of producing over 8,000 value added products. At the same time, MSMEs contribute nearly 35% share in direct export and 45% share in the overall export from the country. SMEs exist in almost all-major sectors in the Indian industry such as Food Processing, Agricultural Inputs, Chemicals & Pharmaceuticals, Electrical & Electronics, Medical & Surgical equipment, Textiles and Garments, Gems and Jewellery, Leather and leather goods, Meat products, Bioengineering, Sports goods, Plastics products, Computer Software etc.

However, despite the significant contributions made to towards various aspects of the nation's socio-economic scenario, this sector too faces several critical issues that require immediate attention. One such factor that falls within the ambit of this publication is the prevalence of age old technologies across the sectors and inherent inefficiencies associated with resource utilization including energy. The National Mission for Enhanced Energy Efficiency in Industry under the National Action Plan for Climate Change (released by Government of India on June 30, 2008) has emphasized the need for improving Energy Efficiency (EE) in the manufacturing sector. A number of sector-specific studies have also unanimously confirmed that energy intensity in the industry can be reduced with the widespread adoption of proven and commercially available technologies which will improve EE and produce global benefits from reduced Green House Gasses (GHGs) emissions.

As a result of increasing awareness towards efficient usage of energy and other resources, there has been a visible reduction in energy intensity in comprehensive Indian industrial sector. However, focusing the observation on the MSME sector reveals that the energy intensity per unit of production is much higher than that of the organized large scale sector.

Since energy cost is significant contributor to the overall production cost of SMEs due to high and rising energy costs in current scenarios, it is required to increase the EE levels in order to ensure the sustenance of SMEs. One of the ways to reduce the inefficiencies is by replacing the conventional/old/obsolete technology with feasible and adaptable energy efficient technologies. This would not only contribute towards reduction in production cost, but would also improve the quality and productivity of MSME products. However, there are still a number of barriers and market failures that have prevented widespread adoption of new energy efficient technologies. These are listed below.

Key barriers in promotion and adoption of EE technologies in Indian SME sector

- Lack of awareness and capacity on the part of SMEs to take up energy conservation activities
- Lack of scientific approach on monitoring and verification of performance assessment of installed equipments and utilities.
- Non availability of benchmark data for various equipments/process
- Low credibility of the service providers such as equipment suppliers and their technologies
- The SME owners are more concerned on production and quality rather than energy efficiency and conservation
- The key technical personnel employed in the SME units are based on their past experience in similar industries rather than technically qualified personnel and hence, the persons are not aware of the latest technologies or measures which improve energy efficiency
- Less priority interest to invest in improving efficiency than in expansion and this may be due to lack of knowledge on cost benefit

A majority of SMEs are typically run by entrepreneurs who are leanly staffed with trained technical and managerial persons to deploy and capture energy efficiency practice to reduce manufacturing cost and increase competitive edge. Therefore, it is useful to build energy efficiency awareness in the SMEs by funding/subsidizing need based studies in large number units in the SMEs and giving energy conservation recommendations including short term energy conservation opportunities, retrofit/replacement options and technology up-gradation opportunities.

In this context, the Bureau of Energy Efficiency (BEE) has laid adequate emphasis on the SME sector as presented in the Working Group on Power for 11th Five-Year Plan (2007-2012)-Sub-Group 5. Consequently, the BEE has initiated the energy efficiency Improvement program in 25 SME clusters in India.

1.1 PROGRAM OBJECTIVES

The BEE SME Program aims to improve EE (Energy Efficiency) in SME sector by technological interventions in the various clusters of India. The EE in SMEs is intended to be enhanced by helping these industries in the 25 energy intensive SME clusters of India by:

- Technology interventions
- Sustaining the steps for successful implementation of EE measures and projects in clusters, and
- Capacity building for improved financial planning for SME entrepreneurs.

The program also aims at creating a platform for dissemination of the best practices and the best available technologies available in the market for energy efficiency and conservation, to create awareness in the clusters, and to demonstration of the new technology interventions/ projects to stimulate adoption of similar technology/projects in the clusters.

The BEE SME program has been designed in such a way so as to address the specific needs of the industries in the SME sector for EE improvement and to overcome the common barriers in way of implementation of EE technologies in cluster through knowledge sharing, capacity building and development of innovative financing mechanisms. The major activities in the BEE SME program are:

- Energy use and technology studies
- Capacity building of stake holders in cluster for building EE projects
- Implementation of energy efficiency measures
- Facilitation of Innovative financing mechanisms for implementation of energy efficiency projects

The brief objective of each of these activities is presented below:

➲ *Energy use and technology studies*

An in-depth assessment of the various production processes, energy consumption pattern, technology employed and possible energy conservation potential and operational practices in cluster by means of conducting detailed energy audits and technological gap assessment studies were conducted in the cluster. The energy audit study shall include analysis of the overall energy consumption pattern, study of production process, identification of energy intensive steps/sub-processes and associated technology gap assessment for the individual units. The study has also focused on identifying the best operating practices and the EE measures already implemented in the units.

➲ *Capacity building of stakeholders*

The aim of this activity is capacity building of the enrolled LSPs to equip them with capacity to carry on the implementation of the EE technology projects in cluster on a sustainable basis. It would be ascertained that the needs of the LSPs is identified as a preparatory exercise to this activity, as in what they expect from the BEE Program in terms of technical and managerial capacity building.

➲ *Implementation of EE measures*

To implement the EE and technology up-gradation projects in the clusters, technology specific Detailed Project Reports (DPRs) for five different technologies for three scales of operation will be prepared. The DPRs will primarily address the following:

- Comparison of existing technology with feasible and available EE technology
- Energy, economic, environmental & social benefits of proposed technology as compared to conventional technology
- Details of technology and service providers of proposed technology
- Availability of proposed technology in local market
- Action plan for implementation of identified energy conservation measures
- Detailed financial feasibility analysis of proposed technology

➲ *Facilitation of innovative financing mechanisms*

The program aims to develop innovative and effective financing mechanisms for easy financing of EE measures in the SME units in the cluster. The easy financing involves following three aspects:

- Ease in financing procedure
- Availability of finance on comparatively easy terms and relaxed interest rates
- Compatibility and availing various other Central/ State Governments' incentive schemes like CLCSS, TUFF etc.

1.2 EXPECTED PROJECT OUTCOME

Expected project outcome of BEE SME program in clusters are:

➲ *Energy Use and Technology Analysis*

The outcome of the activity includes identification of the EE measures, assessment of potential of renewable energy usage, fuel switching, feasibility analysis of various options, and cost benefit analysis of various energy conservation measures including evaluation of financial returns in form of payback period, IRR and cash flows. The

cost liability of each measure, including the capital and operational cost will also be indicated.
The identified EE measures will be categorized as per the following types:

- Simple housekeeping measures/ low cost measures
- Capital intensive technologies requiring major investment.

The sources of technology for each of the suitable low cost and high cost measures, including international suppliers as well as local service providers (LSPs)/ technology suppliers, in required numbers shall be identified. It is envisaged to create a knowledge bank of detailed company profile and CVs of key personnel of these technology sources. The knowledge bank will also include the capability statements of each of these sources.

The EE measures identified in the energy use and technology audit study will be prioritized as per their energy saving potential and financial feasibility. Inventorization survey was done to establish details like the cluster location, details of units, production capacity, technologies employed, product range, energy conservation potential along with possible identified EE measures and respective technology suppliers.

The specific outcomes of this activity are as follows:

- Determination of energy usage and energy consumption pattern
- Identification of EE measures for the units in cluster
- Development and preparation of case studies for already implemented EE measures and best operating practices in the units
- Evaluation of technical & financial feasibility of EE measures in terms of payback period, IRR and cash flows.
- Enlisting of Local Service Providers(LSPs) for capacity building & training including creation of knowledge bank of such technology suppliers
- Capacity building modules for LSPs
- Development and preparation of cluster manuals consisting of cluster details and EE measures identified in cluster.

➲ *Implementation of EE measures*

The aim of this activity is development and finalization of bankable DPRs for each of the EE projects which would be presented before the SME units for facilitation of institutional financing for undertaking the EE projects in their respective units.

The activity will ensure that there is close match between the proposed EE projects and the specific expertise of the Local Service Providers (LSPs). These DPRs will be prepared for EE, renewable energy, fuel switching and other possible proposed measures during course of previous activities. Each DPR will include the technology assessment, financial assessment, economic assessment and sustainability assessment of the EE project for which it has been developed. The technology assessment will include the details of the design of equipment/ technology along with the calculation of energy savings. The design details of the technology for EE project will include detailed engineering drawing for the most commonly prevalent operational scale, required civil and structural work, system modification and included instrumentation and various line diagrams. The LSPs will be required to report the progress of the implementation of each such project to BEE PMC. Such implementation activities can be undertaken by the LSPs either solely or as a group of several LSPs.

➲ *Capacity Building of LSP's and Bankers*

The outcome of this activity would be training and capacity building of LSPs so as to equip them with necessary capacity to undertake the implementation of proposed EE projects as per the DPRs. Various training programs, training modules and literature are proposed to be used for the said activity. However, first it is important to ascertain the needs of the LSPs engaged, as in what they expect from the program in terms of technical and managerial capacity building. Another outcome of this activity will be enhanced capacity of banking officers in the lead banks in the cluster for technological and financial feasibility analysis of EE projects that are proposed by the SME units in the cluster. This activity is intended to help bankers in understanding the importance of financing energy efficiency projects, type and size of projects and ways and means to tap huge potential in this area. Different financing models would be explained through the case studies to expose the bankers on the financial viability of energy efficiency projects and how it would expand their own business in today's competitive environment.

➲ *Concluding workshop*

The outcome of this activity will be the assessment of the impact of the project as well as development of a roadmap for future activities. The workshop will be conducted for the representatives of the local industrial units, industry associations, LSPs and other stakeholders so that the experiences gained during the course of project activities including implementation activities of EE project can be shared. All the stakeholders in the project will share their experience relating to projects undertaken by them as per their respective roles. Effort from industrial units as well as LSPs to quantify energy savings thus achieved would be encouraged. This would

lead to development of a roadmap for implementing similar programs in other clusters with greater efficiency and reach.

1.3 IDENTIFIED CLUSTERS UNDER THE PROGRAM & TARGET CLUSTER FOR IMPLEMENTATION

25 most energy intensive MSME clusters across different end use sectors have been identified to implement the BEE SME program for EE improvement. The details of industrial sector and identified cluster are provided in Table 1 below:

Table 1.1: *List of clusters identified for BEE SME Program*

S. No.	Cluster Name	Location
1.	Oil Milling	Alwar; Rajasthan
2.	Machine Tools	Bangalore; Karnataka
3.	Ice Making	Bhimavaram; Andhra Pradesh
4.	Brass	Bhubaneswar; Orissa
5.	Sea food processing	Kochi, Kerala
6.	Refractories	East &West Godavari, Andhra Pradesh
7.	Rice Milling	Ganjam, Orissa
8.	Dairy	Gujarat
9.	Galvanizing	Howrah, West Bengal
10.	Brass& Aluminum	Jagadhari, Haryana
11.	Limestone	Jodhpur, Rajasthan
12.	Tea processing	Jorhat, Assam
13.	Foundry	Batala, Jalandhar & Ludhiana, Punjab
14.	Paper	Muzaffarnagar, Uttar Pradesh
15.	Sponge iron	Orissa
16.	Chemicals& Dyes	Vapi, Gujarat
17.	Brick	Varanasi, Uttar Pradesh
18.	Rice Milling	Vellore, Tamil Nadu
19.	Chemical	Ahmedabad, Gujarat
20.	Brass	Jamnagar, Gujarat
21.	Textile	Pali, Rajasthan
22.	Textile	Surat, Gujarat
23.	Tiles	Morbi, Gujarat
24.	Textile	Solapur, Maharashtra
25.	Rice Milling	Warangal, Andhra Pradesh

As a part of BEE SME program, one of cluster identified was the Ahmedabad, Chemical cluster. It was proposed to carry out energy use and technology audit studies in 75 units in the Ahmedabad Chemicals cluster covering all types and sizes of the industries to understand/give valuable insight into the process of developing energy efficiency solutions relevant to the SME industries in the Ahmedabad, Chemical cluster.

Ahmedabad Chemical Cluster Scenario

2.1 OVERVIEW OF AHMEDABAD CHEMCAL CLUSTER

Ahmedabad is inhabited by various types of chemical manufacturing SME units like Dyes, Dye Intermediates and Pigments manufacturing units. All these chemical manufacturing units are pocketed at Vatva, Naroda and Odhav industrial areas. There are about 600 chemical units in Vatva, 100 units in Naroda and 50 units in Odhav. Most of manufacturing units in these areas are operational since last 15 years. Figure 1.1 shows the geographical distribution of units in Ahmedabad Chemical cluster.

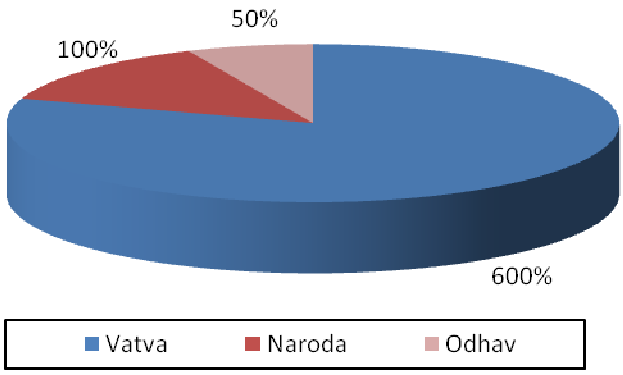


Figure 2.1: *Geographical distribution of Chemical units in Ahmedabad Chemical cluster*

Ahmedabad chemical cluster like many other clusters, was in a dire straits in regard to the energy efficiency and conservation. In almost all units, whether big or small, there had been no conscious effort to take up energy conservation and energy efficiency measures as a part of day to day operations. Some of the bigger units had experimented with few parameters to improve the energy efficiency in the units, but the results and outcome was confined to them only. All the units in cluster had been operating in traditional conditions and most of the equipments in cluster were procured from the local suppliers. They are making the equipments by their traditional expertise, which has remained unchanged over the years.

These units are using various types of raw material such as Sulphuric acid, Hydrochloric acid, Acetylic acid, Chlorine gas, Benzene, Sodium nitrate, Ethylene, Ammonia, Disulphuric-acid, Copper, Chlorine, Ammonia, Potassium sulphate etc, type of raw material depends on their final product manufacturing in the unit. All these raw materials are being procured from local manufacturers/traders & bought from neighbour states. There are various types of chemical products that are

manufactured in Ahmedabad chemical cluster, few of them are DASDA, Alpha & Beta Pigment, Reactive dyes, Acid dyes, Direct dyes etc. In fact majority of the chemical units in Ahmedabad Chemical cluster are manufacturing two or three different types of chemical related products as per the market requirements.

2.1.1 Classification units

Different Chemical units in Ahmedabad Chemical cluster are broadly classified based on the type of product, production capacity, type of fuel used and type of Dryers employed in drying process.

➲ *Type of Product*

Major products being manufactured in Ahmedabad chemical cluster are classified into Dyes, Dye intermediates and Pigments. Following figure shows the classification of chemical units based on type of products manufacturing in unit:

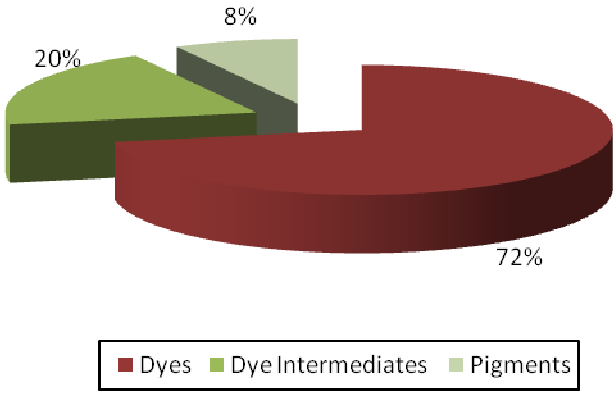


Figure 2.2: ***Classification of Chemical units based on type of manufacturing unit***

➲ *Production capacity*

Production capacity of chemical units in Ahmedabad Chemical cluster depends on the type of product manufacturing in unit. Production capacity of Chemicals in Ahmedabad chemical cluster is in the range of 100-1000 tpa (Tonnes per Annum). The following figure shows the classification of chemical units in Ahmedabad Chemical cluster based on production capacity.

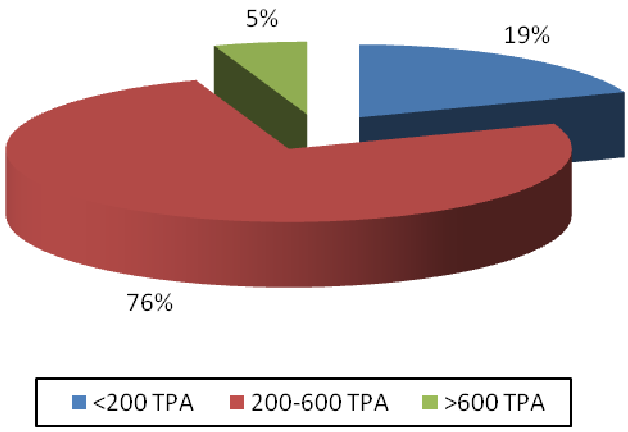


Figure 2.3: ***Percentage distribution of chemical units in Ahmedabad Chemical cluster based on production capacity***

➲ *Type of fuels*

In Ahmedabad chemical cluster different types of fuels are being used in to cater the thermal energy requirement in chemical units. Major fuels used in Ahmedabad chemical cluster are:

- Wood
- Natural gas
- LDO/Furnace oil
- White coke/Briquettes
- Coal

The following figure shows the classification of Chemical units based on type of fuel used in generation of thermal energy requirement:

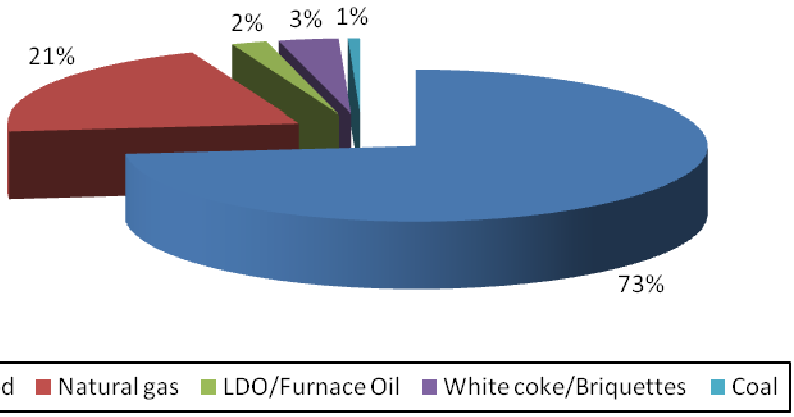


Figure 2.4: ***Percentage distribution of chemical units in Ahmedabad Chemical cluster based on type of fuel used***

➲ *Type of Drying system*

Different types of dryers are being used for drying of chemicals in Ahmedabad Chemical cluster. Type of drying system will depend on the type of product, production, quality and economical point of view. Different types of dryers used in Ahmedabad are:

- Tray dryer
- Spray dryer
- Spin flash dryer
- Fluidized bed dryer
- Sun drying/outside

The following figure shows the classification of chemical units based on drying system being used for drying purpose.

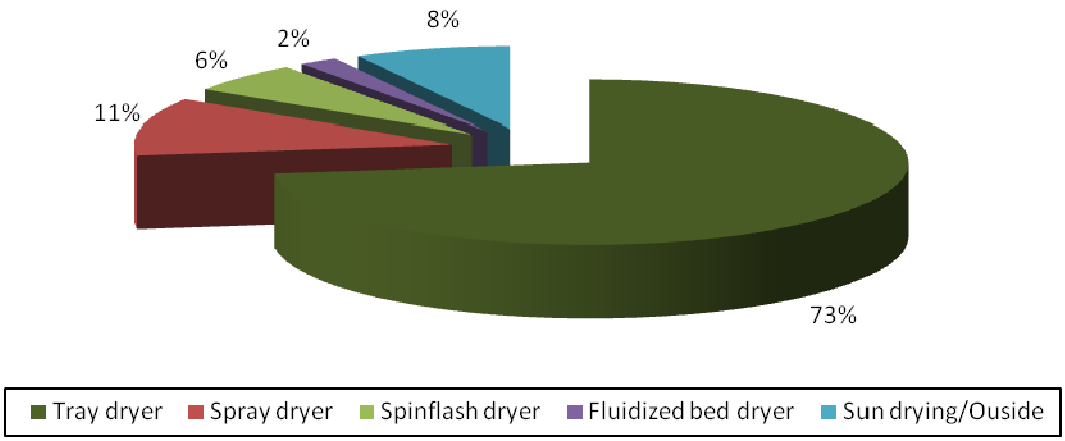


Figure 2.5: ***Classification of chemical units in Ahmedabad Chemical cluster based on drying system***

2.2 ENERGY SITUATION IN CLUSTER

Majority of the industries located in Ahmedabad Chemical cluster are engaged in manufacturing of different chemicals. Different chemical units in the Ahmedabad Chemical cluster are using different types of energy sources including electricity and fuels such as wood, natural gas, biomass briquettes & coal depending on application of technology, process requirement, availability, economic and safety point of view. There are two forms of energy is using in manufacturing of chemicals in typical chemical units in Ahmedabad Chemical cluster; these are electrical energy and thermal energy. Electrical energy is being used in operation of equipment & other electrical utilities, and, the Thermal energy is being used in process and drying applications in chemical manufacturing units. Energy cost represents around 10-15 percent of manufacturing cost in Chemical units. The following figure shows the

percentage of thermal energy and electrical energy cost in typical chemical manufacturing unit.

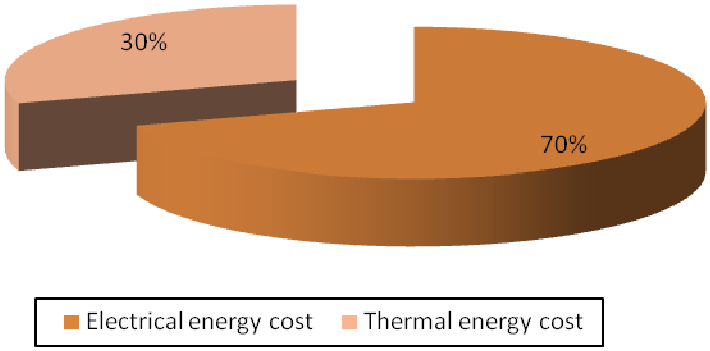


Figure 2.6: *Percentage of Thermal energy cost and Electrical energy cost in typical chemical manufacturing unit*

2.2.1 Type of fuels used in Ahmedabad chemical cluster

Details of fuels used in Ahmedabad Chemical cluster is presented in table below:

Table 2.1: *Details of fuels used in cluster and its prices*

S. No	Name of fuels	Cost of fuel (Rs)	Units	Gross Calorific values
1	Wood	3	Kg	2700 kCal/Kg
2	Natural gas	18	Nm^3	9800 kCal/Nm^3
3	Furnace oil	28	litre	9800 kCal/litre
4	White coke (Briquettes)	4.5	Kg	4300 kCal/Kg
5	Coal	7	Kg	4500 kCal/Kg

2.2.2 Energy consumption in typical chemical unit

Energy consumption (thermal energy & electrical energy) in a typical chemical unit in cluster varies depends on final product manufacturing and size of the unit.

Annual electrical energy and thermal energy consumption of typical chemical units in three scales is presented in table below:

Table 2.2: *Annual Energy consumption in typical chemical units in three scales*

Parameter	Units	<200 tpa	200-600 tpa	>600 tpa
Annual electrical energy consumption	kWh	64,000	352,661	1,938,225
Annual electrical energy consumption	kCal	55,680,000	306,815,070	1,686,255,750
Annual electrical energy consumption	toe	5.56	30.68	168.60
Annual thermal energy consumption	kCal	291,600,000	3,564,000,000	8,279,628,800
Annual thermal energy consumption	Toe	29.16	356.40	827.90
Annual production capacity	tpa	70	360	2500

Annual electrical energy consumption and fuels in Ahmedabad Chemical cluster is around 284,068,493 kWh and 2,387,102,000,000 kCal (238,710 toe) respectively. **Total energy consumption in the Ahmedabad Chemical cluster is around 263,594.6 toe (tonnes of oil equivalent)**

2.2.3 Specific energy consumption typical chemical unit in Ahmedabad Chemical cluster

Specific electrical energy and thermal energy consumption in Chemical unit depends on the final product manufacturing in that unit. Details of specific energy consumption of three different sizes of typical chemical units in Ahmedabad chemical cluster is presented in table below:

Table 2.3: *Specific energy consumption of typical chemical unit in Ahmedabad Chemical cluster*

Parameter	Units	<200 tpa	200-600 tpa	>600 tpa
Specific electrical energy consumption	kWh/kg of product	0.9	1	0.78
Specific electrical energy consumption	kCal/kg of product	788	876	683
Specific thermal energy consumption	kCal/kg of product	4050	9990	3312
Specific electrical energy cost	Rs./kg of product	4.9	5.3	4.2
Specific thermal energy cost	Rs./kg of product	4.6	11	6.4
Specific energy consumption	kCal/kg of product	4838.4	10752.3	3995

2.3 MANUFACTURING PROCESS OVERVIEW ON TYPICAL CHEMICAL UNIT

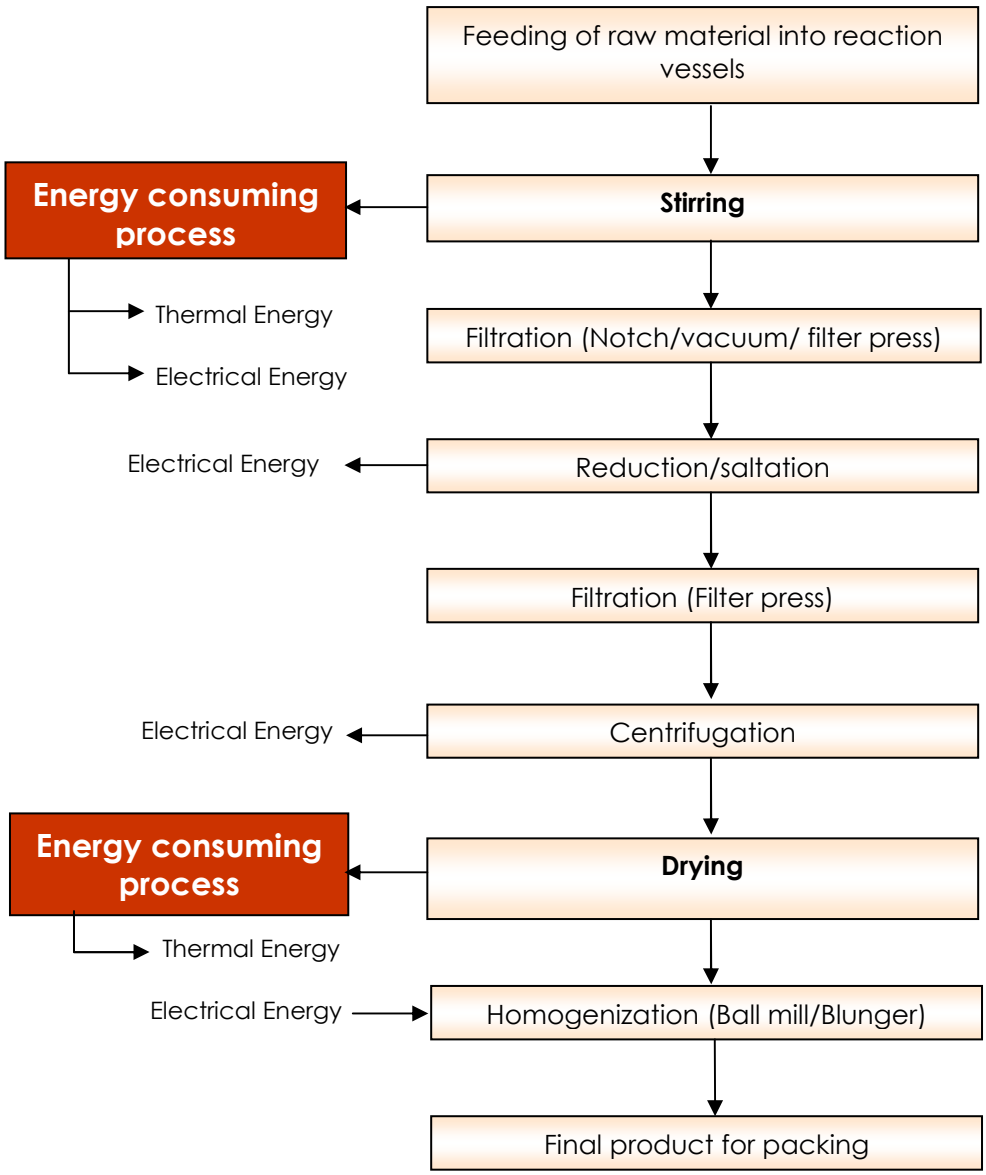


Figure 2.7: ***Process flow chart of manufacturing of chemical in typical chemical manufacturing unit***

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

From the above figure it is clear that major energy consuming process in typical manufacturing industry are stirring and drying operation. Drying operation will

consume around 55% of total energy and stirring operation (including steam circulation in vessel) will consume around 45% of total energy.

2.4 ISSUES RELATED/BARRIESRS IN IMPLEMENTATION OF ENERGY CONSERV ATION MEASURES/TECHNOLOGY UPGRADATION

The processes to do with technology and innovations in SMEs are different from those that take place in large firm context. Technology in the SME sector has an increasingly complex or combinative character, most of the SMEs units in cluster are regarded for their labour intensive and the capability work with local resources. In the past, SME entrepreneurs are laying less emphasis on technology in order to cut initial cost of plant /machinery. Major barriers in up gradation of technology in the cluster are:

- Lack of awareness on energy efficiency
- Lack of organizational commitment
- Narrow focus on energy
- Not clear about their existing level of operations and efficiency, due to lack of instrumentation & non availability of energy consumption data
- Limited manpower
- Cost of energy conservation options
- Orthodox mind set of entrepreneurs

Details of the other barriers in the implementation of energy efficient technologies/equipments in the Jamnagar Brass cluster are presented in below sections:

2.5.1 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 has made it difficult for the Chemical unit owners to identify the most effective technical measures.

Majority of Chemical units in Ahmedabad Chemical cluster have been established several years ago when energy efficiency was not an important issue for the operation of a plant. They are operating with outdated and low end technologies.

As a 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 chemical unit entrepreneurs that, energy efficiency initiatives are a challenge, and people are not ready to take the risk of business interruption due to production loss against the drive to save energy. However these can be overcome by motivating them to attend the awareness programs on energy efficiency. Further, sourcing of expertise on maintenance service provider or training by the equipment supplier will definitely overcome the above mentioned barriers.

2.5.2 Financial Barrier

Significant amount of investment is not commonly seen in most of Ahmedabad Chemical industries. Further, from the business perspective for any industry owner, it is more viable, assured and convenient to invest in project expansion for improving the production capacity, 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 entrepreneurs from Chemical units in Ahmedabad would not have taken up the risks to invest in energy efficiency measures.

2.5.3 Manpower

Skilled workers are locally available to run the machines available in Ahmedabad. However, there is hardly any engineer employed in these enterprises and the production process remains traditional. This is one of the lacunas of the Ahmedabad Chemical cluster.

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

Energy Audit and Technology Assessment in Cluster

3.1 METHODOLOGY ADOPTED FOR ENERGY USE AND TECHNOLOGY AUDIT STUDIES

A well planned methodology was followed to execute energy use and technology audit studies and to achieve the desired objectives of project. Major steps which were followed during the energy use and technology studies of the project are mentioned below:

- Discussion with the industry representatives/local industry association
- Inventorization of the units so as to understand their energy consumption pattern
- Selection of suitable representative units for carrying out energy use and technology assessment studies

3.1.1 Pre-energy use & technology audit studies

Chemical industries in Vatva area have organized themselves into one association (co-operative society) called The Green Environment Services Co-op society Ltd. The following table gives the coordinates of the association.

Table 3.1: *Details of the Vatva Chemical industries Association, Ahmedabad*

Name of the association	The Green Environmental Services Co-op Society Ltd.
Contact Person	Mr. Bipin Patel
Profile	Chairman- The Green Environment Services Co-op Society
Contact Details	Plot no: 244-251, Phase-II, GIDC Estate, Vatva, Ahmedabad-India Email: info@gescsl.com

The association provided a platform for development of mutual understanding among the industries and discussions relating to common problems and identification of viable solution for that. Therefore, as a first step for making inroad in the cluster, the association and its office bearers were approached. Detailed discussions with the association were held on apprising the association about the objective of the project, tentative schedule of the activities being undertaken and expected project outcome.

The office bearers of associations were apprised about benefits of the project for the industries and the cluster. The association took up the task of dissemination of all this information among their respective member units. The outcome of this activity was introduction of project concept to the association and later on to the industry. This helped in identification of progressive and interested entrepreneurs out of the whole lot.

3.1.2 Preliminary energy audit studies

53 Preliminary energy audit studies were conducted in Ahmedabad Chemical cluster. The methodology followed in preliminary energy audit study is as presented below:

- Collection of past energy consumption details and energy bill
- List out major energy consuming areas of the plant
- Existing technology of various processes and utilities (latest or old, crude or efficient, local or reputed company make etc)
- Identification of the areas for special attention for low cost measures with quick payback period
- Understanding the detailed process with energy and material balance
- Establish specific energy consumption, if possible for the each typical equipment/process
- Identify the areas for detailed energy audit study and measurements required

3.1.3 Detailed energy audit studies

22 Detailed energy audit studies were conducted in Ahmedabad Chemical cluster. Methodology followed in detailed energy audit study is presented below:

- Collection of past energy consumption details and energy bill
- List out major energy consuming areas of the plant
- Existing technology of various processes and utilities (latest or old, crude or efficient, local or reputed company make etc)
- Status of instruments installed in the plant and necessary instrumentation required for the detailed study
- Identification of the areas for special attention for low cost measures with quick payback period
- Understanding the detailed process with energy and material balance
- Monitoring & measuring of different parameters of various equipment / machines to evaluate performance
- Collection of operational data from various measuring instruments / gauges installed in the plant
- Compilation of design data/name plate details of various equipment from design manuals and brochures

- Discussions with concerned plant personnel to take note of operating practices and shop-floor practices being followed in the plant and to identify specific problem areas and bottlenecks if any with respect to energy consumption
- Critical analysis of data collected and parameters monitored
- Identification of energy wastage areas and quantification of energy losses
- Identification of suitable energy conservation measures for reducing energy consumption

3.2 OBSERVATIONS MADE DURING ENERGY USE AND TECHNOLOGY AUDIT STUDIES

Observations made during the energy use and technology audit studies in various processes/equipments are presented in the below sections:

3.2.1 Manufacturing process and technology/equipments installed

Manufacturing process of chemical units in Ahmedabad chemical cluster depends on final product, quality of final product manufacturing unit and raw material properties. The major energy consuming processes in typical chemical are stirring, reduction, coupling and drying. Production process of typical chemical is presented in below section, after initial gradual addition of chemicals in the reaction vessel with continuous stirring, slowly reaction will take place after certain time; most of these reactions are exothermic but for process requirement liquid in reaction vessel has to maintain at 20 deg C. Hence the reaction mass has to maintained at 20 deg C with the help of with addition of ice to chemical in reaction vessel or chilled water circulation in the jacket of reaction vessel. After the chemical reaches a required temperature the addition of the other suitable chemicals into main reaction vessel is done. Coupling of other material into main chemical will required to maintain at 90 deg C for reaction, this temperature in reaction vessels would be maintained by using the passage of live steam in to reaction vessel or steam circulation in jacket or thermic fluid oil circulation. After the suitable temperature is reached the liquid slurry is sent into Notch filter/manual filter press/Hydraulic press to separate mother liquor. After filtering operation wet cake is dried in tray dryer under the temperature of around 100 deg C. Dry chemicals are mixed in a ball mill to make uniform quality of chemicals.

- The agitator systems used in the stirring operation are of a very primitive design. The design of the stirring system does not consider various critical parameters of process liquid such as viscosity, specific gravity etc of processed liquid. Poor design of agitator system is affecting the quality and productivity of chemicals in unit

- The drying system used in the unit are of a very poor design, they are not considered the air quantity required in between the two trays, resistance of air flow in tray dryer, cycle of hot air circulation in unit etc. All these mentioned areas are affecting drying quality as well as drying time of chemicals in tray dryer. This leads to higher energy consumption.

Major energy consuming equipments installed in typical chemical units in Ahmedabad chemical cluster are:

- Hot air generator
- Dryers (Tray dryers, spray dryers, Fluid bed dryers)
- Steam Boilers
- Reaction vessels (motors)
- Pumps
- Compressors
- Centrifuges
- Ballmills/Blungers
- Filter press
- ID& FD fans
- Thermic fluid heaters

3.2.2 Energy consumption profile of various utilities

Percentage energy consumption of various utilities in typical chemical industry, in overall energy consumption is furnished in the figure below:

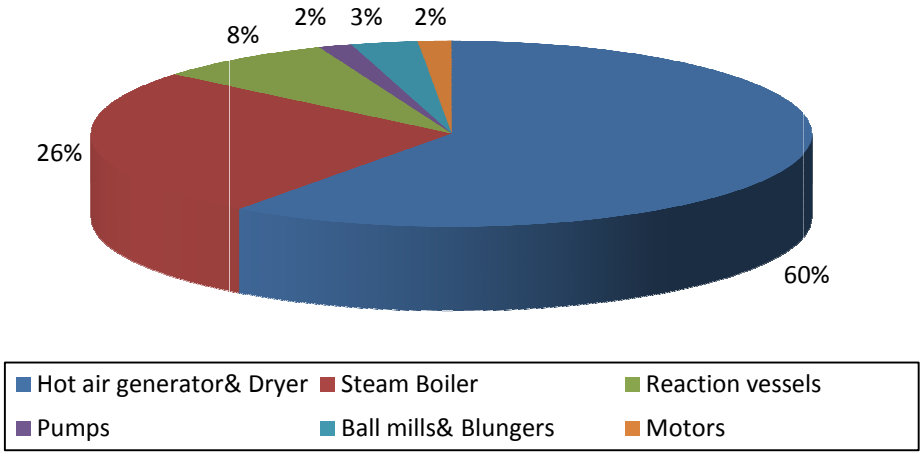


Figure 3.1: *Percentage energy consumption of different utilities in typical chemical industry in Ahmedabad Chemical cluster*

From the above figure it is clear that hot air generator & dryer is using around 60% of total energy, steam boiler is using the 26% of total energy and remaining utilities are using 14% of total energy.

3.2.3 House keeping Practices

Majority of the Chemical industries in Ahmedabad Chemical Cluster maintain very poor operational practices in different utilities. There are no specific procedures to be followed in any of the units for the operation of the various equipments.

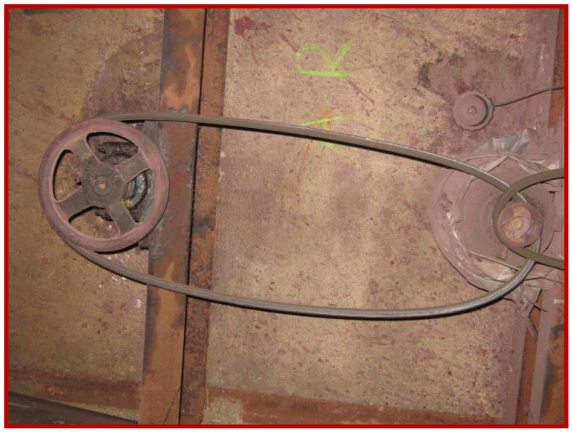


Figure 3.2: ***Operation of V-belts drives in typical chemical industry in Ahmedabad Chemical cluster***

By improving the operational practices in various utilities in chemical units, efficiency will improve by around 5-8%. Few of suggested house-keeping practices in Chemical industries are presented below:

- Adoption of Best operational practices in motors/ transmission system
- Proper tightening/tensioning of belts in various drives
- lubrications of gear systems in reaction vessels
- Adoption of best operational practices in Filter press
- Cleaning of compressor filters regularly
- Location of compressors should be away from heat generating equipments in unit
- Closing of charging doors in hot air generator system, this will avoid radiation heat losses
- Removal of ash depositions on heat transfer pipes hot air generator system, this will improve heat transfer efficiency between flue gases and cold air
- Avoid hot air leakages in tray dryers
- Rotational speed of fans in tray dryers should be same to avoid short circuit of air, this can be maintained by equal tension of two belts in motors
- Opening of exhaust locations for proper hot air circulation in tray dryers
- Avoiding steam leakages in steam utilization system

- Use filter press with full capacity, if less quantity is to be filtered use block plate to reduce the cake holding capacity
- Use proper cloth& clean the cloth regular intervals for effective filter press operation
- Fix the cloth properly in filter press, so that there is no crease developed on the sealing boarder of the plate
- In case of filter press cake is to be washed with water or any liquor, use the counter current flow to wash the cake thoroughly
- Use air flushing to reduce extra moisture in wet cake
- Avoid use of sharp or metallic scraper to remove cake from filter plates, as it will harm the cloth
- Arrange filter plates in wash-non wash sequence

3.2.4 Availability of data and information

A majority of the units do not have any instrumentation/data monitoring systems to monitor the various operational parameters. Some of the units have installed some instruments for monitoring of various operational parameters in their units. Accuracy of the readings from those instruments are poor.

A majority of entrepreneurs in Ahmedabad Chemical cluster are not interested in sharing the energy consumption data, due to various reasons. Very few entrepreneurs have shared their energy consumption against production data in the respective months/annum.

3.3 TECHNOLOGY GAP ANALYSIS IN CHEMICAL INDUSTRIES

Chemical units in unorganized sector have these characteristics such as; low engineering, limited technology innovation and poor R&D base as well as low level of human resource on knowledge of technology etc. The 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.

A majority of chemical units in Ahmedabad Chemical cluster use low end technologies/in-efficient equipments in their processes and utilities; performance of those processes/equipments is poor as compared to the technologies available in the market. There are various technological gaps that were identified in various utilities in chemical units and the same is presented in below:

- Lack awareness on the technologies available
- Lack of awareness on quantum of energy loss and its monetary benefit
- Lack of awareness among the workforce etc.

There is a tremendous need for chemical industries in Ahmedabad Chemical cluster to modernize/upgrade its technology and adopt energy efficient technologies in some of the areas.

From technology audit studies conducted in Ahmedabad Chemical cluster, below mentioned areas were identified for technology up gradations; those are:

- Conventional wood fired hot air generator
- Conventional tray dryer system
- Horizontal agitator system
- Conventional filter press
- Design of waste heat recovery system in exothermic reaction

Technical gap analysis in above mentioned areas is presented in below sections:

3.3.1 Conventional wood fired hot air generator

Technology gaps/design flaws in conventional wood fired hot air generator system are identified and a detail of same is presented below:

- **Natural draft system**: Draft is the most important factor in efficient fuel combustion in hot air generator. The conventional hot air generator system operates on natural draft system. Due to poor design of natural draft system in conventional hot air generator it leads to inefficient fuel combustion.
- **Design of ash pit and combustion system**: The grate area of the hot air generator and ash pit below combustion chamber adds overall resistance to draft system, this causes air flow through the grate more difficult. Due to lack of sufficient combustion air in combustion chamber, this leads to partial/improper combustion of fuel.
- **Heat transfer efficiency**: Heat transfer between the flue gas and air occurs in air heating chamber in hot air generator. Due to poor heat transfer area and short contact time between flue gas and hot air leads to poor heat transfer, this leads to inefficiency of the hot air generator system.
- **Radiation loss from charging door**: The charging door of hot air generator remains more or less open during the entire operation of hot air generator due to human error and non compatibility of wood logs in combustion chamber. Grate/combustion chamber is not designed to accommodate wood log size and vice versa. It is observed that radiation loss from charging door is around 5% of total losses in hot air generator.

- **Monitoring on fuel consumption**: In conventional hot air generator system there is no control on fuel firing irrespective of temperature of hot air.
- **Insulation on hot air generator:** From energy use and technology studies it was observed that around 4-5% of energy is lost from the surface area of hot air generator due to poor insulation on hot air generator.
- **Temperature of hot air**: There is no temperature control of hot air in hot air generator. Sometimes it causes temperature overshoot of hot air, it automatically affects quality of drying material.

From the above mentioned analysis it is clear that conventional hot air generator has poor performance in terms of energy and environmental point of view. Existing wood fired hot air generator installed in majority of chemical industries have poor energy efficiency, generating more GHGs (Green House Gasses) to environment, poor safety of operation. Due to above mentioned reasons it is need to upgrade conventional hot air generator with energy efficient hot air generator.

3.3.2 Tray dryers

Technology gaps/design flaws in conventional tray dryer system are being identified during technology audit studies and details of the same are presented below:

- **Location of inlet and exhaust locations in tray dryers:** Location of hot air inlet and exhaust air outlet location in tray dryers will affects the heat transfer between wet cake and hot air. Selection of hot air inlet and exhaust air outlet should be such that hot air should complete one full cycle in tray dryer for effective utilization of hot air
- **Partion between fans in tray dryers**: In conventional tray dryer system there is no partition between two fans. If the speed of the two fans are different, there is a possibility that air velocity of two fans can oppose each other this will reduce the effective air handling capacity of tray dryer. Some times this is reducing the 5-10% effective air flow in tray dryer.
- **Insulation of tray dryer**: From technology studies it was observed that in conventional tray dryer system there is no insulation on tray dryers. It is recommended to use cera wool as insulating material, to reduce the radiation heat losses in tray dryers. It is observed that radiation losses in tray dryer system were observed as 3-5%.
- **Volume of air in between two trays**: From technology studies it was observed that air velocity between two trays is less, it will leads to poor heat transfer efficiency and increased drying time. Due to different quantity of air between different trays in tray dryer affecting the quality of product.

- **Spacing between trays in tray dryers:** Due to non uniform spacing between trays in tray dryer, quality of final product being affected and drying time is increased.
- **Air circulations fans:** Conventional tray dryer systems being used as propeller fans for air circulation in tray dryer, which have poor efficiency compared to axial flow fans. Propeller fans have 20% lower efficiency than axial flow fans.
- **Gaps between bottom & top portion of trays with respect to tray dryer:** This causes less resistance to air flow in tray dryer compared to resistance in between trays, it automatically reduces the heat transfer efficiency between hot air and wet cake.

3.3.3 Horizontal agitator system

Technology gaps/design flaws in conventional horizontal agitator system being identified during technology audit studies and details of the same are presented below:

- **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.
- **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.
- **Quality of final product:** Poor mixing of various chemicals in reaction vessels causes the inferior quality of final product.
- **Transmission efficiency in Agitator system:** Almost of 20% energy is wasted in the transmission system in horizontal agitator system. This can be avoided by being use of energy efficient direct drive transmission system instead of belt driven gear system in horizontal agitator system. This automatically reduces the size of the motor i.e. reduces the operational and capital cost of drive.
- **Efficiency of gear system:** Conventional gears being used in horizontal agitator system has poor efficiency compared planetary gear system.
- **Size of the 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.

3.3.4 Filter press

Technology gaps/design flaws in conventional recess filter press system being identified during technology audit studies and details of the same are presented below:

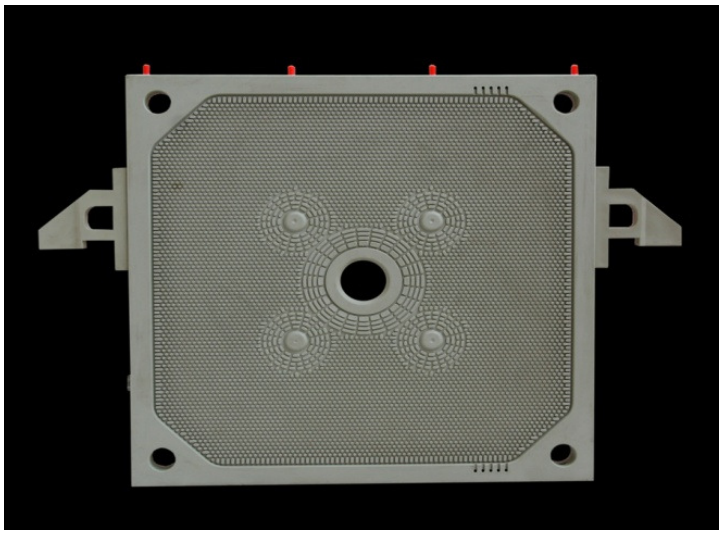


Figure 3.3: *Filter plates in Membrane filter press*

- **Design of filter plates:** Conventional filter press have poor design of filter plates. Due to its poor design this type of plates are not able to remove maximum moisture content from chemical fluids.
- **Pressure between filter plates:** From technology audit studies it was observed that pressure between the two filter plates is different; this causes the uneven moisture content in wet cake from various plates.
- **Drying time:** Time required to evaporate moisture content will be directly proportional to moisture content in wet cake. Due to poor design of conventional filter press, wet cake discharged from conventional filter press has more moisture content. More moisture content in wet cake will increases drying time, which automatically increases drying cost.

3.3.5 Waste heat recovery system

Majority of the chemical reactions in the manufacturing process of various chemicals are exothermic. In most of chemical reactions 100-130 deg C heat will be available for 6-10 hours depends on type reaction, this heat can easily captured and used in other applications in chemical industries.

3.4 ENERGY CONSERVATION PROPOSALS

From Energy use and technology audit studies conducted in Ahmedabad Chemical cluster, various energy conservation proposals are identified for chemical units in Ahmedabad Chemical cluster; same are presented in below sections:

3.4.1 Replacement of conventional horizontal agitator system with vertical agitator system

Background

Existing agitator system situated in the reaction vessels are of very primitive design, it is recommended to replace the conventional agitator system with scientifically designed agitator system by considering the viscosity, specific gravity of material etc. By considering these parameters into the design of agitator system will improves the heat and mass transfer in system in process liquid, this will improves the quality of the final product. By replacing the conventional horizontal agitator system with vertical agitator system will improves the transmission efficiency.

Benefits of proposals

Major advantages of energy efficient vertical agitator system in place of conventional agitator system in reaction vessels are presented below:

- Improved product quality
- 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
- Vertical mounted motors in place of conventional horizontal motors, this saves the energy
- Improved percentage loading of the motors, this will improves the efficiency of motor
- Improved power factor

Cost benefits analysis

Cost benefit analysis of the replacement of conventional agitator system with energy efficient agitator system in typical chemical industry are presented in table below:

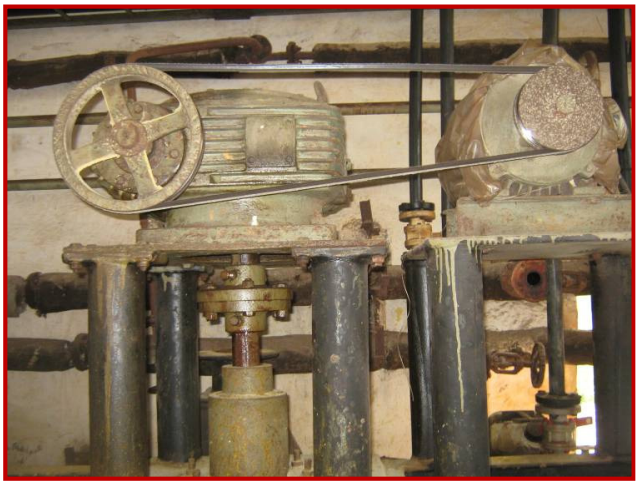


Figure 3.4: ***Operation of conventional horizontal agitator system at typical chemical unit***

Figure 3.5: ***Operation of vertical agitator system at typical chemical unit***

Table 3.2: ***Cost benefits analysis of replacing conventional agitator system with energy efficient agitator system***

Details	Units	Value
Rating of the motors installed in horizontal/conventional agitator system	hp	15
Average Input power consumption of motors	kW	8.4
Percentage loading of the motors	%	63
Amount of electrical power saving after replacing the conventional/horizontal agitator system with vertical agitator system	kW	2.5
Operational hours per annum	hours	4500
Annual energy savings due to replacing the horizontal agitator system with vertical efficient agitator system	kWh	11,340
Annual monetary savings (@ 5.4 Rs/kWh)	Rs.lakh	0.6
Investment required for replacing the horizontal agitator system with vertical agitator system	Rs.lakh	2.2
Simple payback period	years	3.5

From the above table it is clear that replacement of conventional agitator system with energy efficient agitator system is financially attractive.

- **Issues in implementation:**
  - Lack of awareness on proposed energy conservation measures
  - Cost of implementation
  - Down time in replacement of vertical agitator system is more compared to horizontal system

3.4.2 Replacement of manual filter press with mechanical filter press

- **Background**

Most of the chemical industries are being used the manual filter press for separation of various chemicals out of mother liquor, it is recommended to replace the conventional manual filter press with mechanical filter press. In mechanical filter press pressure in between the two plates is more compared to the manual filter press, this will reduces the moisture content in wet cake; this will saves the drying time in dryer.

- **Benefits of proposals**

Major advantages of the mechanical filter press over conventional filter press are presented below:

- Improved product quality
- Saving in drying time, it automatically leads to energy savings
- Productivity improvements
- Uniform moisture in wet cake

- **Cost benefits analysis**

Cost benefit analysis of the replacing conventional filter press system with mechanical filter press is presented in table below:

Table 3.3: *Cost benefits analysis of replacing conventional manual filter press system with mechanical filter press system*

Parameter	Units	Value
Moisture content in wet cake discharged from conventional manual filter press	%	72
Moisture content in wet cake discharged from mechanical filter press	%	67
Drying time reduction in using mechanical filter press instead of manual filter press	hours	8
Wood consumption of existing hot air generator	Kg/hr	70*
Wood saving per batch by using mechanical filter press instead of manual filter press	Kg/batch	560
Number batches per annum	No	200
Annual wood saving by using mechanical filter press	tpa	112

Parameter	Units	Value
system instead of conventional manual filter press		
Annual Monetary savings (Rs 3000 per tonne of wood)	Rs.lakh	3.36
Implementation cost of mechanical filter press	Rs. lakh	10
Simple payback period	years	3

* Size of the hot air generator is 120,000 kCal/hr and outlet of hot air temperature is around110 deg C

From the above table it is clear that replacement of conventional manual filter press system with mechanical filter press is financially attractive.

- **Issues in implementation**
  - Lack of awareness on proposed energy conservation measures
  - Cost of implementation

3.4.3 Replacement of conventional filter press (recess plates) with membrane filters press

- **Background**

In the membrane filter presses, membrane in turn inflates or flexes outward arid exert pressure on the filter cake which has been formed. The cakes are then squeezed to reduce the amount of moisture prior to cake discharge. Membrane squeeze plates is plates is offered to suit upto 30 bar squeezing pressure. Due to additional liquid extraction during the squeezing cycle, solid percentage increases.

Figure 3.6: ***Filter press plates in conventional filter press***

Most of the chemical industries are using the manual filter press to solid –liquid separation purpose; it is recommended to replace the conventional recess chamber plate filter press with membrane filter press.

Technical specifications of membrane filter press

Technical specifications of 40 plate membrane filter press are presented in table below:

Table 3.4: *Technical specifications of membrane filter press*

Parameter	Value
Size of membrane filter press plates	1000mm X 1000mm
Operating pressure	3-4 Kg/cm^2
Squeezing pressure	8-10 Kg/cm^2 (Max)
Cake thickness	40mm+/-2mm
Type of material of Squeezing Header with Hose Pipes & all Accessories Membrane Plates of type P.P	SS- 3004
Membrane plates of type P.P	1000mm*1000mm
Recess plates of type P.P	1000mm*1000mm
One side recess first plate of type P.P	1000mm*1000mm
One side recess end plate of type P.P	1000mm*1000mm
Hydraulic cylinder type	Pull back
Power back unit	2 hp

Benefits of proposals

Major advantages of the membrane filter press over conventional recess filter press are presented below:

- Improved product quality
- Reduction of drying time, it automatically leads to energy savings
- Productivity improvements
- Uniform moisture content in wet cake
- Reduction of wash water

Cost benefits analysis

Cost benefit analysis of replacing conventional recess plate filter press system with membrane plate filter press is presented in table below:

Table 3.5: *Cost benefits analysis of replacing conventional manual filter press system with membrane filter press*

Parameter	Units	Value
Moisture content in wet cake discharged from recess filter press	%	65
Moisture content in wet cake discharged from membrane filter press	%	38
Reduction in moisture content using membrane filter press instead of recess filter press	%	27
Reduction of water in wet cake (@ considering 1000 Kg of solid liquid material)	litre	270
Drying time with recess membrane filter press	hours	72
Drying time with membrane filter press	hours	49
Reduction of drying time	hours	23
Wood consumption in hot air generator	Kg/hr	70
Amount wood saved per batch	Kg/batch	1,610
Number of batches per annum	no	150
Annual wood energy savings	tpa	242
Annual monetary saving (@ Rs 3000 per tonne)	Rs. lakh	7.25
Implementation cost of membrane filter press	Rs. lakh	22
Simple payback period	years	3

From the above table it is clear that replacement of conventional recess filter press system with membrane filter press is financially attractive.

- **Issues in implementation**
  - Lack of awareness on proposed energy conservation measures
  - Cost of implementation

3.4.4 Matching the centre of motor axis with ball mill axis

- **Background**

Majority of chemical industries in Ahmedabad Chemical cluster being used ball mills for mixing of chemicals. In existing ball mill systems it was observed that there is displacement angle of 135 degrees between the motor axis and ball mill axis. It is recommended to match (parallel) the centre of ball mill axis with motor axis.

Figure 3.7: *Conventional Position of motor in operation of ball mills in typical chemical unit*

Benefits of proposals

Major advantages of the matching the centre of motor axis with ball mill axis are presented below:

- Improved transmission efficiency, this automatically saves energy
- Improved life of belt and pulley system
- Reduction in size of the motor
- Improved motor loading & power factor

Cost benefits analysis

Cost benefit analysis of matching the centre of motor axis with ball mill axis is presented in table below:

Table 3.6: *Cost benefits analysis of matching centre of motor axis with ball mill axis*

Parameter	Units	Value
Rating of motor installed in ball mill	hp	10
Input power consumption of ball mill when the angle of displacement is 135 deg between ball mill and motor axis	kW	4.9
Input power consumption of motors when the angle of displacement is zero deg	kW	3.8
Reduction in power consumption	kW	1.1
Operational hours per annum	hours	4,000
Annual energy saving due to matching centre of motor axis with ball mill axis	kWh	4,400
Monetary savings (@ 6 Rs/kWh)	Rs.lakh	0.26
Investment required	Rs. lakh	0.1
Simple payback period	years	0.4

3.4.5 Replacement of conventional gear system with planetary gear system in reaction vessels

Background

Majority of the chemical industries are being used truck gear system in reaction vessels. Efficiency of conventional /truck gears has efficiency of 50-60%. It is recommended to replace conventional gear system with energy efficient gear system. Replacement of conventional gear system with energy efficient planetary gear system will saves 20% of energy.

Figure 3.8: *Operational of conventional /truck gear system*

Benefits of proposals

Major advantages of the energy efficient planetary gear system over conventional gear system are presented below:

- Improved transmission efficiency, this automatically saves energy
- Availability of different speed in energy efficient gears over single speed available in truck gears (conventional gears)
- Lubricant leakage problem is avoided
- Improved life of belt and pulley system
- Reduction in size of the motor
- Improved motor loading & power factor

Cost benefit analysis

Cost benefits analysis of replacing the conventional gear system with energy efficient gear system is presented in table below:

Table 3.7: *Cost benefits analysis of replacing conventional gear system with energy efficient gear system*

Details	Units	Value
Input power consumption of motor using conventional truck gear system	kW	6.6
Input power consumption of motor using energy efficient gear system	kW	5.3
Reduction in power consumption using energy efficient gear system in place of conventional gear system	kW	1.3
Operational hours per annum	hours	4,000
Annual energy saving due to replacing conventional gear system with energy efficient gear system	kWh	5,200
Monetary savings (@ 5.4 Rs/kWh)	Rs.lakh	0.28
Investment required for replacing conventional gear system with energy efficient gear system	Rs.lakh	0.40
Simple payback period	years	1.43

From the above table it is clear that replacement of conventional gear system with energy efficient gear system is financially attractive.

- **Issues in implementation**
  - Lack of awareness on proposed energy conservation measure
  - Cost of implementation

3.4.6 Improving insulation of hot air generator

- **Background**

Majority of the chemical industries are being used the hot air generator for generating the hot air; this is subsequently used in dryers for drying of chemicals. From energy use and technology studies it is observed that, In few of chemical industries average surface temperatures of hot air generators is around 100-130 deg C, this 3-7% of input energy of wood fired hot air generator is lost in radiation losses . It is recommended to use the proper insulation and aluminium cladding over it, to minimize the radiation losses in hot air generator.

Figure 3.9: *Operation of hot air generator without insulation over it*

Technical specification

Technical specifications of recommended insulating material for hot air generator are presented in table below:

Table 3.8: *Technical specification of insulating material for hot air generator*

Parameter	Value
Type of insulation material	Cera wool
Thickness of material	3”
Density	100-125 Kg/m^3
Type of cladding material	Aluminum
Thickness of cladding material	0.5”

Benefits of proposals

Major advantages of the use of insulation system over hot air generator surface are presented below:

- Reduction of radiation losses
- Improved efficiency of hot air generator i.e. fuel savings
- Improved working conditions
- Productivity improvements
- Improved life of hot air generator system

Cost benefit analysis

Cost benefits analysis of installing insulation system over hot air generator system is presented in table below:

Table 3.9: *Cost benefits analysis of installing proper insulation on hot air generator system*

Details	Units	Value
Average surface temperature of hot air generator	deg C	112
Ambient temperature	deg C	28.5
Surface area of hot air generator	m^2	9.4
Radiation heat loss in hot air generator due to poor insulation	kCal/hr	9870
Annual operational hours	hours	6000
Annual energy loss due to radiation	kCal/annum	59,220,000
Equivalent annual wood loss due to with out proper insulation	tpa	22
Annual monetary saving after implementation of suitable insulation over it	Rs. lakh	0.66
Investment required for implementation of proposed measure	Rs. lakh	0.40
Simple pay back period	years	0.60

3.4.7 Replacement of conventional hot air generator system with energy efficient hot air generator system

- **Background**

From the above chapters it is clear that, hot air generator is one of the major energy consuming equipment in overall manufacturing process of chemicals. Conventional wood fired hot air generator system has efficiency of around 30-40%. It is recommended to replace the conventional hot air generator system with energy efficient hot air generator system of efficiency around 70%.

Figure 3.10: *Energy efficient wood fired hot air generator at typical chemical* industry

Proposed energy efficient wood fired hot air generator operates on force draft system and controlled fuel combustion system. Improved grate area, this will reduce the resistance to the draft system and reduction of radiation loses from combustion chamber. This system has three pass design compared single path design in conventional hot air generator system which will improves the heat transfer area and time, this automatically lead to improved heat transfer efficiency between flue gas and air. Due to all above mentioned things will lead to improved drying air temperature; this automatically reduces drying time.

Technical, economic, environmental and safety aspects of conventional hot air generator and energy efficient hot air generator are compared over life cycle of equipment, same is presented in table below:

Table 3.10: ***Comparison of conventional hot air generator with energy efficient hot air generator***

S. No	Details	Conventional hot air generator	Energy efficient hot air generator
			
1	Wood consumption	High (36 Kg/hr)*	Low (20kg/hr)
2	Environment pollution	High (*partial combustion & more fuel consumption*)	Low (*Complete combustion & less fuel consumption*)
3	Safety of workers	Poor	Good
4	Maintenance	High	Low
5	Operational cost	High	Low
6	Availability of local service providers	Yes	Yes
	Technical comparison between convention & energy efficient hot air generators		
7	Draft system	Natural	Forced
8	Fuel combustion	Partial	Complete
9	Control of fuel combustion	No	Yes
10	Temperature monitoring & control	No	Yes
11	Radiation losses	More	Less

S. No	Details	Conventional hot air generator	Energy efficient hot air generator
12	Heat transfer between hot gasses and cold air	Less (Single path flue gas); Heat transfer efficiency is less	More (Three path flue gas); heat transfer efficiency is more
13	Radiation heat in combustion chamber	Not utilized	Utilized in the transfer of heat

** Wood consumption mentioned for hot air generator of capacity 30,000kCal/hr*

From the above table it is clear that energy efficient hot air generator has significant advantages in energy, environmental, economic & safety aspects over conventional hot air generator. It is justifiable to install energy efficient hot air generator in place of conventional hot air generator.

Technical specification

Design specifications of proposed energy efficient hot air generator are presented in table below:

Table 3.11: ***Technical specifications of AHA-300-C"energy efficient hot air generator"***

Details	Units	Value
Name of equipment	NA	Energy efficient wood fired hot air generator
Model	NA	AHA-300-C
Capacity	kCal/hr	30,000
Blower model	NA	25-200
Blower capacity	hp	2
Fuel used	NA	Wood
Fuel consumption	Kg/hr	20
ID Fan model	NA	28-160
ID Fan motor	hp	½
ID Fan control	NA	ON-OFF
Total connected electrical load	hp	2.5
Electric supply	NA	AC 3 phase, 415V, 50 Hz
Hot air pipe outlet dimensions	in*in	9*9
Diameter of flue gas outlet	in	8
Air temperature of outlet	deg C	150 (Max)

Benefits of proposals

Major advantages of the replacement of conventional hot air generator with energy efficient hot air generator are presented below:

- Improved productivity

- Quality improvements
- Reduction of manufacturing cost
- Improved working environment
- Reduction of deforestation
- Resultant GHG reduction
- Improved life of hot air generator system
- Easy operation& maintenance

Cost benefit analysis

Energy & monetary savings after implementation of energy efficient hot air generator in place of conventional hot air generator in typical chemical manufacturing unit are presented below. From energy use and technology audit studies it was observed that energy consumption of hot air generator is depends on the number of tray dryers operate on particular hot air generator and temperature of hot air generating in hot air generator. Analysis was carried out on conventional hot air generator average wood consumption from various energy use and technology audit studies in chemical units in Ahmedabad chemical cluster; it comes out to be 36 kg/hr. Wood consumption of proposed energy efficient hot air generator is 20 Kg/hr. Annual monetary savings of implementation of energy efficient hot air generator in place of conventional hot air generator is Rs. 1.73 lakh per annum. Energy& economic benefit analysis of energy efficient hot air generator in place of conventional hot air generator is presented in table below:

Table 3.12: *Energy& Economic benefit analysis of energy efficient hot air generator over conventional hot air generator*

Parameter	Unit	Value
Present wood consumption of existing/conventional hot air generator	Kg/hr	36*
Operational hours	hours/day	12
Operational days per annum	days/annum	300
Wood consumption of energy efficient hot air generator	Kg/hr	20
Reduction of wood consumption after replacing conventional wood fired hot air generator with energy efficient wood fired hot air generator	Kg/hr	16
Cost of wood	Rs./Kg	3
Annual wood saving after replacement of conventional hot air generator with energy efficient hot air generator	Kg	57,600
Cost savings after implementation	Rs. lakh	1.73
Cost of implementation	Rs. lakh	2.75
Simple payback period	years	1.60

**Energy consumption of 30,000 kCal/hr hot air generator*

From the above table it is clear that it clear that replacement of conventional hot air generator with energy efficient hot air generator project seems more viable interms of energy and economical point of view.

- **Issues in implementation**
  - Lack of awareness on proposed energy conservation measure
  - Cost of implementation
  - Availability of single local service provider/technology supplier

3.4.8 Replacement of conventional wood fired hot air generator system with energy efficient gas fired hot air generator system

- **Background**

Conventional wood fired hot air generator system has efficiency of around 30-40% due to its poor design of hot air generator as well as inefficient combustion of wood in conventional hot air generator. It is recommended to replace conventional wood fired hot air generator system with energy efficient gas fired hot air generator system of efficiency around 80%.

Figure 3.11: ***Operation of conventional wood fired hot air generator***

- **Technical specification**

Design specifications of proposed Energy efficient gas fired hot air generator of capacity 30,000 kCal/hr are presented in table below:

Table 3.13: *Technical specifications of AHA-600-G"Energy efficient gas fired hot air generator"*

Parameters	Units	Value
Name of equipment	NA	Energy efficient gas fired hot air generator
Model	NA	AHA-600-G
Capacity	kCal/hr	60,000
Blower capacity	hp	5
Burner	NA	Fully automatic
Fuel used	NA	gas
Fuel consumption	Nm^3/hr	9
Gas pressure required	mbar	50-80
Burner blower capacity	hp	0.5
ID Fan control	NA	ON-OFF
Total connected electrical load	hp	5.5
Electric supply	NA	AC 3 phase, 415V, 50 Hz
Hot air pipe outlet dimensions	in*in	12*12
Diameter of flue gas outlet	in	8
Air temperature of outlet	deg C	150 (Max)

- **Benefits of proposals**

Major advantages of the use of gas fired energy efficient hot air generator over wood fired hot air generator are presented below:

- Improved productivity
- Quality improvements
- Improved working environment
- Reduction of deforestation
- Resultant GHG reduction
- Improved life of hot air generator system
- Easy operation& maintenance

- **Cost benefit analysis**

Energy & monetary savings after implementation of energy efficient gas fired hot air generator in place of conventional hot air generator in typical chemical manufacturing unit are presented below. From energy use and technology audit studies it was observed that energy consumption of hot air generator is depends on the number of tray dryers operate on particular hot air generator and temperature of hot air generating in hot air generator. Analysis was carried out on conventional hot air generator of capacity 60,000 kCal/hr average wood consumption comes out to be 58 kg/hr. Natural gas consumption of proposed energy efficient hot air generator is 6.23 Nm^3/hr. Annual monetary savings of implementation of energy efficient gas fired hot

air generator in place of conventional hot air generator is Rs. 2.23 **lakh per annum**. Energy& economic benefit analysis of energy efficient gas fired hot air generator in place of conventional hot air generator is presented in table below:

Table 3.14: ***Energy& Economic benefit analysis of energy efficient gas fired hot air generator over conventional wood fired hot air generator***

Details	Units	Value
Efficiency of existing conventional wood fired hot air generator	%	31.18
Wood consumption of existing hot air generator	Kg/hr	58.00
Hourly wood cost in existing hot air generator (@ Rs.3/kg)	Rs./hr	174.00
Total energy input in the wood fired hot air generator (@ 2700 kcal/kg)	kCal/hr	156,600.00
output energy from the hot air generator	kCal/hr	48,827.88
Efficiency of the proposed energy efficient gas fired hot air generator	%	80.00
Gas required to generate required amount of energy in energy efficient gas fired hot air generator	Nm^3/hr	6.23
Hourly gas consumption cost in energy efficient gas fired hot air generator (@Rs.19/$Nm^{3)}$	Rs./hr	118.33
Hourly energy cost saving after replacing conventional wood fired hot air generator system with energy efficient gas fired hot air generator system	Rs./hr	55.67
Annual operational hours	hours	4000.00
Annual wood consumption of existing wood fired hot air generator	Kg/annum	232,000.00
Annual gas consumption of energy efficient wood fired hot air generator	Nm^3/annum	24,912.18
Annual monetary savings after replacing conventional wood fired hot air generator system with gas fired hot air generator system	Rs.lakh/annum	2.23
Implementation cost of energy efficient gas fired hot air generator (With proper instrumentation, insulation)	Rs.lakh	5.00
Simple pay back period	Years	2.25

** Capacity of the hot air generator is 60,000 kCal/hr*

From the above table it is clear that it clear that replacement of conventional wood fired hot air generator with energy efficient gas fired hot air generator project seems more viable in terms of energy and economical point of view.

- **Issues in implementation**
  - Lack of awareness on proposed energy conservation measure
  - Cost of implementation
  - Fluctuations in gas prices

3.4.9 Improvements in hot air distribution system

- **Background**

From energy use and technology studies it was observed that in majority of the industries are using 2-4 tray dryers for drying of chemicals, it is observed that drying time, quality of product in different dryers is different, due to different volumetric flow of hot air and variation in hot air temperature in different tray dryers; this is affecting the quality and drying time of chemical in different tray dryers. It is recommended to consider the below mentioned points in the design of hot air distribution system:

- Equal distribution of air in all dryers, by making the partions in hot air distribution pipe
- Reduction of pressure drops in hot air pipe
- Improving the insulation of hot air transfer pipes
- Avoid dusting in dryers

Figure 3.12: ***Hot air distribution system in typical chemical unit***

- **Benefits of proposals**

Major advantages of the use of proper hot air distribution system are presented below:

- Quality improvements
- Productivity improvements
- Improved working environment
- Resultant GHGs reduction

- **Cost benefit analysis**

Energy & monetary savings after implementation of proper air distribution system in typical chemical manufacturing unit are presented below. From energy use and technology audit studies it was observed that drying of wet material in tray dryer will depend on quantity of available air and temperature of air. Annual monetary savings after implementation of suitable hot air distribution system is Rs.1.05 **lakh per annum**. Energy& economic benefit analysis of suitable hot air generator distribution system is presented in table below:

Table 3.15: *Energy& economic benefit analysis of suitable hot air generator distribution system in typical chemical unit*

Parameter	Unit	Value
Average drying time of three dryers with conventional hot air distribution system	hours	48
Average drying time of three dryers with proper hot air distribution system	hours	43
Saving in drying time	hours/batch	5
Wood consumption of hot air generator	Kg/hr	70
Wood saving due to suitable hot air distribution system	Kg of wood/batch	350
Number of batches per annum	no	100
Annual wood savings	tpa	35
Annual monetary savings (@Rs 3000 per tonne)	Rs. Lakh	1.05
Cost of implementation	Rs. lakh	0.5
Simple payback period	years	0.5

From the above table it is clear that installation of suitable and properly sized hot air distribution system seems more viable in terms of energy and economical point of view.

- **Issues in implementation**
  - Lack of awareness on proposed energy conservation measure
  - Non availability of local service providers

3.4.10 Replacement of conventional tray dryer system with energy efficient tray dryer system

- **Background**

Majority of the chemical industries are using conventional tray dryers for drying of chemicals. There are lot of design flaws in conventional tray dryer system those are; uneven spacing between the trays, poor efficiency of propeller fans, no partition

between fans and lots of air leakages in the system. All these things lead to increase in drying, this will lead to increase in energy consumption in hot air generator.

Figure 3.13: Operation of conventional tray dryer system at Chemical unit

Figure 3.14: ***Energy efficient tray dryer system***

- **Technical specifications of proposed tray dryers**

Technical specifications of proposed energy efficient tray dryer are presented in table below:

Table 3.16: ***Technical specifications Model AHD-192 energy efficient tray dryer***

Parameter	Value
Heat input to tray dryer	30,000 kCal/hr
Model No	AHD -192
Number of trays	200
No of fans	Four
Rating of motor fans	1 hp
Number of doors	Two
No of Racks and placement of racks in tray dryer	four
Overall dimensions (L*W*H) approx	3950mm*1950mm*2100mm
Size of trays	32”*16”*1.25”
Power supply	AC,3 Phase, 415 V, 50 Hz, 4 wire
Type of drying	Air heater dryer

- **Benefits of proposals**

Major advantages of the replacement of conventional tray dryers with energy efficient tray dryer system are presented below:

- Quality improvements
- Productivity improvements

- Improved working environment
- Faster drying, it leads to energy savings
- Reduction of deforestation
- Resultant GHGs reduction

Cost benefit analysis

Energy & monetary savings after implementation of proper energy efficient tray dryer system in place of conventional tray dryer system in typical chemical manufacturing unit are presented below. From energy use and technology audit studies it was observed that drying of wet material in tray dryer will depend on quantity of available air and temperature of air. Annual monetary savings after implementation of energy efficient tray dryer in place of conventional tray dryer is Rs. 2.52 **lakh per annum**. Energy& economic benefit analysis of energy efficient tray dryer system is presented in table below:

Table 3.17: ***Energy & economic benefit analysis of energy efficient tray dryer system over conventional tray dryer system***

Parameter	Unit	Value
Drying time with conventional tray dryer system	hours	48
Drying time with energy efficient tray dryer system	hours	30
Savings in drying time per batch	hours/batch	18
Wood consumption of hot air generator	Kg/hr	36
Wood savings after installation of energy efficient tray dryer system in place of conventional tray dryers	Kgs of wood/batch	648
Number of batches per annum	no	130
Annual wood savings	tpa	84
Annual monetary savings (@Rs 3000 per tonne)	Rs. lakh	2.52
Implementation cost of energy efficient tray dryer in place conventional tray dryer	Rs. lakh	4.40
Simple payback period	years	1.75

From the above table it is clear that installation of energy efficient tray dryer in place of conventional tray dryer seems more viable in terms of energy and economical point of view.

Issues in implementation

- Lack of awareness on proposed energy conservation measure
- Non availability of local service providers
- Cost of implementation

3.4.11 Replacement of conventional tray dryer system with solar tray dryer system

Background

Majority of chemical industries are being used the wood fired hot air generators for generation of hot air generator. Hot air subsequently used in tray dryer for drying of chemicals. It is recommended to use the solar tray dryer system instead of conventional wood fired tray dryer system.

Benefits of proposals

Major advantages of the using solar tray dryer system in place of conventional wood fired tray dryer system is presented below:

- Reduction of energy cost
- Reduction of deforestation
- Resultant GHGs reduction

Cost benefit analysis

Energy & monetary savings after implementation of energy efficient solar tray drying system in place of conventional wood fired tray dryer system in typical chemical manufacturing unit are presented below. Annual monetary savings in implementation of energy efficient solar tray dryer in place of conventional tray dryer is Rs. 2.16 **lakh per annum**. Energy& economic benefit analysis of solar tray dryer system in place of conventional wood fired tray dryer system is presented in table below:

Table 3.18: *Energy& Economic benefit analysis of solar tray dryer system in place of conventional tray dryer system*

Parameter	Unit	Value
Drying time with conventional tray dryer system	hours	48
Wood consumption of hot air generator	Kg/hr	36
Annual operational hours	hours/annum	2000
Annual wood consumption of hot air generator	tpa	72
Annual wood savings after installing solar based tray dryer in place of wood fired tray dryer	tpa	72
Annual monetary savings after installation of solar based tray dryer	Rs. lakh	2.16
Implementation cost of solar tray dryer	Rs. lakh	7.80
Simple payback period	years	3.60

From the above table it is clear that installation of solar tray dryer in place of conventional tray dryer seems more viable in terms of energy and economical point of view.

Issues in implementation

- Lack of awareness on proposed energy conservation measure
- Not proven technology
- Non availability of local service providers
- Cost of implementation

3.4.12 Insulation of cyclone system in spray dryers

Background

Majority of chemical industries are being used spray dryers for drying of chemicals. Inlet hot air temperature and feed flow rate in spray dryer depends on the cyclone temperature. By improving the insulation of cyclone chamber in spray dryer can increase the feed rate of spray dryer or hot air temperature can be reduce, will leads to fuel saving.

Figure 3.15: ***Insulation on cyclone chamber in spray dryer***

Benefits of proposals

Major advantages of the use of proper insulation over cyclone system are presented below:

- Improved working environment
- Improved productivity
- Reduction of energy cost

Cost benefit analysis

Energy & monetary savings after implementation of insulation over cyclone system in spray dryer in typical chemical manufacturing unit are presented below. Annual monetary savings in implementation of insulation over cyclone in spray dryer system is Rs. 0.99 **lakh per annum**. Energy& economic benefit analysis of insulating cyclone system in spray dryer system is presented in table below:

Table 3.19: *Energy & economic benefit analysis of insulation on cyclone system*

Parameter	Unit	Value
Feed flow rate without insulation of cyclone system in spray dryer	Kg/hr	500
Feed flow rate after insulation of cyclone system in spray dryer	Kg/hr	525
Moisture content in feed liquid	%	72
Extra water evaporated due to installation of insulation over cyclone system	litre/hr	18
Operational hours per annum	hours	3000
Extra water evaporation due to improving the insulation of cyclone chamber in spray dryer	litre per annum	54,000
Amount of energy required to evaporate one litre of water	kCal/litre of water	1000
Amount of energy saved due to insulation of cyclone chamber in spray dryer	kCal per annum	54,000,000
Annual gas savings (9800 kCal/Nm^3)	Nm^3 per annum	5510
Annual monetary savings (@18 Rs/Nm^3)	Rs. lakh	0.99
Implementation cost	Rs. lakh	0.50
Simple payback period	years	0.50

From the above table it is clear that insulation of cyclone chamber in spray dryer system seems more viable in terms of energy and economical point of view.

- **Issues in implementation**

➥ Lack of awareness on proposed energy conservation measure

3.4.13 Installation of exhaust gas heat recovery system in spray dryer

- **Background**

Spray dryers are being used to dry the chemicals in chemical industries. Exhaust temperature in spray dryer system depends on drying product and inlet hot air temperature. Exhaust gas from the spray dryer which is exhausted at a temperature of around 120 deg C, this will be taken through the tubes of heat exchanger and the supply air of hot air generator will be routed through the shell side of the same. The pre heated air will be used in the hot air generator of spray dryer.

- **Benefits of proposals**

Major advantages of the use of exhaust gas heat recovery system in spray dryer system are presented below:

➥ Improved working environment

➥ Resultant GHGs reduction

- **Cost benefit analysis**

Energy& economic benefit analysis of exhaust gas recovery system in spray dryer system is presented in table below:

Table 3.20: *Energy& Economic benefit analysis of exhaust gas heat recovery system in spray dryer system*

Parameter	Unit	Value
Volume of air flow to hot air generator	m^3/hr	13248
Temperature of ambient air (Inlet hot air temperature)	deg C	30
outlet temperature hot air from heat exchanger	deg C	80
Exhaust gas outlet temperature from outlet heat exchanger	deg C	63.23
Heat exchanged in heat exchanger	kCal/hr	190779
Fuel used	Not Applicable	Natural gas
Annual operational hours	hours	6000
Annual total energy exchanged in heat exchanger	kCal/Annum	1144674000
Annual fuel savings	Nm^3/annum	116,803
Annual monetary savings (@Rs 19/ Nm^3)	Rs. lakh	22.20
Cost of implementation	Rs. lakh	35.00
Simple pay back period	years	1.57

From the above table it is clear that it clear that installation of exhaust gas heat recovery system in spray dryer system project seems more viable in terms of energy and economical point of view.

- **Issues in implementation**

  - Lack of awareness on proposed energy conservation measure
  - Orthodox mind set of entrepreneurs
  - Citing of failed cases

3.4.14 Replacement of conventional wood fired Boiler with energy efficient wood fired Boiler

- **Background**

Majority of the chemical industries are being used the conventional vertical boilers for generation of steam; further produced steam from Boiler being used in the manufacturing process of chemicals. From energy use and technology audit studies it was observed that operating efficiency of conventional wood fired boilers was around 35-55%. It is recommended to install energy efficient wood fired Boiler of efficiency around75% in place of conventional Boiler.

Figure 3.16: ***Operation of conventional wood fired Boiler at typical chemical unit***

- **Benefits of proposals**

Major advantages of replacement of conventional wood fired with energy efficient wood fired Boiler are presented below:

- Quality improvements
- Productivity improvements
- Improved working environment
- Reduction of deforestation
- Resultant GHGs reduction

- **Cost benefit analysis**

Energy & Monetary savings after replacing of conventional wood fired Boiler with energy efficient Boiler in typical chemical manufacturing unit is presented below. Annual monetary savings in implementation of energy efficient wood fired Boiler in place of conventional wood fired Boiler is Rs. 3.6 **lakh per annum**. Energy& economic benefit analysis of replacing conventional wood fired boiler with energy efficient Boiler system is presented in table below:

Table 3.21: *Energy & economic benefit analysis replacing conventional Boiler system with energy efficient Boiler system*

Details	Units	Value
Rating capacity of Boiler	Kg/hr	800
Rated steam generation pressure of Boiler	Kg/cm^2	6.5
Efficiency of existing Boiler	%	48
Efficiency of the energy efficient Boiler	%	75
Wood consumption of existing Boiler	Kg/hr	222
Wood consumption of proposed energy efficient boiler	Kg/hr	142
Savings in wood consumption	Kg/hr	80
Annual operational hours	hours	1500
Annual wood savings	Kg/annum	120,000
Annual monetary savings (Rs.3/kg)	Rs.lakh/annum	3.60
Implementation cost of energy efficient boiler (With proper instrumentation, insulation)	Rs.lakh/annum	6.00
Simple pay back period	years	1.70

From the above table it is clear that installation of energy efficient wood fired Boiler in place of conventional wood fired Boiler seems more viable in terms of energy and economical point of view.

- **Issues in implementation**
  - Lack of awareness on proposed energy conservation measure
  - Non availability of local service providers
  - Cost of implementation

3.4.15 Replacement of conventional motors with suitable size energy efficient motors

- **Background**

Majority of the motors installed in chemical industries are being used conventional motors, which is having lower values of efficiency compared to energy efficient motors. It is recommended to install suitable size of energy efficient motors in place of conventional motors in various drives.

- **Benefits of proposals**
  - Energy saving
  - Improved power factor

Cost Benefit analysis of proposal

Cost benefit analysis of replacement of conventional motors with energy efficient motors are presented in table below:

Table 3.22: *Cost benefit analysis of replacing conventional motors with energy efficient motors*

Parameter	Units	Value
Rating of motor in chlorination vessel	hp	15
Rated full load efficiency of existing motor	%	83.4
Full load efficiency of energy efficient motor (Eff-1)	%	91.5
Power saving after replacing conventional motors with energy efficient motors of same size	kW	0.95
Operational hours per annum	hours	6,000
Annual energy savings	kWh	5730
Annual monetary savings (@ Rs.5.4/kWh)	Rs.lakh	0.31
Investment required for replacement of conventional motors with energy efficient motors	Rs.lakh	0.3
Simple pay back period	year	1

From the above table it is clear that replacement of conventional motors with energy efficient motors project economically attractive.

3.4.16 Replacement of conventional v belts with synchronous belts in various drives:

Background

V-belts have power transmission efficiency of only 93% resulting in a loss of 7% energy input; due to inherent design problems of V-belts. It is recommended to replace the V-belts with energy efficient synchronous transmission belts, which have higher transmission efficiency of 98% compared to V-belts. The increase in efficiency of flat belts is due to superior material properties and operational characteristics.

Benefits of proposals

- Synchronous belts offer longer life than V belt system
- 20-50% narrower pulley widths compared to V belts pulleys
- High tensile strength and very high modulus viscosity
- Reliability of flat belts is good
- Less wear pulleys in flat belt system compared to V-belt system

Cost Benefit analysis of proposal

Cost benefit analysis of replacing conventional V belts with energy efficiency belts are presented in table below:

Table 3.23: *Cost benefit analysis of replacing conventional V belts with synchronous belts*

Parameters	Units	Value
Rating of the motor	hp	15
Input power consumption of the motor with conventional V belts	kW	10.200
Input power consumption of the motor with energy efficient synchronous belts	kW	9.775
Electrical power saving after replacing the conventional V belts system with synchronous belts	kW	0.425
Annual operational hours of the motors	hours	4000
Energy savings after installation of the synchronous belts in place of conventional V belts	kWh	1700
Monetary savings (@ Rs. 5.4/kWh)	Rs.lakh	0.092
Investment required for replacement of all conventional v belts with energy efficient ones	Rs.lakh	0.100
Simple payback period	years	1.100

Issues/barriers in implementation

- Lack of awareness on energy conservation measure
- High cost in implementation

3.4 AVAILABILITY OF TECHNLOGY SUPPLIERS/LOCAL SERVICE PROVIDERS FOR IDENTIFIED ENERGY CONSERVATION PROPOSALS

Technology suppliers/local service providers are identified for all major energy saving proposals discussed in above sections. Majority of the local service providers are in cluster.

Details of the identified technology supplier/local service providers in Ahmedabad Chemical cluster are furnished in Annexure-2 and same is attached along with this report.

3.5 IDENTIFIED TECHNOLOGIES FOR DPR PREPARATION

Manufacturing process is almost similar to majority of chemical industries in Ahmedabad Chemical industries. However, depending on final product, quality of final product manufacturing unit and raw material properties, process flow is altered to suit the requirement of the industry.

Based on the production capacity and process requirements various types of dryers, hot air generators and boilers were installed for thermal energy requirements. From energy use and technology audit studies carried out in Ahmedabad chemical cluster, revealed that the equipments/utilities installed are of inefficient, inferior quality, poor safety and consuming more energy. There is considerable potential in all cluster units for energy conservation by replacing the old/obsolete technology/equipments with energy efficient technologies/equipments.

As process and equipments are more or less similar in all units in cluster, all the technologies/equipments identified can be replicated as per the requirement of the units and detailed project reports for the specific technologies prepared also can be replicated in different chemical units as per the capacity requirement. The following technologies/equipments were considered for preparation of detailed project report.

- Hot air generators
- Tray dryers
- Agitator systems
- Boilers
- Filter press
- Waste heat recovery system in exothermic reactions

3.5.1 Justification for technologies/equipments identified for DPR preparation

Energy saving potential and replication potential in percentage of number of units of identified technology up gradation projects are presented in table below.

Table 3.24: *Energy saving potential and replicability of identified technology up gradation projects*

Area for Technology up gradation	Existing technology	Technology up gradation measure	Energy saving potential (%)	Replicability potential in no of units in cluster (nos)	Replicability potential in cluster (%)
Agitator system	Horizontal agitator system	Vertical agitator system	15-20	525	70
Hot air generator (HAG) system	Vertical wood fired HAG system	Energy efficient wood fired HAG system	30	340	45
		Energy efficient gas fired HAG system	20-30	265	35
Tray dryer	Conventional tray dryer	Energy efficient tray dryer system	30-40	400	53
		Solar tray dryer	70-80	300	40
Filter press system	Recess plate system	Membrane filter press	30-40	225	30

Area for Technology up gradation	Existing technology	Technology up gradation measure	Energy saving potential (%)	Replicability potential in no of units in cluster (nos)	Replicability potential in cluster (%)
Waste heat recovery	No heat recovery in exothermic reaction	Heat recovery in exothermic reaction	10-20	300	40
Boiler	Vertical wood fired boilers	Energy efficient wood fired Boiler	25-35	300	40
		Energy efficient gas fired Boiler	25-35	265	35

Environmental Benefits

In this chapter various environmental benefits after implementation of proposed energy conservation measures are discussed in this chapter.

4.1 REDUCTION OF DEFORESTATION

Most of units in the cluster are using the non renewable wood for thermal energy requirement; by implementing proposed energy conservation measures will reduce consumption of non renewable wood, this automatically reduces deforestation.

4.2 GHG REDUCTION

All proposed energy conservation measures will have less energy consumption or fuel consumption compared to conventional/existing technology/equipment consumption, these automatically leads to reduction of GHGs emissions. Reduction of GHGs emissions leads to improved environment and better compliance with environmental regulations

After implementation of proposed energy conservation measures will reduce the grid electricity consumption, natural gas and non renewable wood. Major GHGs emission reduction due to saving of grid electricity and fuels is CO_2, reduction of other GHGs are negligible. Annual GHGs reduction potential identified in cluster is around 353,073 tonnes of CO_2.

Conclusion

5.1 SUMMARY

In this section summary of energy use and technology studies conducted in Ahmedabad Chemical cluster is discussed, which include identified energy conservation measures, its energy & monetary benefits, payback period, issues in implementation are discussed. Details of the same are furnished in table below:

Table 5.1: *Summary of energy saving proposals in Ahmedabad Chemical cluster*

S. No	House keeping practices/No cost energy conservation measures	Issues in implementation
1	Proper tightening/tensioning of belts in various drives	▪ Lack of awareness EC measure
2	lubrications of gear systems in reaction vessels	▪ Lack of awareness EC measure
3	Cleaning of compressor filters regularly	▪ Lack of awareness EC measure
4	Closing of doors in hot air generator system, this will avoid radiation heat losses	▪ Lack of awareness EC measure ▪ Non compatibility wood lags in the hot air generator
5	Removal of ash depositions in hot air generator system, this will improve heat transfer efficiency between flue gases and cold air	▪ Lack of awareness EC measure ▪ Design flaws
6	Avoid hot air leakages in tray dryers by suitable design	▪ Lack of awareness EC measure ▪ Design problems in tray dryer
7	Rotational speed of fans in tray dryers should be same to avoid short circuit of air, this can be maintained by equal tension of two belts in motors	▪ Lack of awareness EC measure ▪
8	Opening of exhaust locations for proper hot air circulation in tray dryers	▪ Lack of awareness EC measure

S. No	House keeping practices/No cost energy conservation measures	Issues in implementation
9	Avoid steam leakages in steam utilization system	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP
10	Use filter press with full capacity, if less quantity is to be filtered use block plate to reduce the cake holding capacity	▪ Lack of awareness EC measure among workers
11	Use proper cloth& clean the cloth regular intervals for effective filter press operation	▪ Lack of awareness EC measure ▪
12	Fix the cloth properly in filter press, so that there is no crease developed on the sealing boarder of the plate	▪ Lack of awareness EC measure among workers
13	In case of filter press cake is to be washed with water or any liquor, use the counter current flow to wash the cake thoroughly	▪ Lack of awareness EC measure
14	Avoid use of sharp or metallic scraper to remove cake from filter plates, as it will harm the cloth	▪ Lack of awareness EC measure
15	Arrange filter plates in wash-non wash sequence	▪ Lack of awareness EC measure

S. No	Energy conservation measure	Annual energy/Fuel saving	Annual Monetary saving (Rs. lakh)	Implementation cost (Rs. lakh)	Simple payback period (years)	Issues in implementation	Short listed for DPR preparation (Yes/No)	Applicable to number of units in cluster (nos)	Annual cluster energy saving potential of particular EC measure
1	Replacement of conventional horizontal agitator system with vertical agitator system	11,340 kWh	0.61	2.2	3.6	▪ Lack of awareness EC measure ▪ Cost of implementation	Yes	525	5,953,500 kWh of electrical energy

S. No	Energy conservation measure	Annual energy/Fuel saving	Annual Monetary saving (Rs. lakh)	Implementation cost (Rs. lakh)	Simple payback period (years)	Issues in implementation	Short listed for DPR preparation (Yes/No)	Applicable to number of units in cluster (nos)	Annual cluster energy saving potential of particular EC measure
2	Replacement of Manual filter press with mechanical filter press	112 tpa of wood	3.36	10	3.0	▪ Lack of awareness EC measure ▪ Cost of implementation	No	150	16,800 tpa of wood
3	Replacement of conventional filter press (recess plates) with membrane filters press	241.5 tpa of wood	7.25	22	3.0	▪ Lack of awareness EC measure ▪ Cost of implementation	Yes	112	27,168 tpa of wood
4	Matching the centre of motor axis with ball mill axis	4,400 kWh	0.26	0.1	0.4	▪ Lack of awareness EC measure	No	350	1,540,000 kWh of electrical energy
5	Replacement of conventional gear system with planetary gear system in reaction vessels	5,200 kWh	0.31	0.4	1.3	▪ Lack of awareness EC measure ▪ Cost of implementation	No	300	1,560,000 kWh of electrical energy
6	Improving insulation of hot air generator	22 tpa of wood	0.66	0.4	0.6	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP	No	250	5,500 tpa of wood
7	Replacement of conventional hot air generator system with energy efficient hot air generator system	57.6 tpa of wood	1.73	2.75	1.6	▪ Lack of awareness EC measure ▪ Cost of implementation	Yes	340	19,584tpa of wood
8	Replacement of conventional wood fired hot air generator system with energy efficient	232 tpa of wood	2.23	5	2.2	▪ Lack of awareness EC measure ▪ Cost of	Yes	130	30,160 tpa of wood against consumption of

S. No	Energy conservation measure	Annual energy/Fuel saving	Annual Monetary saving (Rs. lakh)	Implementation cost (Rs. lakh)	Simple payback period (years)	Issues in implementation	Short listed for DPR preparation (Yes/No)	Applicable to number of units in cluster (nos)	Annual cluster energy saving potential of particular EC measure
	gas fired hot air generator system					implementation ▪ Fluctuations in gas prices			3,300,840 Nm^3 of gas
9	Improvements in hot air distribution system	35 tpa of wood	1.05	0.5	0.5	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP	No	250	8,750 tpa of wood
10	Replacement of conventional tray dryer system with energy efficient tray dryer system	84 tpa of wood	2.52	4.4	1.7	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP ▪ Cost of implementation	Yes	400	44,100 tpa of wood
11	Replacement of conventional wood fired tray dryer system with solar tray dryer system	72 tpa of wood	2.16	7.8	3.6	▪ Lack of awareness EC measure ▪ Non availability of suitable LSP ▪ Not proven technology ▪ Cost of implementation	Yes	300	32,400 tpa of wood
12	Insulation of cyclone system in spray dryers	5510 Nm^3 of gas	0.99	0.5	0.5	▪ Lack of awareness EC measure	No	120	661,200 Nm^3 of gas
13	Installation of exhaust gas heat recovery system in spray dryer	116,803 Nm^3 of gas	22.2	35	1.6	▪ Lack of awareness EC measure	No	100	11,680,300 Nm^3 of gas

S. No	Energy conservation measure	Annual energy/Fuel saving	Annual Monetary saving (Rs. lakh)	Implementation cost (Rs. lakh)	Simple payback period (years)	Issues in implementation	Short listed for DPR preparation (Yes/No)	Applicable to number of units in cluster (nos)	Annual cluster energy saving potential of particular EC measure
						▪ Orthodox mind set of entrepreneurs			
14	Replacement of conventional wood fired Boiler with energy efficient wood fired Boiler	120 tpa of wood	3.6	6	1.7	▪ Lack of awareness EC measure	Yes	300	36,000 tpa of wood
15	Replacement of conventional motors with energy efficient motors	5,730 kWh	0.31	0.3	1	▪ Lack of awareness EC measure	No	600	3,438,000 kWh of electrical energy
16	Replacement of conventional v belts with flat belts in various drives	1,700 kWh	0.092	0.1	1.1	▪ Lack of awareness EC measure ▪ Cost of implementation	No	600	1,020,000 kWh of electrical energy

5.2 SUMMARY OF LEVEL OF AWARENESS ON ENERGY EFFICIENCY AND ENERGY CONSERVATION PRODUCTS IN THE CLUSTER

Level of awareness on energy efficiency and energy conservation products in the Ahmedabad Chemical cluster is poor, due to below mentioned reasons.

- Lack of awareness on the Energy efficiency
- Lack of organizational commitment
- Narrow focus on Energy
- Not clear about their existing level of operations and efficiency, due to lack of instrumentation & non availability of Energy consumption data
- Limited manpower
- Lack of trained manpower
- Limited information on new technologies
- Cost of Energy conservation options

Major energy sources being used in cluster are Electrical energy and Wood & Natural gas. Annual electrical energy consumption and fuels in Ahmedabad Chemical cluster is around 284,068,493 kWh and 2,387,102,000,000 kCal (238,710 MTOE) respectively. **Total energy consumption in the Ahmedabad Chemical cluster is around 263,595 MTOE (Tonnes of Oil Equivalent).** After implementation of proposed energy conservation measures will save the 13,511,500 kWh of electrical energy, 193,662 tonne of wood and 9,040,660 Nm^3 of natural gas. **Annual energy saving potential identified in cluster is around 72,432 MTOE, which is around 27% of total energy consumption.**

Detailed Technology Assessment Report

Most of the chemical industries in unorganized sector i.e. especially Chemical industries in Ahmedabad Cluster has these characteristics, 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:

- There are various technological gaps were identified in chemical units as under 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 industry to modernize/upgrade its technology and adopt energy efficient technologies in some of the areas. Further, as per the discussions made with the management, they are interested in improve the efficiency of the plant by installing the energy efficient equipment/ technology instead of going for retrofit options in the existing equipments.

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

- Energy efficiency and energy conservation is 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 measures 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 energy efficiency and conservation places no financial and administrative burden as no separate manpower is required and only training of operation and maintenance of the technologies adopted is envisaged
- The return on investment is attractive with lower pay back periods.

Technical gap in analysis in below mentioned areas are identified and details are presented below sections:

- Hot air generator
- Tray dryer
- Agitator system
- Filter press
- Waste heat recovery system

Technical gap analysis on conventional wood fired hot air generator:

Various areas of design flaws/technology gaps in conventional wood fired hot air generator system are identified and described the details below:

- **Draft system**: Draft is the most important factor in efficient fuel combustion. In conventional hot air generator system is operates on the natural draft system. Due to poor design of natural draft system in conventional hot air generator is leading to in efficient fuel combustion.
- **Design of ash pit and combustion system**: The grate area of the hot air generator and ash pit below the combustion chamber adds to overall resistance to the draft system, this causes air flow through the grate more difficult. Due to lack sufficient combustion air in combustion chamber, this lead to partial/improper combustion of fuel.
- **Heat transfer efficiency**: Heat transfer between the flue gas and air occurs in the air heating chamber in hot air generator. Due to poor heat transfer area and short contact time between flue gas and hot air leads to poor heat transfer, this leads to inefficiency of the hot air generator system.
- **Radiation loss from charging door**: The charging door remains more or less open during the entire operation of hot air generator due to various reasons; those are human error and non compatibility of wood lags in combustion chamber. Grate/combustion chamber is not designed to accommodate wood log size and vice versa.
- **Monitoring of fuel feeding to hot air generator:** In conventional/existing hot air generator there is no control on amount of fuel feeding to combustion chamber of hot air generator
- **Insulation:** From technology audit studies it was observed that 100-130 deg C on surface of hot air generator, this leads to poor efficiency of hot air generator.
- **Temperature of hot air**: There is no temperature control of hot air in hot air generator, some times it causes temperature overshoot in the hot air automatically it affecting the quality of drying material.

From the above mentioned analysis it is clear that conventional wood fired hot air generator has poor performance in terms of energy, environment and social point of view. Existing wood

fired hot air generator installed in most of the chemical industries has poor energy efficiency, generating more GHGs (Green House Gasses) to environment, poor safety of operation. Due to above mentioned reasons it is need to upgrade conventional hot air generator with energy efficient hot air generator. Technical specifications of typical energy efficient hot air generator are presented in table below:

Technical specifications of AHA-300-C"Energy efficient hot air generator"

Details	Units	Value
Name of equipment	NA	Energy efficient wood fired hot air generator
Model	NA	AHA-300-C
Capacity	kCal/hr	30,000
Blower model	NA	25-200
Blower capacity	hp	2
Fuel used	NA	Wood
Fuel consumption	Kg/hr	20
ID Fan model	NA	28-160
ID Fan motor	hp	½
ID Fan control	NA	ON-OFF
Total connected electrical load	hp	2.5
Electric supply	NA	AC 3 phase, 415V, 50 Hz
Hot air pipe outlet dimensions	in*in	9*9
Diameter of flue gas outlet	in	8
Air temperature of outlet	Deg C	150 (Max)

Tray dryers:

Technology gaps/design flaws in conventional tray dryer system are identified during technology audit studies and details of the same are presented below:

- **Location of inlet and exhaust locations in tray dryer:** Location of hot air inlet and exhaust air outlet location in tray dryers will affects the heat transfer between wet cake and hot air. Selection of hot air inlet and exhaust air outlet should be such that hot air should be complete one full cycle in tray dryer.
- **Partion between fans in tray dryers**: in conventional tray dryer system there is no partion between two fans. If the speed of the two fans are different, there is a possibility that air velocity of two fans can oppose each other this will reduce the effective air handling capacity of tray dryer.

- **Insulation of tray dryer**: In conventional tray dryer system there is no insulation on tray dryer**.** It is recommended to use cera wool as insulating material, to reduce the radiation heat losses in tray dryer.
- **Volume of air in between two trays**: In majority of the cases it was observed that volume of air between two trays is not considered in design stage of tray dryer. Low volume of hot air between the trays leads to poor heat transfer efficiency and it automatically increasing the drying time.
- **Spacing between trays in tray dryers:** Non uniform spacing between trays in tray dryer causes the volume of air flow between the trays is different, this causes the uneven drying of material in tray dryer
- **Air circulation fans:** Conventional tray dryer systems are using propeller fans, which has poor efficiency compared to axial flow fans. Efficiency of propeller fans is 20% lower than axial floe fans.
- **Gaps between Bottom & top portion of trays with respect to tray dryer:** This causes less resistance to air flow in tray dryer compared to resistance in between trays, it automatically reduces the heat transfer efficiency between hot air and wet cake.
- **Short circuit of circulating air:** cause the reduction of overall air circulation in tray dryer; this can be avoided by using internal Partion in between the air circulation fans.

From the above mentioned analysis it is clear that conventional tray dryer system has more drying time. Existing/conventional tray dryer system in most of the chemical industries has poor energy efficiency, generating more GHGs (Green House Gasses) to environment, poor safety of operation. Due to above mentioned reasons it is need to upgrade conventional tray dryer system with energy efficient tray dryer system. Technical specifications of energy efficient tray dryer system are presented in table below:

Parameter	Value
Heat input to tray dryer	30,000 kCal/hr
Model No	AHD -192
Number of trays	200
No of fans	Four
Rating of motor fans	1 hp
Number of doors	Two
No of Racks and placement of racks in tray dryer	Four
Overall dimensions (L*W*H) approx	3950mm*1950mm*2100mm
Size of trays	32”*16”*1.25”
Power supply	AC,3 Phase, 415 V, 50 Hz, 4 wire
Type of drying	Air heater dryer

Agitator system:

Technology gaps/design flaws in conventional horizontal agitator system are identified during technology audit studies and details of the same are described below:

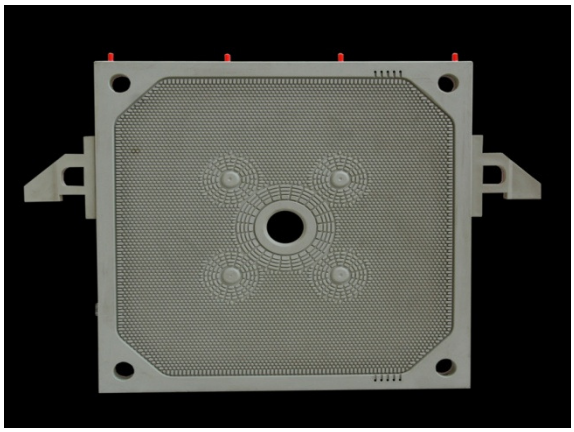
- **Heat and mass transfer:** Conventional agitator systems are not designed for specific viscosity and specific gravity of particular material this causes the poor heat and mass transfer of material in reaction vessel.
- **Mixing times of chemicals in reaction vessel:** due to poor design of impeller system in conventional agitator system causes time required to mix the various chemicals is more. Apart from the time it affecting the quality of final product.
- **Transmission efficiency:** Almost of 20% energy is wasted in transmission system in horizontal agitator system. This can be avoided by using the direct drive system, this automatically reduces the size of the motor i.e. reduces the operational and capital cost of drive.
- **Efficiency of gear system:** From technology studies it was observed that majority of units are using truck gears in agitator system, those having efficiency around 30-50%.
- **Bigger size of the drive system:** Majority of the industries are using bigger size motors, this can be reduced by proper selection of suitable impeller, material of impeller system, design of impeller as per Viscosity & specific gravity of material, reduction of transmission losses, use of energy efficient gear system and vertical mounting of drive system.

From the above mentioned analysis it is clear that conventional horizontal agitator system has producing inferior quality of chemicals and poor energy efficiency. Due to above mentioned reasons it is need to upgrade conventional horizontal agitator system with vertical mounted agitator system:

Filter press:

Technology gaps/design flaws in conventional recess filter press system are identified during technology audit studies and details of the same are described below:

- **Design of filter plates:** Conventional filter press are having poor design of filter plates. These types of plates are not able to remove maximum moisture content from fluids.



- **Pressure in between filter plates:** From technology studies it was observed that pressure between the plates is different this causes the uneven moisture content in wet cake from various plates. Which is adversely affecting the final quality of material.
- **Drying time:** Due to poor design of filter press not able to remove the water and solid separation effectively this causes increased drying time, which automatically increases drying cost.

From the above mentioned analysis it is clear that conventional recess plate filter press system agitator system has producing inferior quality of chemicals and poor liquid solid separation capacity . Due to above mentioned reasons it is need to upgrade conventional recess plate filter press with membrane filter press.

Waste heat recovery system:

Majority of the chemical reactions in manufacturing of chemicals are exothermic. In most of the chemical reactions 100-130 deg C heat will be available for 6-10 hours depends on type reaction, this heat can easily captured and used in other applications in chemical industries.

Details of technology/service providers in Ahmedabad chemical cluster

S. No	Name of company	Contact person	Address of company	Local service provider for
1.	Aero Therm Systems Pvt Ltd	Narendra Vadher	Plot No: 1517; Phase III; GIDC, Vatva, Ahmedabad	❖ Hot air generator ❖ Tray dryer ❖ Steam Boiler ❖ Vaccum Pumps ❖ Blowers ❖ ID & FD fans ❖ Hot air distribution system
2	Sachin Filtech	K.D Patel	Sachin house, Plot No 77-4; F-Road; Phase-I, GIDC estate, Vatva, Ahmedabad	❖ Membrane filter press
3	Rathi Vessels &Systems Pvt Ltd	Mayur B.kathiria	3rd Floor, Baner road, Pune-411007	❖ Energy efficient agitator system
4	Insulation associates	Zalak sheth	Plot no 402/B, GIDC, Phase II, Opp: Water tank, Vatva, Ahmedabad	❖ Hot and cold insulation systems
5	Acmefil Engineering system Pvt Ltd	Nair	Plot No: 535, Phase-II, GIDC, Vatva, Ahmedabad	❖ All types of dryers
6	Conservation engineers Pvt Ltd	Bharat Bakhda	302, Mayur Tower, Nr. Shyamal Row houses, Satellite, Ahmedabad-380015	❖ Energy efficient motors ❖ Energy efficient control system
7	Kamini Boiler Repairing works	Kunj Bihari Sharma	2153, Bhukarani Pole, Dehli Chakala, Ahmedabad, Gujarat	❖ Steam Boiler (IBR)
8	Tech drive engineering	P.D patel	38, Keshava Industrial estate, near Nagarvel Hanuman temple, Rakhial, Ahmedabad	❖ Energy efficient gear system
9	Techno Bonanza Pvt Ltd	Hasmukh M. Parikh	71/10, GIDC Estate,Phase-1, Vatva, Ahmedabad	❖ Powder processing technologies ❖ Ball mill ❖ Blungers

Quotations of techno commercial bids from service/technology providers

Quotations of techno commercial bids of energy efficient wood fired hot air generator

Aero Therm® SYSTEMS PVT. LTD.
Regd. Office : Plot No. 1617, Phase-III, GIDC, Vatwa, Ahmedabad-382445. INDIA.
Phone : +91-79-25890158, 25895243 • Fax : +91-79-25834987
Email : contact@aerothermsystems.com • Website : www.aerothermsystems.com

REF : GREEN-04 4TH DECEMBER, 2009

TO : **M/S. WINROCK INTERNATIONAL.,**
788, UDYOG VIHAR, PHASE-IV, GURGAON 122 001.
PH : 0124 4303868 / 4303815 (DIRECT) FAX : 4303862

KIND ATTN : **MR. SRIPAL T [PROGRAM OFFICER]**
[ENERGY & ENVIROMENT]
E MAIL : sripal@winrockindia.org

SUB : ENERGY EFFICIENT TRAY DRYER & WOOD FIRED INDIRECT AIR HEATER FOR TRAY DRYER

THIS HAS REFERENCE TO DISCUSSION YOU HAD WITH OUR MR. NAREN VADHER; WE ARE PLEASED TO ENCLOSE HEREWITH OUR DETAIL OFFER ON FOLLOWING:

-1. THREE PASS WOOD/COAL FIRED INDIRECT AIR HEATER
-A. MODEL : AHA – 600 – C
SUITABLE UP TO 400 TRAYS
-B. MODEL : AHA – 300 – C
SUITABLE UP TO 200 TRAYS

-2. CABINET TYPE TRAY DRYER
MODEL : AHD – 192

-3. TERMS & CONDITIONS FOR SALE

OUR TECHNICAL DETAILS AND SCOPE OF SUPPLY ARE ENCLOSED HEREWITH FOR YOUR KIND CONSIDERATION.

WE HOPE YOU WILL FIND OUR OFFER IN LINE WITH YOUR REQUIREMENT AND NOW LOOK FORWARD TO RECEIVE YOUR VALUED ORDER AT AN EARLIEST.

THANKS N REGARDS.

UPEN VADHER
[DIRECTOR TECH.]
[M : 9825008720
: 9824408720]

TYPE : AHA – C **SCOPE OF SUPPLY**

FRONT PLATE & BACK PLATE	:	FABRICATED FROM HEAVY DUTY MS PLATE OF SUFFICIENT THICKNESS, WELDED CONSTRUCTION AND LINING WITH ACC CASTABLE REFRACTORY AT BACK SIDE.
BODY	:	FABRICATED FROM GOOD QUALITY MS PLATE HAVING SUFFICIENT THICKNESS AND STIFFENERS FROM OUTSIDE.
FLUE PIPES	:	MS ERW HEAVY DUTY PIPES, WELDED AT BOTH END HAVING AMPLE AREA OF HEAT TRANSFER, ARRANGE TO GIVE THREE PASS OF FLUE GAS.
FIRE CHAMBER & INSIDE FIRE WORK	:	FIRE CHAMBER WILL BE SHELL TYPE FABRICATED FROM GOOD QUALITY **SS 304 PLATE** OF SUFFICIENT THICKNESS AND FIRE BAR WILL BE PROVIDED INSIDE FIRE CHAMBER. ALL PARTS FROM INSIDE OF FIRE ZONE WILL ALSO LINING WITH CASTABLE REFRACTORY.
OUTSIDE INSULATION:		COMPLETE UNIT WILL BE INSULATED FROM OUTSIDE BY MINERAL WOOL HAVING SUFFICIENT THICKNESS TO PROTECT THE HEAT LOSSES FROM THE SURFACE AND THEN CLADDING WITH ALUMINUM SHEET.
MOUNTING & BASE PLATE	:	COMPLETE UNIT WILL BE FLOOR MOUNTED TYPE, FACTORY FINISHED, MOUNTED ON STAND FABRICATED FROM MS CHANNEL SECTION WITH SUFFICIENT SUPPORTING MEMBERS.
I D FAN	:	INDUCED DRAFT BLOWER OF SUFFICIENT CAPACITY WILL BE PROVIDED COMPLETE WITH VEE BELT DRIVE ARRANGEMENT WITH MOTOR.
AIR BLOWER	:	MS FABRICATED HEAVY DUTY CENTRIFUGAL TYPE AIR BLOWER WILL BE PROVIDED WITH UNIT. IMPELLER OF THE BLOWER WILL BE FABRICATED FROM MS SHEET, DULY DYNAMICALLY BALANCED, MOUNTED ON EN-8 SHAFT RUNNING ON BEARING PEDESTAL OF GREASE LUBRICATED.
CONTROL PANEL	:	DUST PROOF, FOOL PROOF, PRE-WIRED CONTROL PANEL CONSISTING OF FOLLOWING MAJOR ITEM: - CONTACTORS FOR BLOWERS - OVER CURRENT RELAYS FOR MOTORS - DIGITAL TEMP. INDICATOR CONTROLLER WITH THERMOCOUPLE. - MAIN ISOLATOR SWITCH, FUSES, INDICATING LAMPS.

TECHNICAL SPECIFICATION

TWO PASS WOOD / COAL FIRED INDIRECT AIR HEATER

M O D E L	:	**AHA - 300 - C**
CAPACITY	:	30,000 KCAL/HR
AIR TEMP. AT OUTLET	:	150 DEG C
BLOWER MODEL	:	25 - 200
BLOWER HP	:	2 HP
FUEL	:	WOOD / COAL
FUEL CONSUMPTION	:	20 KG/HR
I D FAN MODEL	:	28 - 160
I D FAN MOTOR	:	1/2 HP
I D FAN CONTROL	:	ON - OFF
TOTAL CONNECTED ELECT. LOAD	:	2.5 HP
ELECTRIC SUPPLY	:	AC 3 PHASE 415 V 50 HZ

NOZZLE DETAILS

- HOT AIR OUTLET	:	9" X 9"
- FLUE GAS OUTLET	:	8" DIA.

PRICE DETAIL

-PRICE OF THE OFFERED EQUIPMENT	:	**RS. 2,75,000-00 EACH UNIT.**

RS. TWO LAC SEVENTY FIVE THOUSAND ONLY.

TERMS AND CONDITIONS

PRICE	:	QUOTED PRICES IS EACH, UNPACKED, EX-WORKS, AHMEDABAD. MATERIAL WILL BE DESPATCH IN OPEN CONDITION BY SPECIAL CHARTED TRUCK ON DOOR DELIVERY FREIGHT TO-PAY BASIS. UNLOADING, PLACEMENT, ERECTION WILL BE DONE BY YOU AT YOUR COST. ANY ROAD PERMIT/OCTROI/GOVT. LEVIES WILL BE PAID BY YOU.
EXCISE DUTY	:	ALL APPLICABLE EXCISE DUTY WILL BE CHARGED EXTRA AT THE RATE PREVAILING AT THE TIME OF DELIVERY. KINDLY FURNISH US YOUR ECC DETAIL TO AVAIL MODVAT BENEFIT. - PRESENT RATE OF E D IS 8%* + 2 % EDU. CESS + 1 % SECONDARY HIGHER EDU. CESS (I.E. 8.24%) WILL BE CHARGED EXTRA. (*) CENTRAL EXCISE NOTIFICATION NO. 4/2009 DT. 24/2/2009
TAXES	:	ALL APPLICABLE TAXES WILL BE CHARGED EXTRA AT THE RATE PREVAILING AT THE TIME OF DELIVERY. - PRESENT RATE OF VAT IS 4% + 1% ADDL. TAX WILL BE CHARGED EXTRA. (TOTAL 5 % VAT).
PAYMENT	:	1/3RD AS ADVANCE ALONG WITH FIRM ORDER AND BALANCE AGAINST PERFORMA INVOICE PRIOR TO DESPATCH. ALL PAYMENT WILL BE BY DEMAND DRAFT PAYABLE AT AHMEDABAD.
DELIVERY	:	WITHIN **10 - 12 WEEKS** TIME FROM THE DATE OF RECEIPT OF YOUR FIRM ORDER WITH SECURITY DEPOSIT AND TECHNICALLY AND COMMERCIALLY CLEAR ORDER.
INSPECTION	:	YOU WILL DEPUTE YOUR TECHNICAL PERSON FOR VISUAL INSPECTION AT OUR WORKS AT YOUR COST PRIOR TO DESPATCH, IF REQUIRED BY YOU.
COMMISSIONING:		WE WILL DEPUTE OUR ENGINEER FOR FIRST COMMISSIONING AFTER ALL NECESSARY ELECTRICAL, ALL PIPING & CHIMNEY CONNECTION COMPLETE BY YOU. YOU HAVE TO PROVIDE 1ST CLASS TO-FRO RLY. FARE + LODGING & BOARDING FREE OF COST TO OUR ENGINEER DURING THE STAY + RS. 600-00 PER DAY. (FROM START TO FINISH OF THE JOURNEY).
GUARANTEE	:	OUR EQUIPMENT WILL BE GUARANTEED FOR A PERIOD OF 12 MONTHS FROM THE DATE OF DESPATCH AGAINST FAULTY WORKMANSHIP AND DEFECTIVE MATERIAL.
VALIDITY	:	OUR OFFER IS VALID FOR **15 DAYS** FOR ACCEPTANCE AND THEN AFTER SUBJECT TO OUR WRITTEN CONFIRMATION.

Quotations of techno commercial bids of vertical agitator system:

Reference is made to your enquiry for agitators. As per the information provided by you, we have designed/ selected the mixers to suit your requirement. Below are the details for the same-

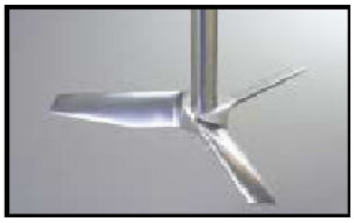
Tank Details:
ID* : 1950 mm
St. Ht* : 2650 mm
Top : Open
Bottom : Flat
Operating Volume : 7000 Liters

Process Details:
Contents : Liquid/ Solid
Sp. Gr : 1.3 *{maximum}
Viscosity : 1000 Cps *{maximum}
Temperature : Atm.
Pressure : Atm.

RATHI VESSELS & SYSTEMS PVT. LTD.
Mixer Specifications:
Mixer Model : RVIHQ-2.2
Motor : 2.2 kW / 1420 rpm TEFC IP55
Drive : Inline Helical of Reputed Indian Make
Impeller Details : 2 x AX-30B/3 of f 940 mm

AX-30B/3:

AX-30B/3 is a three bladed hydrofoil impeller. It provides a combination of performance characteristics and high flow efficiency not available from other types of axial flow impellers. The AX-30B/3 can produce the same flow and process results at a lower power than other axial flow impellers thus reducing operating and capital costs.



AX-20/2:

AX-20/2 is a two bladed turbine operating at the bottom of the tank as a kicker to lift the material and avoid deposition

Mixer Speed : ~45 rpm
Shaft : 60 mm dia x ~2800 mm long
Wetted Parts : MS
Non Wetted Parts : MS
Coupling : Rigid/ Flexible
Mounting : ASME
Note: "Selection of materials in contact with the in tank product is not the responsibility of Rathi Vessels & Systems Pvt. Ltd".
Client to confirm the vessel dimensions and also the physical properties of the mixture

Commercial Details:
Price : Rs. 1,12,000/- are each ex-works unpacked including motor
Packing & Forwarding : Extra @3%
Taxes & Duties : Extra as applicable at the time of dispatch
Insurance & Freight : To your account
Validity : 30 days
Delivery : 9 working weeks from the date of receipt of advance with order
Payment Terms : 40% advance, balance against Performa Invoice before dispatch.
Conditions of Sale : Rathi Vessels Conditions of Sale will apply

We trust this is inline with your requirements. Should you require any further information then please feel free to contact us.

Thanks & Regards,

Mayur B. Kathiriya.

09662054589

Techno commercial quotations of energy efficient tray dryer & Energy efficient solar tray dryer:

SPECIFICATION AND SCOPE OF SUPPLY

EQUIPMENT		:	TRAY DRYER
M O D E L		:	**AHD - 192**
DIMENSIONS	L	:	3950 MM
	W	:	1950 MM
	H	:	2100 MM
HEATING		:	HOT AIR GENERATOR OR SOLAR HEATING
HEAT INPUT		:	30,000 KCAL/HR

GENERAL DESCRIPTION

CABINET : CABINET OF THE DRYER WILL BE OF 200 TRAYS CAPACITY, MADE FROM MS ANGLE FRAME OF DOUBLE WALL CONSTRUCTION LINED INTERNALLY WITH **18 SWG MS** SHEET AND EXTERNALLY **18 SWG MS** SHEET. THE CAVITY FORMED IN BETWEEN DOUBLE WALL WILL BE PROPERLY INSULATED WITH 65 MM THICK MINERAL WOOL TO PREVENT HEAT LOSSES FROM DRYER.

DOORS : HEAVY DUTY AIRTIGHT HINGED DOORS MADE FROM **16 SWG MS** SHEET BACKED BY 50 MM MINERAL WOOL ON THE INNER SIDE AND BALL CATCH LOCKING ARRANGEMENT TOGETHER WITH 40 MM ASBESTOS GASKET ROPE ENSURE VERY STURDY CONSTRUCTION OF THE DRYER.

AIR CIRCULATION : THE UNIFORM AIR CIRCULATION WITHIN THE DRYER WILL BE CARRIED BY FOUR NOS. OF MULTY BLADE TYPE MS FABRICATED FAN MOUNTED ON EXTERNALLY ON BALL BEARING PEDESTAL AND DRIVEN BY 1 HP TEFC ELECTRIC MOTOR. AIR INLET AND OUTLET DAMPERS ARE PROVIDED ON THE TOP ROOF OF THE DRYER CABINET.

TROLLEYS : THE STRUCTURE FOR THE HEAVY DUTY TROLLEYS WILL BE MADE FROM 40 MM **MS ANGLE** AND HORIZONTAL SUPPORT WILL BE OF 25 MM **MS ANGLE**. THE DESIGN OF TROLLEY WILL BE GOOD ENOUGH FOR THE PROPER HOT AIR CIRCULATION. THE TROLLEY WILL BE FITTED WITH 2 NOS. CASTOR WHEEL AND 2 NOS. FIXED WHEEL FOR THE EASY MOVEMENT.

ELECTRICALS	:	FOUR NOS. 1 HP X 1440 RPM TEFC ELECTRIC MOTORS WITH SET OF PULLEYS AND VEE BELTS DRIVE ARRANGEMENT WILL BE PROVIDED. MAKE : CROMPTON/ROTOMOTIVE
CONTROL PANEL	:	PRE WIRED CONTROL PANEL WILL BE CONSISTING OF **DIGITAL TEMP. INDICATOR**, CONTACTOR FOR MOTOR, OVER CURRENT RELAY, FUSES, INDICATING LAMP, PUSH BUTTONS, MAIN ISOLATOR SWITCH ETC.
PAINTING	:	THE DRYER WILL BE SPRAY PAINTED WITH TWO COATS OF HIGH TEMPERATURE RESISTANCE ALUMINUM PAINT AND THE OUTSIDE CABINET HAVE ONE COAT OF REDOXIDE BACKED BY HAMMER TONE FINISHED PAINT.
PRICE	**:**	**RS. 4,40,000-00 EACH UNIT.** **RS. FOUR LAC FORTY THOUSAND ONLY.**
OPTIONAL ACCESSORIES	:	FOLLOWING ACCESSORIES CAN BE PROVIDED AT AN EXTRA COST.
SOLAR HEATING	:	SOLAR HEATING PANEL SUITABLE TO GENERATE 30,000 KCAL/HR HEAT.
PRICE	**:**	**RS. 7,00,000-00 EACH.** **RS. SEVEN LAC ONLY.**
TRAYS	:	MADE FROM **18 SWG ALUMINUM** SHEET SIZE : 32" X 16" X 1.25" QTY REQUIRED : 200 NOS.

TERMS AND CONDITIONS

PRICE	:	QUOTED PRICES IS EACH, UNPACKED, EX-WORKS, AHMEDABAD. MATERIAL WILL BE DESPATCH IN OPEN CONDITION BY SPECIAL CHARTED TRUCK ON DOOR DELIVERY FREIGHT TO-PAY BASIS. UNLOADING, PLACEMENT, ERECTION WILL BE DONE BY YOU AT YOUR COST. ANY ROAD PERMIT/OCTROI/GOVT. LEVIES WILL BE PAID BY YOU.
EXCISE DUTY	:	ALL APPLICABLE EXCISE DUTY WILL BE CHARGED EXTRA AT THE RATE PREVAILING AT THE TIME OF DELIVERY. KINDLY FURNISH US YOUR ECC DETAIL TO AVAIL MODVAT BENEFIT. - PRESENT RATE OF E D IS 10%* + 2 % EDU. CESS + 1 % SECONDARY HIGHER EDU. CESS (I.E. 10.30%) WILL BE CHARGED EXTRA. (*) C. E. NOTI. NO. 06/2010 C.E. DT. 27/02/2010
TAXES	:	ALL APPLICABLE TAXES WILL BE CHARGED EXTRA AT THE RATE PREVAILING AT THE TIME OF DELIVERY. - PRESENT RATE OF VAT IS 4% + 1% ADDL. TAX WILL BE CHARGED EXTRA. (TOTAL 5 % VAT) WITHIN GUJARAT STATE. - 2 % CST AGAINST FORM-C / 5 % CST IN ABSENCE OF C FORM. (OUTSIDE GUJARAT STATE)
PAYMENT	:	1/3RD AS ADVANCE ALONG WITH FIRM ORDER AND BALANCE AGAINST PROFORMA INVOICE PRIOR TO DESPATCH. ALL PAYMENT WILL BE BY DEMAND DRAFT PAYABLE AT AHMEDABAD / CHEQUE PAYABLE AT PAR.
DELIVERY	:	WITHIN **10 - 12 WEEKS** TIME FROM THE DATE OF RECEIPT OF YOUR FIRM ORDER WITH SECURITY DEPOSIT AND TECHNICALLY AND COMMERCIALLY CLEAR ORDER.
INSPECTION	:	YOU WILL DEPUTE YOUR TECHNICAL PERSON FOR VISUAL INSPECTION AT OUR WORKS AT YOUR COST PRIOR TO DESPATCH, IF REQUIRED BY YOU.
COMMISSIONING:		WE WILL DEPUTE OUR ENGINEER FOR FIRST COMMISSIONING AFTER ALL NECESSARY ELECTRICAL, ALL PIPING & CHIMNEY CONNECTION COMPLETE BY YOU. YOU HAVE TO PROVIDE 1ST CLASS TO-FRO RLY. FARE + LODGING & BOARDING FREE OF COST TO OUR ENGINEER DURING THE STAY + RS. 1,200-00 PER DAY. (FROM START TO FINISH OF THE JOURNEY).
GUARANTEE	:	OUR EQUIPMENT WILL BE GUARANTEED FOR A PERIOD OF 12 MONTHS FROM THE DATE OF DESPATCH AGAINST FAULTY WORKMANSHIP AND DEFECTIVE MATERIAL.
VALIDITY	:	OUR OFFER IS VALID FOR **15 DAYS** FOR ACCEPTANCE AND THEN AFTER SUBJECT TO OUR WRITTEN CONFIRMATION.

Techno commercial quotations of Energy efficient gas fired hot air generator:

TECHNICAL SPECIFICATION

THREE PASS GAS FIRED FULLY AUTOMATIC INDIRECT AIR HEATER

M O D E L	:	**AHA - 600 - G**
CAPACITY	:	60,000 KCAL/HR
AIR TEMP. AT OUTLET	:	150 DEG C (MAX.)
BLOWER HP	:	5 HP
BURNER	:	FULLY AUTOMATIC
FUEL	:	NATURAL GAS
C V OF NATURAL GAS	:	8,400 KCAL/M3
FUEL CONSUMPTION	:	9.0 M3/HR
GAS PRESSURE REQUIRED	:	**50 - 80 mBAR (ADJUSTABLE)**
BURNER BLOWER HP	:	1/2 HP
TOTAL CONNECTED ELECT. LOAD	:	5.5 HP
CONTROL	:	ON - OFF
ELECTRIC SUPPLY	:	AC 3 PHASE 415 V 50 HZ
NOZZLE DETAILS		
-HOT AIR OUTLET	:	12" X 12"
-FUEL GAS INLET	:	1/2" BSP
PRICE DETAIL		
-PRICE OF THE OFFERED EQUIPMENT	:	**RS. 2,90,000-00 EACH UNIT.**
		RS. TWO LAC NINETY THOUSAND ONLY.

NOTE : GAS VALVE TRAIN, GAS PIPING, PRESSURE REGULATOR, ETC. WILL BE PROVIDED BY CLIENT.

: DUCT WITH INSULATION BETWEEN DRYER & HAG WILL BE PROVIDED BY YOU.

TYPE : AHA - G **SCOPE OF SUPPLY**

FRONT PLATE & BACK PLATE	:	FABRICATED FROM HEAVY DUTY MS PLATE OF SUFFICIENT THICKNESS, WELDED CONSTRUCTION AND LINING WITH ACC CASTABLE REFRACTORY AT BACK SIDE.
BODY	:	FABRICATED FROM GOOD QUALITY MS PLATE HAVING SUFFICIENT THICKNESS AND STIFFENERS FROM OUTSIDE.
FLUE PIPES	:	MS ERW HEAVY DUTY PIPES, WELDED AT BOTH END HAVING AMPLE AREA OF HEAT TRANSFER, ARRANGE TO GIVE THREE PASS OF FLUE GAS.
FIRE CHAMBER & INSIDE FIRE WORK	:	FIRE CHAMBER WILL BE SHELL TYPE FABRICATED FROM GOOD QUALITY **SS 304 PLATE** OF SUFFICIENT THICKNESS AND HAVE INSIDE LINING WITH ACC FIRECRET-SUPER CASTABLE REFRACTORY TO PROTECT THE CHAMBER FROM HEAT. ALL PARTS FROM INSIDE OF FIRE ZONE WILL ALSO LINING WITH CASTABLE REFRACTORY.
OUTSIDE INSULATION:		COMPLETE UNIT WILL BE INSULATED FROM OUTSIDE BY MINERAL WOOL HAVING SUFFICIENT THICKNESS TO PROTECT THE HEAT LOSSES FROM THE SURFACE AND THEN CLADDING WITH ALUMINUM SHEET.
MOUNTING & BASE PLATE	:	COMPLETE UNIT WILL BE FLOOR MOUNTED TYPE, FACTORY FINISHED, MOUNTED ON STAND FABRICATED FROM MS CHANNEL SECTION WITH SUFFICIENT SUPPORTING MEMBERS.

TYPE : AHA - G **SCOPE OF SUPPLY**

BURNER : OUR OWN MAKE FULLY AUTOMATIC NOZZLE MIX GAS BURNER HAVING FOLLOWING MAJOR ITEMS.

- BURNER BODY WITH MOUNTING PLATE
- COMBUSTION AIR BLOWER WITH MOTOR MOUNTED ON THE BURNER BODY WILL DELIVERS THE SUFFICIENT QUANTITY OF AIR WITH PRESSURE TO OVER COME THE FLUE PASS RESISTANCE.
- SOLENOID VALVE.
- GAS NOZZLE WITH FLEXIBLE PIPES.
- S.S. DIFFUSER WITH ROD.
- IGNITION TRANSFORMER WITH SET OF ELECTRODES, H T LEADS AND SOCKET.

AIR BLOWER : MS FABRICATED HEAVY DUTY CENTRIFUGAL TYPE AIR BLOWER WILL BE PROVIDED WITH UNIT.

IMPELLER OF THE BLOWER WILL BE FABRICATED FROM MS SHEET, DULY DYNAMICALLY BALANCED, MOUNTED ON EN-8 SHAFT RUNNING ON BEARING PEDESTAL OF GREASE LUBRICATED.

CONTROL PANEL : DUST PROOF , FOOL PROOF, PRE-WIRED CONTROL PANEL CONSISTING OF FOLLOWING MAJOR ITEM

- CONTACTORS FOR BLOWER AND BURNER MOTORS
- OVER CURRENT RELAYS FOR MOTORS
- DIGITAL TEMP. INDICATOR CONTROLLER WITH THERMOCOUPLE.
- SEQUENCE CONTROLLER FOR BURNER WITH FLAME MONITOR UNIT.
- MAIN ISOLATOR SWITCH, MCBS, INDICATING LAMPS.
- ALARM HOOTER.

NOTE : DUCT WITH INSULATION BETWEEN DRYER & HAG WILL BE PROVIDED BY YOU.

Techno commercial quotations of Energy efficient gas fired Boiler:

TECHNICAL SPECIFICATIONS

THREE PASS GAS FIRED SMOKE TUBE HORIZONTAL FULLY AUTOMATIC PACKAGE STEAM BOILER (IBR)

M O D E L	:	**ASGH – 06 – G**
RATED STEAM OUTPUT	:	600 KG/HR
STEAM PRESSURE (MAX)	:	10.54 KG/CM2 G.
STEAM TEMPERATURE	:	185 DEG C
FUEL	:	NATURAL GAS
N C V OF FUEL	:	8,400 KCAL/M3
FUEL CONSUMPTION	:	45 M3/HR
GAS PRESSURE REQ.	:	100 - 200 mBAR (ADJUSTABLE)
EFFICIENCY	:	86 +/- 2 %
FEED WATER PUMP HP **(SS 304 MULTISTAGE VERTICAL)**	:	3 HP (ONE STAND BY)
BLOWER MOTOR HP	:	2 HP
FUEL PUMP MOTOR HP	:	1/2 HP
BURNER CONTROL	:	ON - OFF
TOTAL CONNECTED ELECTRICAL LOAD	:	5.5 HP / 8.5 HP (WITH STAND BY PUMP)
POWER SUPPLY	:	AC 3 PHASE 415 V 50 HZ

NOZZLE DETAILS

- STEAM OUTLET	:	1.5" FE
- FUEL GAS INLET	:	1.5" FE
- FLUE GAS OUTLET	:	12" FE

PRICE DETAILS

- PRICE OF THE OFFERED EQUIPMENT	:	**RS. 7,80,000-00 EACH UNIT.**
		RS. SEVEN LAC EIGHTY THOUSAND ONLY.
- EXTRA FOR STANDBY FEED PUMP WITH MOTOR.	:	**RS. 29,500-00 EACH.**

NOTE: GAS VALVE TRAIN & GAS PIPING WILL BE DONE BY CLIENT.

TYPE : ASGH - G (IBR) **SCOPE OF SUPPLY**

THREE PASS SMOKE TUBE HORIZONTAL FULLY AUTOMATIC PACKAGE STEAM BOILER, FULLY WELDED CONSTRUCTION OF CLASS I, RADIOGRAPHY AS PER IBR NORMS.

MAIN BOILER UNIT WILL BE COMPRISING OF FOLLOWING MAJOR ITEMS:

- SHELL : OUTER SHELL WILL BE FABRICATED FROM BOILER QUALITY MS PLATE OF SUFFICIENT THICKNESS, WELDED CONSTRUCTION. 100 % X-RAYED UNDER INSPECTION AUTHORITY OF I B R.

- TUBE PLATES : FABRICATED FROM BOILER QUALITY M S PLATE OF SUFFICIENT THICKNESS, WELDED AT BOTH END OF THE SHELL.

- FLUE PIPES : M S (E R W) I B R APPROVED HEAVY DUTY PIPES, WELDED AT BOTH END HAVING AMPLE AREA OF HEAT TRANSFER, ARRANGE TO GIVE THREE PASS OF THE FLUE GAS.

- FIRE CHAMBER : FIRE CHAMBER WILL BE FABRICATED FROM BOILER QUALITY MS PLATE OF SUFFICIENT THICKNESS. 100% X-RAYED UNDER INSPECTION AUTHORITY OF I B R.

- BLOWER : BLOWER WITH MOTOR, DELIVERS THE SUFFICIENT AIR WITH HAVE PRESSURE TO OVER COME THE FLUE PASS.

- BURNER : FULLY AUTOMATIC NOZZLE MIX GAS FIRED BURNER ASSEMBLY SUITABLE FOR HORIZONTAL FIRING HAVING FOLLOWING MAJOR ITEMS.

  - BURNER BODY WITH MOUNTING PLATE.
  - GAS NOZZLE
  - SOLENOID VALVE. (DUNGS MAKE MULTI BLOCK TYPE)
  - IGNITION TRANSFORMER WITH SET OF ELECTRODE, H T LEADS & SOCKET
  - S S DIFFUSER

- FEED WATER PUMP : SS 304 VERTICAL TYPE MULTI STAGE FEED WATER PUMP DIRECTLY COUPLED TO MOTOR COMPLETE WITH BASE PLATE.

(FEED WATER SHOULD BE HARDNESS < 5 PPM & TDS< 300 PPM)

TYPE : ASGH - G (IBR) **SCOPE OF SUPPLY**

- CONTROL PANEL : DUST PROOF, FOOL PROOF, PRE-WIRED (WITHIN THE PANEL) CONTROL PANEL WILL BE COMPRISING OF FOLLOWING MAJOR ITEMS.

  - CONTACTORS FOR BLOWER MOTOR & FEED WATER PUMP MOTOR.
  - OVER CURRENT RELAYS FOR MOTORS.
  - DIGITAL TEMP. INDICATOR CONTROLLER WITH THERMOCOUPLE.
  - SEQUENCE CONTROLLER FOR BURNER WITH FLAME MONITOR UNIT.
  - WATER LEVEL CONTROLLER WITH PROBES.
  - MAIN ISOLATOR SWITCH, FUSES, INDICATING LAMPS.
  - ALARM HOOTER.

MOUNTING & FITTINGS (IBR):

- TWO SPRING LOADED SAFETY VALVE.
- TWO NON RETURN VALVE ON FEED WATER LINE.
- TWO GAUGE GLASS TUBE FOR WATER LEVEL INDICATION.
- ONE WATER LEVEL CONTROLLER PROBES.

INSTRUMENTS CONTROL & SAFETY:

- TWO STEAM PRESSURE SWITCH FOR BURNER CONTROL
- ONE STEAM PRESSURE INDICATING PRESSURE GAUGE
- ONE FEED WATER PUMP PRESSURE GAUGE
- ONE STEAM TEMP. INDICATOR CONTROLLER CONNECTED TO ALARM WITH BURNER TRIP.
- ONE FLAME FAILURE DEVICE CONNECTED TO ALARM WITH BURNER TRIP.
- ONE WATER LEVEL CONTROLLER CONNECTED TO ALARM WITH BURNER TRIP AT LOW LEVEL.
- ONE AUDIO ALARM FOR ABNORMAL WORKING CONDITION

TYPE : ASGH - G (IBR) **SCOPE OF SUPPLY**

OUR BATTERY LIMITS:

- STEAM LINE
  - OUTLET OF THE STEAM AT STEAM STOP VALVE
  - OUTLET OF THE SAFETY VALVE
- FEED WATER LINE
  - INLET OF THE FEED WATER PUMP
- FUEL LINE
  - INLET OF THE BURNER
- AIR & FLUE GAS
  - SUCTION OF THE BLOWER
  - FLUE GAS OUTLET ON BOILER
- ELECTRICALS
  - TERMINAL CONNECTION AT CONTROL PANEL

    MAIN ISOLATOR SWITCH
  - SAFETY DEVICES

OUR OFFER DOES NOT INCLUDES:

- REGISTRATION OF BOILER AT CLIENT SITE
- INSTALLATION/ERECTION/CIVIL & STRUCTURAL WORK
- STEAM, WATER & FUEL PIPING FROM OUR TERMINAL POINTS
- GAS VALVE TRAIN, PRESSURE REGULATOR VALVE ETC.
- RAW WATER, SOFT WATER STORAGE / SERVICE TANKS
- ELECTRICAL CABLE FOR SUPPLY & OUT GOING TERMINALS
- WATER TREATMENT PLANT
- LABOUR, TOOLS, UTILITIES AND CONSUMABLE REQUIRED FOR ERECTING & COMMISSIONING OF THE BOILER
- CHIMNEY AND FLUE GAS DUCT BETWEEN UNIT & CHIMNEY
- ANY OTHER ITEMS NOT SPECIFIED IN OUR OFFER.

Ref. No.: SFPL/N 1627/ 2009-10	Date: 15/03/2010

The above Quotation is subject to your general terms and conditions enclosed herewith.

P.N.: The above offer does not Includes:

- Filter Cloth
- Feeding Pump
- Feeding / Washing / Airing Valves
- Foundation Bolts
- Hydraulic Oil ENCLO 68

Hope you shall find the offer most competitive and shall oblige us by placing your valued order with us which shall receive our prompt attention to serve your esteemed organization.

Thanks & regards,

For, SACHIN FILTECH PVT. LTD.

Ref. No.: SFPL/N 1627/ 2009-10	Date: 15/03/2010

-: Commercial Terms & Conditions:-

Price Basis: The prices mentioned are ex-our factory, Ahmedabad and Central Excise duty @ 10 % E. C. @ 3% and VAT @ 5 %/ CST 2% against Form 'C' (or 10 % without form'C') Insurance, Fright, Loading – Unloading and octroi if any at your end shall be charged extra. If this is for exports you have to bear all the necessary cost related to dispatch as the quoted price is ex- our works, Ahmedbad only.

Packing charges: Packing & forwarding @ 4% shall also be charged extra.

Payment: 40% Advance, 40 % during work in progress and balance 20 % on Performa Invoice on completion of the work at our factory site before delivery including all other duties & taxes & other cost if any. If this is for exports you have to transfer the 40% advance payment by T.T. & balance against performa invoice before delivery by confirmed & irrevocable T.T. of 60% on any prime bank & Confirmed by our Banker State Bank if India Prior to Shipment. All charges for the T.T. are to be on buyers account.

Delivery: Within 4 to 5 months time after receiving technically and commercially Clear order duly stamped & sign in original Purchase order along with the advance payment with complete technical clarification and is subject to force majeure clause. Your delivery date will start after receipt of the above. Payment by D.D. or T.T. only. All the charges to be born by you for the payment.

Validity: 1 – 2 weeks from the date of quotation / conformation.

Warrantee: Our quoted products are warranted for six months against all mfg. defects but damages due to improper handling, poor storage, normal tear and wear and use of such material which effects the quoted machinery and or its parts etc. are not covered in this warrantee clause.

Inspection: You shall have to carry out the inspection at our works at your cost and after the dispatch of the goods our responsibility ceases.

Supervision of Installation:

The machine will be delivered in dismantle condition only. We will provide you commissioning engineer for Max. 4-5 days. You have to provide all necessary manpower as well as machines for the same. If any delay cause due to incomplete installation will be charge extra as actual. If the installation is out side India, you have to provide all necessary working Visa(Other wise he will supervise the installation), tickets from Ahmedabad to Ahmedabad (To – fro), food, hotel accommodation, pick up & drop down arrangement fonm the airport / hotel.

Order: If you do not take the delivery of the ordered goods within a stipulated time as above, your order shall be treated cancelled and your deposit shall be forfeited and all other damages due to no-upliftment of the goods shall be to your account.

Disputes: If any arising out of order conformation shall be compulsorily refereed to arbitration of two arbitrators, one to be appointed by each party with liberty to the arbitrators to appoint an umpire shall be binding on the parties.

Jurisdiction: Ahmedabad (India) courts alone.

P. N: The above all Photographs & details are of proprietary of Sachin Filtech Pvt. Ltd. And any misuse of the above will attract legal action.

For, SACHIN FILTECH PVT. LTD.

KAUMIL K. PATEL
Director
Cell: 098242 56078

SPECIFICATION SHEET FOR 40" X 40" SIZE FILTER PRESS

1.	**SKELETON (STRUCTURE)**	**1000mm X 1000mm**
	Inlet body and Tightening End Body	Mild Steel Fabricated – 2062
	Moving Plate	Mild Steel Fabricated – 2062
	M.S. Plate (Tie Bar)	34 X 150mm
2.	**TYPE OF PLATE**	**1000mm X 1000mm**
	Material of Construction	Polypropylene
	Cake Thickness (Recess Thickness)	45mm(Each side 22.5mm +/-2mm)
	Type of Washing	Washing / Non – Washing
	Number of Chamber	**40 Chambers**
	Plate Type	Mix Membrane
	Drainage Surface	Raised Pipes
	Cocks	P. P. (Two Way)
3.	**NOZZLES**	**S. S.**
4.	**FILTERATION AREA**	**1.69 Sq. m. Per Plate**
		67.6 Sq. m. Per Press
5.	**CAKE HOLDING CAPACITY**	**32 Liters Per Plate**
		1280 Liters Per Press
6.	**DELIVERY**	**Open type / Close type**
7.	**CLOSING MACHANISM**	**Pull Back Type Hydraulic Cylinder**
8.	**MAX. OPERATING PRESSURE**	**5 Kg./Cm Sq. At ambient temp.**

Policy guidelines/subsidy schemes available with State governments for improving energy efficiency in cluster

1. Energy audit subsidy scheme by GEDA (Gujarat Energy Development Agency)

The Gujarat Energy Development Agency (GEDA), is nodal Agency established by the Government of Gujarat for promoting use of renewable energy sources and energy conservation in Gujarat. GEDA is also the State Designated Agency for implementing the Energy Conservation Act-2001(EC Act) enacted by the Govt. of India. Promotion of energy efficiency in the industrial and buildings sector form one of the major mandates of the EC Act as it has tremendous potential for improvement.

There is a potential for conserving 30-40% energy in some key industrial clusters. Absence of systematic energy monitoring mechanism is a major factor that is responsible for a large amount of unproductive energy utilisation in industries. GEDA's Energy Audit Scheme provides financial assistance as well as technical expertise through trained & experienced energy expert, to industries and building owners for analysing their energy usage and to increase their profits through achievement of higher energy efficiency.

Energy audits of industrial units, commercial complexes, hotels and hospitals are covered under this subsidy scheme. The subsidy will cover upto 50 % cost of the Energy Audit Study (EAS), upto a maximum of Rs.20, 000/-. Industries with a electrical CD of less than 200 kVA and commercial complexes with a electrical CD less than 75 kW would only be eligible for subsidy under this Scheme.

During the year 2009-10 subsidy shall be provided to 250 industries and commercial buildings , qualifying the eligibility norms of the scheme, on first-come-first-served basis.

Procedures for Applying For Subsidy

1. An industry willing to avail subsidy is required to apply in the format in Form I. Services of GEDA authorized Energy Audit Consultant engaged may be taken for applying procedures.

2. Application should be submitted to GEDA office along with
   - Proposal of the Energy Audit consultant engaged by the industry - financial offer & scope of study.
   - Latest Annual Report of the Industry applying for subsidy.

3. Subsidy sanction issued by GEDA would indicate subsidy amount; elaborate scope of study; duration of study (with last date for report submission) and Terms & conditions of sanction.

Procedures for Claiming Subsidy

1. Submission of one copy of draft Energy Audit Report, along with industry's comment, to GEDA before the specified last date.
2. Formal presentation of the report by the Consultant, in presence of GEDA representative and the concerned executives from the industry. The presentation to be arranged in the premises of the Industry, with prior intimation, on a mutually convenient date.
3. Acceptance of the EA Report, with modifications, if any, after the formal presentation.
4. Submission of 2 copies Final Report, spirally or comb bound, along with the Declaration (as per Form II) duly signed/sealed, proof of payment made to the Energy Audit Consultant for the EA study and implementation energy conservation measures suggested in the report with time schedule, estimates of savings and investments required.

Terms and Conditions of EAS Subsidy Sanction

1. The scope of the EA Study would be as specified by GEDA in its sanction.
2. The work eligible for the EAS subsidy would include assessment of energy use in the industry, outline of cost-effective measures, scope of energy saving, estimates of investments for implementation of corrective measures suggested, payback periods and reporting of results of these activities. Other works, in particular tariff comparison and analysis, preparation of tender specifications and tender evaluation, detailed design work, work connected with implementation of measures and long term Consultancy work **are not eligible for subsidy under the scheme.**
3. Any industry within the Gujarat will be eligible for availing subsidy under this scheme 'once' provided the industry has not availed subsidy under any other government scheme.
4. Energy audits conducted by GEDA authorized energy audit consultants will only be valid for availing subsidy under this scheme.
5. The energy audit must be conducted as per the scope defined in GEDA's sanction letter. Any deviation in the specified scope of study will result in cancellation of the subsidy.
6. The industry must forward the draft report to GEDA with its comments. A formal presentation of the report by the energy audit consultant, in the premises of the industry should be arranged in the presence of GEDA official(s) and concerned executives from within the industry. **Only after the Presentation and discussion the report will be accepted.**

7. The claim for subsidy is subject to the sanction issued by GEDA. Any claim without a prior sanction of GEDA would not be entertained. All payments made by the industry to the Energy Audit Consultant should be done so by cheque or demand draft only.

8. It is mandatory for the industry to implement EC measures so as to achieve atleast 20% of the financial saving projected in the Final Report.

9. GEDA shall follow up on the post-audit implementation by the industry, with either a written communication or a personal visit by its representative to the industry. The industry would be obliged to respond positively to such visits and/or correspondences.

10. GEDA reserves the right to reject an application for EAS subsidy without giving reasons and to change the terms and conditions of the scheme and to terminate the scheme at any time.

11. The Energy Audit Report would be a confidential document. However, GEDA reserves the right to use and publish data and information generated during the study, for dissemination to other similar industries. The industry may have the option of not indicating its name on the Report. In such cases GEDA's sanction number & date should be mentioned in the Report.

12. If the study is not completed within the specified time limit, GEDA may decide to cancel the subsidy. However, extension, if required, may be requested, before the due date of reporting, stating reasons for the extension.

13. **Terms of Payment of Energy Audit Subsidy**
GEDA shall release subsidy amount directly to the industry against submission of two copies of the Final Report. The industry shall submit the subsidy claim letter along with `Declaration' (Form II) and proof of payment released to the Energy Audit Consultant. The subsidy would be disbursed as follows:

- 50% against submission of Final Report
- 50 % against submission of the post-audit Feedback Report, duly certified jointly by the industry and the Energy Audit Consultant. Payment can be claimed a within one month from the date of submission of the Final Report

For further assistance please contact:
Sr. Project Executive / Project Executive,
Gujarat Energy Development Agency,
4th Floor, Block No 11-12, Udyog Bhavan,
Sector-11, Gandhinagar.

2. Assistance for Environment Management to MSMEs

Assistance for environment Management to MSMEs

1 Name of the Scheme

Scheme of assistance for Environment Management to MSMEs.

2 Operative Period

From 11/06/2009 to 10/06/2014

3 Who is eligible to get the benefit ?

Any MSME unit engaged in manufacturing and who intends to set up facilities for waste management/ pollution prevention and abatement will be eligible for assistance under this Scheme.

4 Eligible Activities

The following facilities setup with application of Innovative / State of art technology will be considered as an eligible activity:

- Substitution & Optimization of raw material including catalysts
- Rainwater harvesting
- Any other pre-identified environment management project
- Implementation of cleaner production and clean technology measures, etc.

5 Assistance available

The following quantum of assistance shall be provided:

S.N	Eligible Activity	Quantum of Assistance per project
A	Substitution & Optimization of raw material including catalysts	Upto 25% of cost of plant & machinery; ceiling of Rs 10 lakh per project.
B	Rainwater harvesting	Upto 50% of cost of fixed capital investment ; ceiling of Rs 5 lakh per project
C	Any other pre-identified environment management project	Upto 25% of cost of plant & machinery; ceiling of Rs 10 lakh per project
D	Implementation of cleaner production and clean technology measures, etc.	Upto 50% of cost of plant & machinery; ceiling of Rs 10 lakh per project.

The quantum of assistance under activity at sr. no A and D would be decided by State Level Committee, on the basis of scrutiny of the project report of the eligible activity to be carried out by the Gujarat Cleaner Production Center (GCPC). The quantum of

assistance under activity at sr. no C would be decided by State Level Committee, and the quantum of assistance of activity at sr. no. B will be decided by District Level Committee.

6 Check List

S. N	Particulars	Remarks
1.	Copy of legal status of applicant such as memorandum of article and company registration certificate or partnership deed or registration under society act / trust act etc. and list of directors/partners with addresses.	
2.	Copy of land allotment by GIDC/ sale deed land & copy of 7/12	
3.	Copy of IEM NO. /EM No./Regn.No.	
4.	GPCB NOC/ CONSENT for establishing project	
5.	Please submit detailed project report as applicable.	
6.	Process Diagram of proposed Project.	
7.	Implementation Schedule	
8.	Copy of any other financial assistance granted by GoG and/or GoI for same component or project	
9.	Declaration as per application	
10.	Affidavits regarding any outstanding Government dues and any pending court case against Govt.	

7 Procedure

1. The unit will have to apply to IC/concerned DIC prior to the implementation of the project in prescribed format for assistance along with documents as specified in check list, within one year from the date of issue of quality certificate.
2. On receipt of application with all details, IC/DIC Office will scrutinize the application and submit to the committee for decision within 60 days.
3. After the decision of the committee IC Office will convey the decision within 8 days.
4. The applicant will submit detail expenditure to IC office and/or concerned DIC. DIC will carry out site visit, verify the assets and expenditure incurred and submit the report to IC office within 30 days.
5. IC Office will issue pay order within 15 days and amount will be disburse as per availability of grant.

8 Contact officer for further details /query

Name : MR. N.M. Trivedi
Designation: Dy. Commissioner of Industries (Incentive)
Address : Block No. 1, 6th Floor, Udyog Bhavan, Sector 11, Gandhinagar-382 017
Phone : + 91 79 23252594, 23252588
E-mail : icinc@gujarat.gov.in

Assistance to encouraging Green practice and environmental audit to MSMEs

1 Name of the Scheme

Scheme for assistance to encouraging “Green” practices and environmental audit to MSMEs.

2 Operative Period

From 11/06/2009 to 10/06/2014

3 Who is eligible to get the benefit ?

Eligible Unit means any MSME engaged in manufacturing and who intends to encourage green practices in its unit.

4 Eligible Activities

1. Use of Clean, Efficient and Innovative Pollution Control Equipments in industries
2. Periodic Environmental Audits except those covered under Rules and Judgments
3. Encouraging Environment Management System – setting up of Environment Management Cell
4. Purchase of new equipments/ systems related to safety, occupational health for a cluster of industries (minimum 10 industries in a cluster)
5. Installation of Solar System leading to at least 5% energy saving

5 Assistance available

The following quantum of assistance shall be provided:

S.N	Eligible Activity	Quantum of Assistance per project
A	Use of Clean, Efficient and Innovative Pollution Control Equipments in industries	Upto 25% of cost of equipments; or maximum Rs. 2.5 lakh/ Units
B	Periodic Environmental Audits except those covered under Rules and Judgments	Upto 50% of fees of audit services; or maximum Rs.25,000/ audit
C	Encouraging Environment Management System – setting up of Environment Management Cell	Upto 25% of cost of equipments; or maximum Rs 5 lakh/ plant once in a lifetime
D	Purchase of new equipments/ systems related to safety, occupational health for a cluster of industries (minimum 10 industries in a cluster)	Upto 25% of cost of equipments; or maximum Rs 25 lakh/ cluster. The assistance under the scheme will be provided to industrial association or SPV formed by the Industrial Units.
E	Installation of Solar System leading to atleast 5% energy saving	Upto 25% of cost of system; Rs 2.5 lakh / plant

6 **Check List**

S. N	Particulars	Remarks
1.	Copy of legal status of applicant such as memorandum of article and company registration certificate or partnership deed or registration under society act / trust act etc. and list of directors/partners with addresses.	
2.	Copy of land allotment by GIDC/ sale deed land & copy of 7/12	
3.	Copy of IEM NO./EM No./Regn.No.	
4.	GPCB NOC/ CONSENT for establishing project	
5.	Please submit as applicable, • Equipment wise list with cost and justification for purchase of particular equipment. • Equipment wise cost along with the use of particular equipment • Give details of average present and past consumption of energy/electricity and energy/ electricity saving by installation new equipment with cost	
6.	Copy of Audit report along with payment made to auditor for scheme - B	
7.	Detail justification to setup environment management cell in the unit and its proposed expenditure for scheme - C	
8.	List of beneficiaries of project for scheme - D	
9.	Process Diagram of proposed Project.	
10.	Implementation Schedule	
11.	Copy of any other financial assistance granted by GoG and/or GoI for same component or project	
12.	Declaration as per application	

7 Procedure

- The unit will have to apply to concerned DIC prior to the implementation of the project in prescribed format for assistance along with documents as specified in check list, within one year from the date of issue of quality certificate.
- On receipt of application with all details, DIC will carry out inspection for verification of document and eligible expenditure. The inspection will be completed within 15 working days.
- DIC GM will scrutinize the inspection report and will sanction /reject the application

within 10 days.

- After issuance of sanction letter payment will be made within 10 days, subject to availability of grant.

8 Contact officer for further details /query

Name : MR. N.M. Trivedi
Designation: Dy. Commissioner of Industries (Incentive)
Address : Block No. 1, 6th Floor, Udyog Bhavan, Sector 11, Gandhinagar-382 017
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Financial schemes available with local banks for improving energy efficiency in cluster

1. Credit linked capital Subsidy scheme(CLCSS)

Under this scheme, the ministry of MSME is providing subsidy to upgrade technology (Machinery/plant equipments). Subsidy limit per unit is Rs. 15 lakh or 15% of investment in eligible machinery/Plant equipments whichever is lower. For more details of the scheme visit: www.laghu-udyog.com/scheme/sccredit.htm

2. SIDBI Financing Scheme for Energy Saving Projects in MSME sector under JICA Line of Credit

The Japan International Corporation Agency (JICA) has extended a line of credit to SIDBI for financing Energy Saving projects in Micro, Small and Medium Enterprises (MSMEs). This project is expected to encourage MSME units to undertake energy saving investment in plant and machinery to reduce energy consumption, enhance energy efficiency, reduce CO_2 emissions, and improve the profitability of units in the long run.

Eligible Sub Projects/ Energy Saving Equipment List under JICA line of Credit:

- Acquisition (including lease and rental) of energy saving equipments, including newly installing, remodeling and upgrading of those existing
- Replacement of obsolete equipments and/or introduction of additional equipment which would improve performance
- Equipments/ Machinery that meets energy performance standards/Acts
- Introduction of equipments that utilize alternative energy sources such as natural gas, renewable energy etc., instead of fossil fuels such as Oil and Coal etc.
- Clean Development Mechanism (CDM) projects at cluster level that involves change in process and technologies as a whole, duly supported by technical consultancy will be eligible for coverage.

Financial parameters:

The financial parameters for appraising the project are:

Parameter	Norms
Minimum Assistance	Rs. 10 lakh
Minimum promoters contribution	25% for existing units; 33% for new units
Interest rate	The project expenditure eligible for coverage under the line will carry a rate of interest rate of 9.5-10% p.a
Upfront fee	Nonrefundable upfront fee of 1% of sanctioned loan plus

Parameter	Norms
	applicable service tax
Repayment period	Need based. Normally the repayment period does not extend beyond 7 years. However, a longer repayment period of more than 7 years can be considered under the line if necessary

Eligibility criteria for units (Direct assistance):

- Existing units should have satisfactory track record of past performance and sound financial position.
- Projects will be screened as per Energy Saving List, which is available in SIDBI website.
- Units should have minimum investment grade rating of SIDBI.
- Projects which may result environmental impacts and negative social impacts are also not eligible under this scheme.

For further details eligible energy saving equipments/machinery, projects can be financed under this scheme and details of scheme, please contact the nearest SIDBI branch office or refer to SIDBI website (**www.sidbi.in**)

3. Scheme for Financing Energy Efficiency Projects

PURPOSE:

- Financing SMEs for acquisition of equipments, services and adopting measures for enhancement of energy efficiency/conservation of energy.

ELIGIBILITY

- SME units financed by bank as also other units desirous of shifting their account to Bank of Baroda.

LIMIT:

- Upto 75% of the total project cost, subject to maximum of Rs. 1/- crore. (Minimum amount of loan Rs. 5/- Lakhs).

Project cost may include the following:

- Cost of acquisition/modification/renovation of equipment/software.
- Cost of alterations to existing machinery.
- Cost of structural / layout changes.
- Cost of energy audit/consultancy.
- Preparation of Detailed Project Report (DPR).

RATE OF INTEREST:

- Bank's BPLR from time to time.

REPAYMENT :

- Maximum 5 years, including moratorium, if any.

SECURITY :

a. For Sole Banking Accounts :
   Extension of first charge on all fixed assets.

b. For Consortium/Multiple Banking Accounts :
   first charge on equipments acquired out of loan and collateral, if any, with the total security coverage being not less than 1.25.

Grant from IREDA:

- IRDEA, at present, gives a grant of Rs. 25,000/- for projects costing Rs. 1/- crore or below to meet partial cost of Energy Audit. This grant is available for the first 100 projects (SME Sectors only) approved by them.

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