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# Cluster Profile Report

## ThaneChemical Cluster

**Prepared for**

**Bureau of Energy Efficiency (BEE)**
**Ministry of Power, Government of India**
**New Delhi**

**The Energy and Resources Institute**
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| | |
|---|---|
| APM | Administered Pricing Mechanism |
| BEE | Bureau of Energy Efficiency |
| BoB | Bank of Baroda |
| CAGR | Compound Annual Growth Rate |
| CDGI | Centre of development of glass industry |
| CFC | Common Facility Centre |
| DIC | District Industries Centre |
| DPR | Detailed Project Report |
| DVVNL | Dakshinanchal Vidyut Vitran Nigam Limited |
| EE | Energy Efficiency |
| FI | Financial Institute |
| GAIL | Gas Authority of India Ltd |
| GEF | Global Environmental Facility |
| GHG | Greenhouse Gas |
| GIS | The Glass Industrial Syndicate |
| GoI | Government of India |
| HT | High Tension |
| ID | Induced Draft |
| IDBI | Industrial Development Bank of India |
| KPI | Key Performance Indicators |
| LSP | Local Service Provider |
| LT | Low Tension |
| MoEF | Ministry of Environment and Forests |
| MS | Mild Steel |
| MSME | Micro Small and Medium Enterprises |
| MSME-DI | MSME-Development Institute |
| MT | Million Tonnes |
| NG | Natural Gas |
| NIC | National Industrial Classification |
| OBC | Oriental Bank of Commerce |
| PNB | Punjab National Bank |
| PNG | Piped Natural Gas |
| RLNG | Re-gasified Liquefied Natural Gas |
| SBI | State Bank of India |
| SCM | Standard Cubic Metre |
| SDC | Swiss Agency for Development and Cooperation |
| SIDBI | Small Industries Development Bank of India |
| SWOT | Strengths Weaknesses Opportunities and Threats |
| TCs | Technology Centers |
| TCSP | Technology Centre Systems Programme |
| TERI | The Energy and Resources Institute |

| | |
|---|---|
| toe | Tonnes of Oil Equivalent |
| TTZ | Taj Trapezium Zone |
| UBI | Union Bank of India |
| UPGMS | Uttar Pradesh Glass Manufacturers Syndicate |
| WHR | Waste Heat Recovery |

# Acknowledgements

The Energy and Resources Institute (TERI) is grateful to the Bureau of Energy Efficiency (BEE) for its progressive management and also for vesting its confidence in TERI to carry out this prominent assignment “Energy and Resource Mapping of MSME Clusters in India (Chemical Sector)” and providing full-fledged coordination and support throughout the study.

The study team is thankful to the officials of Thane small scale Industries Association (TSSIA), Chamber of small industries Association (CSIA) and Indian small scale paint Association (ISSPA) for showing keen interest in the study and providing their wholehearted support and cooperation for the preparation of this cluster profile report. We would like to extend our special thanks to Ms Sujata Soparkar, Vice President (TSSIA), Mr. Ninad Jaywant, Gen. Secretary (CSIA).

Last, but not the least, interactions and deliberations with MSME-DI, Mumbai, industries associations, Micro Small and Medium Enterprise entrepreneurs, technology providers, and who were directly or indirectly involved throughout the study were exemplary and the whole experience was a rewarding one for TERI.

**TERI Team**

# Certificate of originality

This is to certify that this report is an original work of TERI. The TERI team held detailed discussions and collected data from numerous industry stakeholders, which included MSME entrepreneurs, senior plant engineers, industries associations, local energy distribution companies, key local bodies, local service providers, suppliers, fabricators, experts, testing labs, effluent treatment plants, academic institutes/ ITIs, and banks/FIs. In addition to this, the team reviewed secondary literature available in the cluster. The cluster profile is an end product of both first hand interactions/data and secondary literature in the cluster. Appropriate references have been indicated in places where TERI has utilized secondary sources of data and information.

## Chapter 1

# 1.0 About the Project

## 1.1 Project overview

The Micro, Small and Medium Enterprises (MSME) sector in India is a unique mix of enterprises using conventional as well as modern technologies. Most of the enterprises in the MSME sector are traditional and deploy technologies that are inefficient and resource intensive. The MSMEs are generally located as clusters. There are many such clusters which are highly energy intensive in their operations.

At national level, the data/information of energy intensive MSME sectors on various parameters like production, type and quantity of fuel consumption, energy saving potential, details on energy efficient technologies, future growth scenarios, etc. are not readily available. This in a way limits the design of appropriate policy instruments to ensure sustainable growth of these sectors. To address this barrier, the Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India, has initiated an ambitious project of mapping the energy intensive MSME sector across the country. Chemical industry is one of the energy intensive sectors identified under the project. The BEE has entrusted The Energy and Resources Institute (TERI), New Delhi to undertake a detailed study of the chemical industry sector in India.

## 1.2 Project objectives

The objectives of the study include the following:

- Map energy intensive Chemical manufacturing sector from energy perspective
- In-depth study of existing scenarios on energy consumption and identify opportunities for energy and resource saving
- Prepare a roadmap to develop the intervening sector energy and resource efficient as well as environment friendly

The five targeted Chemical clusters covered under the project are shown in table 1.2.

**Table 1.2: Targeted clusters under the project**

| S. No. | Cluster | State | Sector |
|---|---|---|---|
| 1 | Ahmedabad | Gujarat | Chemical |
| 2 | Karnal | Haryana | Chemical |
| 3 | Thane | Maharashtra | Chemical |
| 4 | Vapi | Gujarat | Chemical |
| 5 | Jamshedpur | Jharkhand | Chemical |

## 1.3 Major components of the project

The major components of the project and their activities are shown in Table 1.3.

**Table 1.3: Major component of the project**

| Components | Major activities |
|---|---|
| Component-1:<br>Field study and data analysis | • Conduct detailed energy audits covering 10 representative units in each cluster<br>• Conduct benchmark study to develop Key Performance Indicators (KPI) and Energy Efficiency (EE) benchmarks<br>• Develop a sectorial profile for the Chemical sector<br>• Develop sectorial brochure |
| Component-2:<br>Development of roadmap and outreach | • Prepare and publicize sectorial roadmap for Chemical industry<br>• Disseminate outreach and knowledge through;<br>○ Cluster level workshops<br>▪ Project inception workshops<br>▪ Post activities workshops<br>○ National workshops<br>▪ Stakeholder consultation<br>▪ Result dissemination |

Chapter 2

# 2.0 Cluster Scenario

## 2.1 Background

The chemical industry is an integral constituent of the growing Indian Industry sector and ranks 6th in the world in chemicals sales. India is a leading dyes supplier at a global level and account[1] for about 16% of the world's production of dyestuff & dye intermediates. The chemical industry accounted for 1.34% of the "gross value added" (GVA) during 2018-19. This sector is highly diversified (Figure 2.1) and comprises both MSMEs as well as large scale units (including multi-national companies).

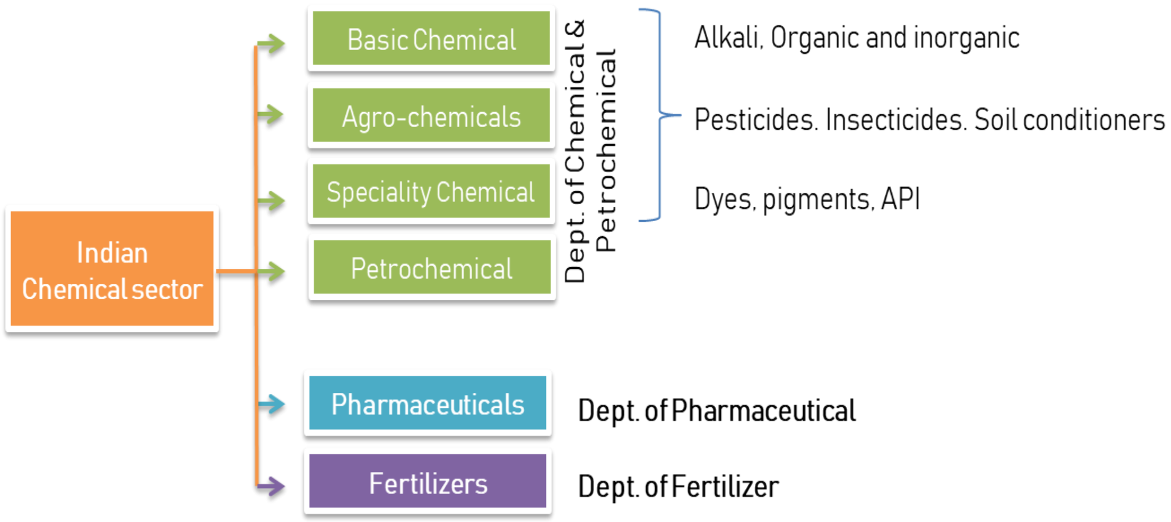


**Figure 2.1: Classification of Indian Chemical Sector**

The chemical industry covers more than 80,000 commercial products[2]. It includes basic chemicals and its products, petrochemicals, fertilizers, paints, varnishes, gases, soaps, perfumes and toiletry, and pharmaceuticals. The industry occupies a pivotal position in meeting basic needs and improving the quality of life. It is the mainstay of industrial and agricultural development of the country and provides building blocks for several downstream industries, such as textiles, papers, paints, varnishes, soaps, detergents, pharmaceuticals, etc.

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[1] https://www.investindia.gov.in/sector/chemicals

[2] As per National Industrial Classification (NIC) 2008, Chemical & Chemical products are covered under the industry division 20

The Indian chemical industry employs more than 20 lakh people[1]. Three independent departments, under the Ministry of Chemicals & Fertilizers Government of India, are responsible for the growth of the respective sub-sectors which include (1) Department of Chemicals and Petrochemicals, (2) Department of Fertilisers, and (3) Department of Pharmaceuticals.

The state of Gujarat is leading state in the manufacturing of chemicals, petrochemicals, and pharmaceutical in the country. The other major Indian states involved in the production of chemicals include Maharashtra, Tamil Nadu, and Uttar Pradesh.

## 2.2 Overview of Thane Chemical cluster

Thane chemical cluster is one of the important chemical clusters in Maharashtra. The cluster houses a number of large scale and MSME units, manufacturing various types of chemical products.

Some of the leading large scale industries and multinational companies like Aarti Industires Limited, Ajanta paper & general product Pvt. Ltd, Alchemic Organics Ltd, Amber Distillence Pvt. Ltd., Ankit Polyester Ltd., Annapurna Dying & Printing, Anthea Aromatics Pvt Ltd, Bombay Crimpers Pvt.Ltd, Cabot India Ltd, BASF, Dorf Ketal, Dow Chemicals, etc. are also located in Thane.The annual turnover of chemical industries in Thane cluster is more than Rs 1,000 crore. The cluster provides employment to about 20K people, of which 80% are locals and the rest are from other states of India[3].

### 2.2.1 Classification of Chemical units

The chemical units in Thane cluster can be classified either on the basis of the type of products or production capacities. More than 80% of the units in the cluster produce Bulk drugs and 20% of the units in the cluster is Solvent distillation, Resin, Cosmetic chemicals and spray drying as shown in figure 2.2.1a.

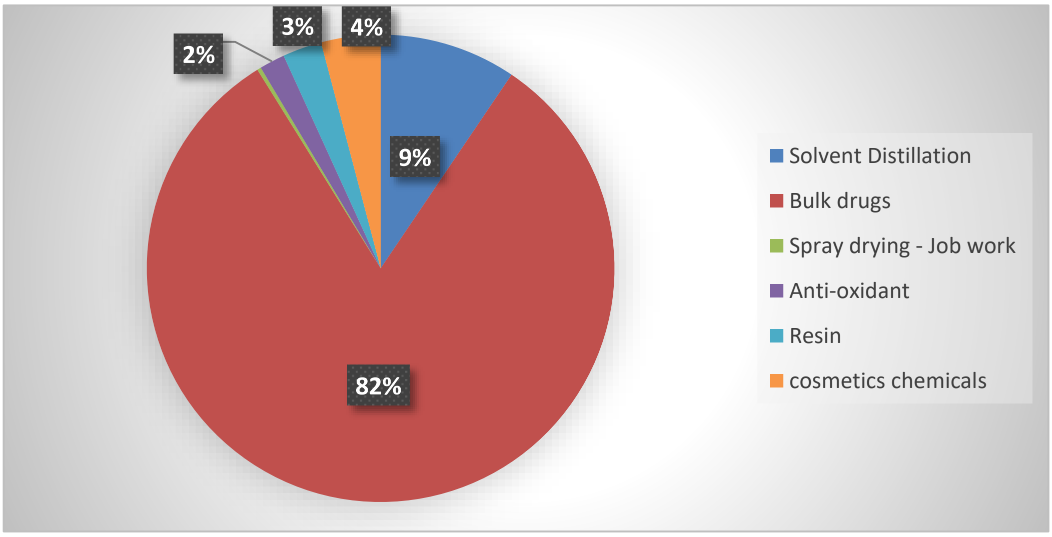


**Figure2.2.1a: Major Products manufacturing in Thane cluster**

The Chemical industries in the cluster can be divided into three different type based on production capacity of the units as shown in figure 2.2.1b.

[3] Business Standard, 2019

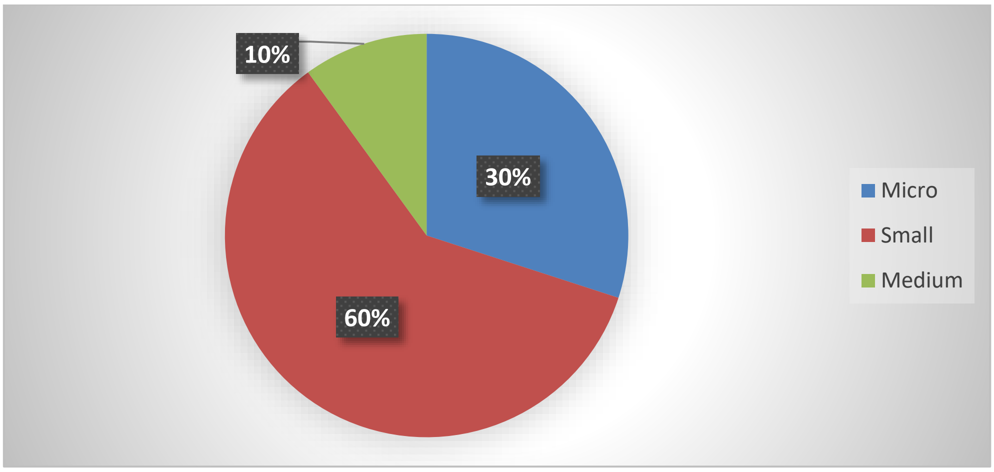


**Figure2.2.1b: Production Capacity in Thane cluster**

### 2.2.2 Major products

The chemical industries in Thane cluster manufacture a diverse range of products like Bulk druygs, Solvent Distillation, Cosmetic Chemical, Spray drying (Job work), resin, paints and Anti-oxidant. Some of the major categories of chemicals produced in the cluster are shown in Table 2.2.2.

**Table 2.2.2: Chemical products manufactured in Thane cluster**

| Category | Products |
|---|---|
| Bulk Drugs | Including drug substance like tablets or granules. |
| Solvent Distillation | Intance,distillation isn the favoured method to separate acetic from acetone, benzene from toluene, and menthanol and ethonal from water. |
| Dyes and pigments | Azo dyes, acid direct dyes, basic dyes, fats colour bases, oil - based dyes, whitening agents, organic pigment colours, pigment emulsion, food colours |
| Anti-Oxidant | Anti-oxidant include viatmins C and E, selenium and carotenoids such as beta-carotene,lycopene, lutein and zeaxanthin. |
| Cosmetic chemicals | Skin loations, cream, shaving cream,eye makeup and deodorants. |
| Paint & Resin | Varnish and adhesives, pigments, binders and solvent. |

### 2.2.3 Market scenario

The chemical units of Thane find customers in both domestic and international markets. As they are manufacturing different different type of products so the all the Major exports of bulk drugs like (Triclabendazole Butaphosphone) are to developed countries like Germany, UK, USA, Switzerland, Spain, Turkey, Singapore and Japan. The chemical units which have acquired international quality and environment certifications are exporting speciality chemicals, inorganic chemicals, and pigments to European countries, parts of North America, Australia, Singapore, Taiwan, Thailand, Africa, and Bangladesh.

### 2.2.4 Raw materials

A variety of basic chemicals are used as raw materials to manufacture major chemical products. These basic chemicals are based on different factors such as chemical composition (organic and inorganic), origin of chemicals (mineral, vegetative, and animal), and state of aggregation (solid, liquid, and gaseous).

The types of mineral raw materials include ore (metallic), non-metallic, and combustible (organic). Ore minerals primarily comprise metal oxides and sulphides (Cu2S, CuS, $Fe_2O_3$, Fe3O4, ZnS, and so on). It also includes $SiO_2$, $Al_2O_3$, CaO, and MgO. Non-metallic raw materials are diverse in chemical composition and are used either in their natural state (sand, clay, asbestos, and mica) or are delivered for chemical processing (chloride, phosphates, sulphates, carbonates, and alumina silicates). Vegetative and animal raw materials include wood, cotton, oils and fats, milk, hides, and wool. They are processed either into food products (food raw materials) or into products for domestic and industrial use. Majority of these raw materials are sourced locally.Cluster level initiatives

### 2.2.5 Cluster level initiatives

The programmes and initiatives undertaken by various organisations are listed in the table 2.2.5.

**Table 2.2.5: Cluster level initiatives**

| Organisation | Programme/initiatives | Brief description | Status |
|---|---|---|---|
| Thane Small Scale Industries Association (TSSIA) | Conducting various educational programs and seminars on Industrial Safety and Health | TSSIA is the largest registered MSMEs Association in the state of Maharashtra and has been functioning for past 44 years in Thane District. | Operational |
| Bureau of Energy Efficiency (BEE) | BEE SME National Programme | Situation analysis, cluster profiling, energy audits and bankable detailed project reports (DPRs) on EE technologies reports (DPRs) on EE technologies | Implemented during 2009-2012 |

# Chapter 3

# 3.0 Major cluster stakeholders

The primary stakeholder of the cluster is the chemical manufacturing units. The other stakeholders include industry associations, government agencies including regulatory bodies, research and academic institutions, and testing facilities and training institutes. These cluster level stakeholders provide a range of services to the chemical manufacturing units. Some of the major stakeholders in Thane chemical industry cluster along with their roles and activities are briefed below.

## 3.1 Industries associations

There are two major industry associations active in Thane chemical cluster. The contact details of the industries associations are given in table 5.

### 3.1.1 Thane small scale Industries Association

Thane small scale Industries Association (TSSIA) has been playing a key role in accelerating the growth in the MIDC area of Thane. TSSIA is always maintaining harmonious relationship with Government / Semi-Government / Other Non-Governmental Organisations and Industries. It has more than 2,500 member units, some of the key activities of TSSIA include (i) conduct various educational programs and seminars on Industrial Safety and Health, (ii) Technological Up gradation, (ii) Resource Mobilization, (iv) Environmental Protection, (v) Energy Conservation, (vi) Export Promotion, (vii) Laws, revenue, labour, ISO 9000 certification, EDP etc. for the development of Micro, Small and Medium Enterprises.

### 3.1.2 Chamber of small industry Association

Chamber of small industry associations (COSIA) is a National Level Chamber of Micro, Small and Medium Enterprises (MSMEs). COSIA currently has a Pan India Membership base of 330 members comprising of Local, District Level, Regional Level and State Level MSME Associations. some of the key activities of COSIA include (i) conducting skill development activities with an aim to provide Skilled Work force for MSMEs, (ii) assist in making Indian MSMEs globally competitive, (iii) promote entrepreneurship among the economically weaker sections and hence countering the unemployment and poverty issues.

### 3.1.3 Indian small scale paint Association

Indian small scale paint Association (ISSPA) has membership of more than 1,900 units located in Thane and other clusters in Maharashtra. The key activities of ISSPA include (i) To promote and protect the small scale paint industry, (ii) To update Members about changes in Government regulations affecting their industry, (iii) disseminate among its Members updates in technology and management practices, etc.

**Table 3.1.3: Contact details of industries associations**

| Name of association | Contact details |
|---|---|
| Thane small scale industries association | TSSIA House,<br>Plot No. P-26, Road No. 16/T, Wagle Indl. Estate,<br>Thane (W)- 400604, Maharashtra<br>Email: tssia.thane@gmail.com<br>Website: www. tssia..org<br>Contact person: Ms Sujata Soparkar- Vice President |
| Chember of small industry association | TSSIA House,<br>Plot No. P-26, Road No. 16/T, Wagle Indl. Estate,<br>Thane (W)- 400604, Maharashtra<br>E-mail: cosia.cosia@gmail.com<br>Website: www.cosia.org.in<br>Contact person: Mr Ninad Jaywant – Hon. Gen. Secretary |
| Indian small scale paint association | 104, Shubham Center No.1B, Cardinal Gracias Road, Chakala, Andheri (E), Mumbai - 400 099.<br>Email: office@isspa.org<br>Website: http://www.isspa.org |

## 3.2 Government bodies

The government agencies involved in the cluster and their key activities in the cluster are given in table 3.2.

**Table3.2: Goverment bodies and key responsibilites**

| Name of organisation | Key roles |
|---|---|
| Msme-Development Institute (MSME-DI), Mumbai | • Policy promotions measures for MSME Sector<br>• Providing Technical Consultancy to Existing and Prospective Entrepreneurs<br>• Disseminating Economic and Statistical Information<br>• Promotion of MSE-Cluster Development Programme |
| Directorate of Industries | • Makes recommendations for import of raw materials and capital goods,<br>• Central Purchase of Stores for the State Government,<br>• Grants No Objection Certificate for location of industries in Mumbai Municipal Region<br>• Recommends licence for industry and grants exemptions of land for industrial use under the Urban Land Ceiling Act and for setting up of Co-operative Industrial Estate.<br>• It also implements programmes for the educated unemployed. |
| Udyog Mitra | • It's main function is to liaison on behalf of the entrepreneurs for securing early clearances.<br>• Guidance to enterpreneures in regard to rules and regulations. It is a single point contact for the enterpreneurs of the area. |

## 3.3 Technical, academic, and R&D institutions

Both public and private testing laboratories are available in Thane and surrounding MIDC areas. Some of the major institutes like Indian Institute of Technology (IIT), Bombay, Institute of chemical technology (ICT), Mumbai offer a variety of courses in chemical engineering and chemical industry technologies relevant for the cluster. These institutes provide technical workforce to the cluster. Around sixteen number of Industrial Training Institutes (ITIs) in Thane district offer industrial training courses like chemical plant operators, laboratory attendants, chemists, process attendants, and ETP operators etc.

## 3.4 Financial institutions

Nationalized, commercial, and cooperative banks operating in the Thane cluster and The Bank of Maharashtra (BOM) is the lead bank in the Thane district. Some of the important banks in the cluster include State Bank of India, Axis Bank, Vijaya Bank, Punjab National Bank, ICICI Bank, HDFC Bank, and Dena Bank. The Thane branch of SIDBI is serving the Chemical industries of MIDC thane area. Most of these banks provide financial assistance towards expansion and infrastructural up gradation of chemical units. In addition, a large number of cooperative banks also operate in the cluster to meet the financial requirements of the cluster.

## Chapter 4

# 4.0 Production process and technology use

## 4.1 Manufacturing process of Solvent Distillation

The major steps of the process involve the reaction of the raw materials at a particular temperature, which is maintained by the utilization of thermic fluid. The output of the condenser on the reaction vessel is collected as the final product. The generic process steps followed by the unit are briefed below.

The pre-prepared batch materials are charged in a reaction vessel with the necessary solvent. Heating is done using a thermic fluid heater up to desired temperature level. Vapours generated from the reaction vessel are condensed in a condenser using cool water from the cooling tower. Condensate is again poured into the reaction vessel until desired product parameters are attained. After attaining desired final product parameters the condensate from the condenser is drained out to the receiver tank. The final product in the receiver is transferred to packaging tanks and stored for dispatch.

A vacuum system is being used to transfer chemicals solvent from tank/ drum to reactors. The water jet has been used for vacuum generation. Low pressure steam is used for heating the reactor and few reactors are equipped with electrical heaters (R-6 and R-7). Cooling water is being used in an overhead condenser to recover the solvent. A schematic of process flow diagram is provided in figure 4.1.

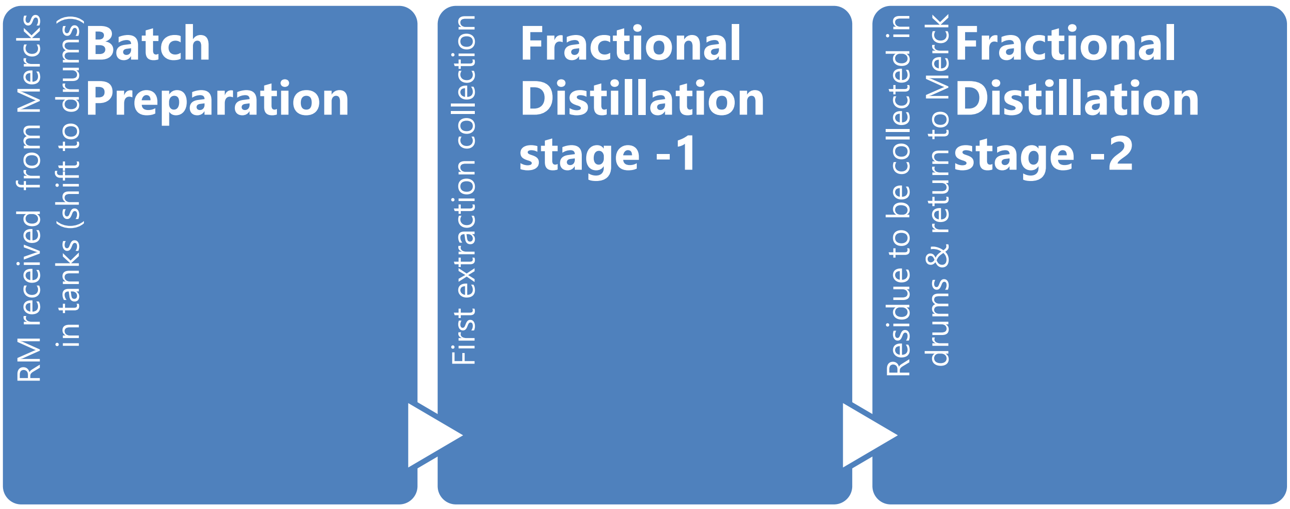


**Figure 4.1: Production process of Solvent Distillation**

## 4.2 Manufacturing process of Anti-Oxidant

Quality Industries is producing Antioxidant which is commonly used in plastics, rubber, petroleum products, foods, pharmaceuticals, and cosmetics.

Anti-oxidant is generally manufactured by reacting para-cresol and Iso-butylene in the presence of an acid catalyst. In the batch manufacturing process, one of the raw materials (para-cresol) is transfer to the reactor and dosing of catalyst in a proportionate manner. Further Iso-butylene.

introduces into the reactor to thermally cracking the starting mother liquor at a temperature of 200°C to 250°C in the presence of an acid catalyst to reform the cresol polymers. Steam at 4 kg/cm$^2$ is used for heating purposes. Cooling water and chilled water are provided in the later stage of the batch for BHT crystallization. Liquid and effluent produced in the process are sent to a multi-effect evaporator to recover solvent and then the solid waste is the transfer for landfilling. BHT slurry is transferred to centrifuge for mother liquid and crystal separation, and then the pure solid is dried in a fluidized bed dryer. The finished product is sieved and packed for dispatch.

The vacuum system is being used to transfer chemicals solvent from tank /drum to reactors, Also used in a distillation column (730 mmHg). The water jet has been used for vacuum generation. Low-pressure steam (4 kg/cm$^2$) is being used for heating the reactor and high pressure (15 kg/cm$^2$) is used in the re-boiler of the distillation column. Also, low-pressure steam is utilised in fluidised bed dryers for hot air generation. A schematic of the process flow diagram is provided in figure 4.2.

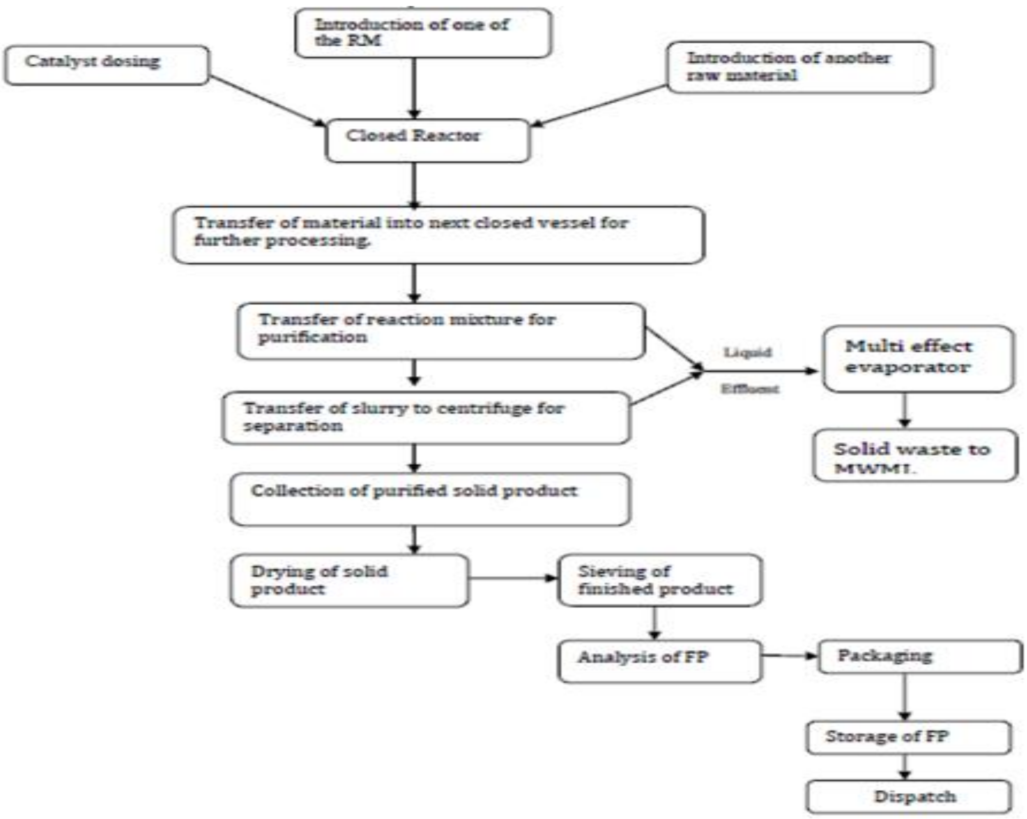


**Figure4.2: Prodction process of Anti-oxidant**

## 4.3 Manufacturing process of Bulk Drugs

NGL Fine-Chem Ltd is producing intermediate chemical for pharmaceutical application and it is used to treat fascioliasis and paragonimiasis.

Chemical synthesis processes use organic and inorganic chemicals in batch operations to produce drug substances with unique physical and pharmacological properties. Typically, a series of chemical reactions are performed in multi-purpose reactors and the products are isolated by extraction, and filtration. The finished products are usually dried, milled and blended. Organic synthesis plants, process equipment and utilities are comparable in the pharmaceutical and fine chemical industries.

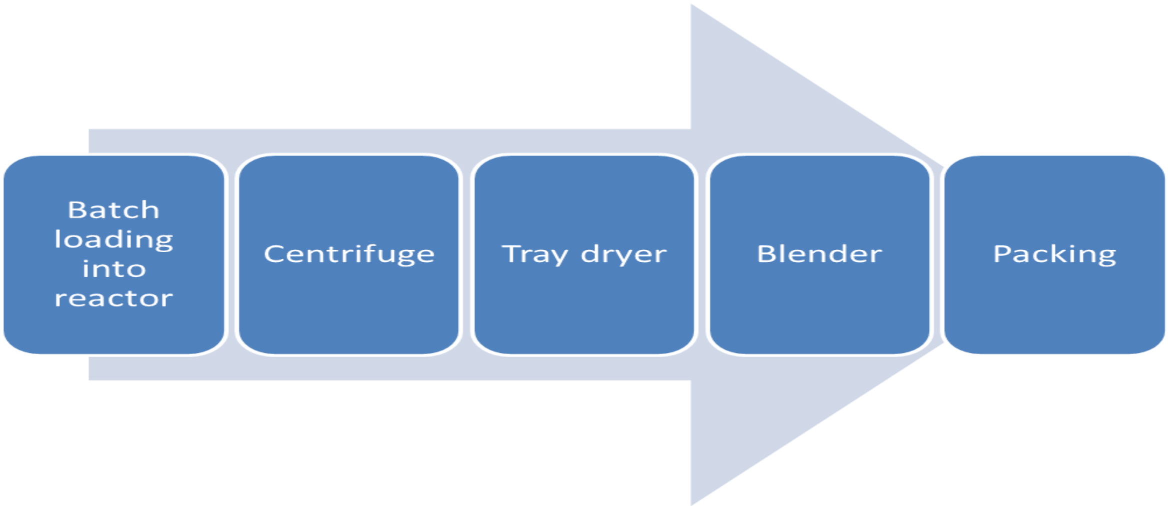


**Figure 4.3: Prodction process of Bulk drugs**

## 4.4 Manufacturing process of Resin

Peroxide which is used as hardener in rasin, rubber and other petrochemical plastic production. The manufacturing process used for preparing methyl ethyl ketone peroxide by taking an acidic ion exchange resin as a catalyst. According to the method, butanone and hydrogen peroxide are taken as raw materials, the acidic ion exchange resin is taken as the catalyst, dibutyl phthalate is taken as a diluent, after constant temperature stirring reaction, an obtained mixture is allowed to stand for separation, and an obtained oil phase is methylethyl ketone peroxide.Vacuum system is being used to transfer chemicals solvent from tank /drum to reactors. Water jet has been used for vacuum generation. Ice water is being used to maintain the reactor temperature. Schematic of process flow diagram is provided in figure 4.4.

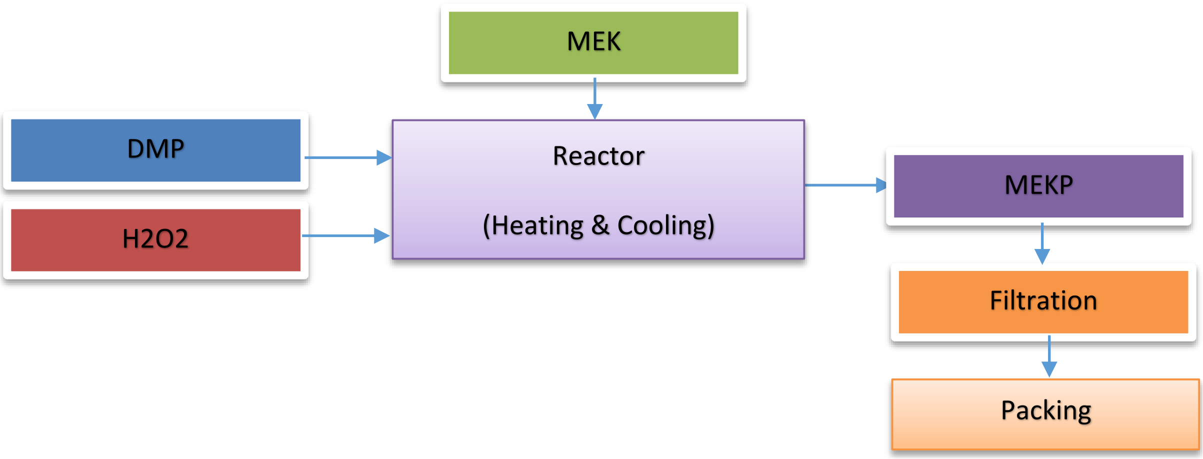


**Figure 4.4: Production process of Resin**

## 4.5 Major technologies and equipment

A variety of chemical products like dyes, pigments, paints, agro-chemicals, and pharmaceutical products are manufactured in Thane cluster. However, the technology use and type of process equipment used in manufacturing of these chemicals are quite similar. The major technologies and equipment used in process areas and utility sections are provided in table 4.5.

**Table4.5: Major technologies/euipment used in chemical industries**

| | |
|---|---|
| Manufacturing process | ▪ Reaction vessels<br>▪ Centrifuge<br>▪ Press filter |
| Auxiliaries/utilities | ▪ Steam boilers<br>▪ Thermic fluid heaters<br>▪ Hot air generators<br>▪ Air compressors<br>▪ Chilling system |

### 4.5.1 Details of process equipment

The brief details of the equipment used in the manufacturing processes are provided below.

#### 4.2.1.1 Reaction vessels/kettles

The chemical reactions take place in kettles, primarily made of stainless steel or rubber lined ceramic material. The chemical units have different capacities of reaction vessels varying in the range of 1-20 kilo litre (kL). The capacities and number of vessels in a chemical unit are dependent on type of manufacturing process, production capacity and batch size.

#### 4.2.1.2 Centrifuge

The intermediate products in the form of slurry (suspended solid particles) are separated from the slurry using centrifuge. Different basket sizes of centrifuge e.g. 24/36/48 inch are used in the cluster.

#### 4.2.1.3 Press filter

In this section, the solid particles and liquid chemicals are separated by pressing the slurry in filter plates using hydraulic force. The separation occurs in chambers formed between the recessed faces of filter plates, which are clamped together in a rugged steel frame. Compressed air at about 5–7 kg/cm$^2$ is used to remove liquids from pores in the filter cake. Upon reaching the desired residual moisture content, the filter is opened and the cake is removed. The filter press helps in reducing the moisture content by 50% to 60%.

#### 4.2.1.4 Dryers

The moisture-laden solid cakes are kept in the dryer chamber and heated to the required temperature to remove the moisture. A wide range of dryers are used namely tray dryer, fluidized bed dryer, rotary vacuum dryer, and spin flash dryer. Steam boilers, thermic fluid heaters, and hot air generator are used for providing heating requirements in the dryer.

### 4.5.2 Details of auxiliaries equipment

The brief details of auxiliaries/utilities used in the chemical industries are provided below.

#### 4.2.1.5 Steam boilers

The steam boilers, as per Indian Boilers Regulations (IBR), are mainly used for low and medium pressure (i.e. 3.5-10.5 kg/cm$^2$) applications in the chemical units. The natural gas is the major fuel used in boilers to generate the steam. However, some of the micro and small size chemical units also use firewood or coal as in the boilers. Most of the chemical processes require low pressure steam (i.e. 3.5-5.5 kg/cm$^2$) for jacket heating and direct purging into the reactor vessels. The capacities of IBR type boilers range from 1-5 tonne per hour (tph). The non-IBR boilers (up to 750 kg per hour evaporation rate) are also used in the chemical units to meet intermittent steam requirements. These boilers are of single pass, once through type and primarily use natural gas or liquid fuels as energy source.

#### 4.2.1.6 Thermic fluid heaters

The thermic fluid heaters (TFH) or thermos-packs are used to cater to the indirect heating requirements of manufacturing processes viz., dryer and jacket heating. The natural gas is mainly used as fuel in TFH. The capacities of thermos-packs vary from 100,000 kcal per hour to 500,000 kcal per hour based on process requirements. The temperature of thermic fluid is about 180-200 °C.

#### 4.2.1.7 Hot air generators

The hot air generators (HAG) are used to generate hot air at about 60-200 °C Based on process requirements. Fans are installed in drying chamber for hot air circulation towards moisture removal. The typical capacities of HAGs used in the cluster vary from 100,000 kcal per hour to 400,000 kcal per hour. While the HAGs use natural gas as fuel, some of the chemical units under micro category use wood fired hot air generators to cater to the heating requirements in tray dryers.

#### 4.2.1.8 Air compressors

The air compressors are used to meet compressed air requirements of processes and pneumatic instrumentation in the chemical units. The end use compressed air pressure varies from 5 $kg/cm^2$ to 7 $kg/cm^2$. Most of the chemical units use small capacities tank mounted, reciprocating type air compressors, while some of the progressive units use screw compressors.

#### 4.2.1.9 Chilling system

Some of the chemical units require to maintain the temperature of processes below 0ºC. To meet this process cooling requirements, ammonia type reciprocating chillers are mainly used in these units. The capacity of ammonia based chillers varies from 15 TR to 110 TR. A few chemical units employing intermittent processes use ice blocks instead of chillers for the cooling process.

Chapter 5

# 5.0 Energy consumption profile and conservation measures

## 5.1 Details of energy use

The chemical industries in Thane cluster use both thermal energy and electricity in the manufacturing processes. Energy accounts for a sizeable portion of manufacturing costs of the chemical units of Thane cluster. The energy costs are 5–7% of the manufacturing costs for inorganic chemicals and about 12–15% for dyes and chemicals. The levels of energy consumption in these units are dependent on the type of products and the process followed. Different types of energy used in the cluster include natural gas, coal, firewood, and electricity.

### 5.1.1 Thermal energy

Thermal energy is used to meet the heating requirements of the processes followed in chemical industry. The details of thermal energy use in the cluster are provided in table 5.1.1.

**Table 5.1.1: Details of fuels used for thermal energy requierments**

| Energy type | Source | Calorific value | Landed cost |
|---|---|---|---|
| HSD | Retail | 10800 | 80 rs. per liter |
| Briqutte | Local market | 4380 | 4200 rs. per tonne |
| FO/LSHS/LDO | Local distributor | 10000 | 55 rs. Per liter |

### 5.1.2 Electricity

Electricity is used in electric motors to operate utilities such as agitator systems of reaction vessels, centrifuge, various pumps, chilling plants, and air compressors. Most of the micro category chemical units use LT connection, whereas the small and medium category units use HT connection. Electricity is supplied by MSEDCL. The applicable tariff of various such categories is given in table 5.1.2.

**Table 5.1.2: Electricity tariff plans in Thane chemical cluster**

| Category | Contract demand | Demand Charges | Energy Charges |
|---|---|---|---|
| MSEDCL | 20 KW | Rs 303 per kW per month | 611 Paise per Unit |
| | 20 KW and Above | Rs 411 per kW per month | 702 Paise per Unit |

## 5.2 Energy consumption pattern

The energy consumption pattern of the chemical units varies based on product type, technology employed and production capacities. The unit level energy consumption of typical production capacities and cumulative cluster level energy consumption of the Thane chemical industries are summarised below.

### 5.2.1 Unit level

The energy consumption of typical chemical units in Thane chemical cluster varies from 150.2 to 190.6 tonnes of oil equivalent (toe) per year (Table 5.2.1) based on the type of industries. Thermal energy accounts for 73% of total energy consumption, with LDO (Light Diesel Oil) as one of the main fuel.

**Table5.2.1: Unit level energy consumption**

| Category | Thermal energy (toe/year) | Electricity (toe/year) | Total energy consumption (toe/year) |
|---|---|---|---|
| **API/Pharmaceuticals** | 112.4 | 78.1 | 190.6 |
| **Other Chemicals** | 128.6 | 21.6 | 150.2 |

### 5.2.2 Cluster level

The cumulative annual energy consumption of Thane chemical cluster is estimated to be 36,590 toe (Table 5.2.2). Biomass accounts for maximum share in the total energy consumption (34%) followed by electricity (23%) and Natural gas (19%) as shown in figure 5.2.2.

**Table 5.2.2: Cluster level energy consumption**

| Fuel type | Unit | Annual Consumption | Annual Consumption (toe/year) |
|---|---|---|---|
| Natural gas | Million SCM/year | 8 | 7,012 |
| Biomass | Tonnes/year | 33,048 | 12,314 |
| LDO/FO/HSD | kL/year | 10081 | 8,889 |
| Electricity | Million kWh/year | 97.4 | 8,375 |
| Total | | | **36,590** |

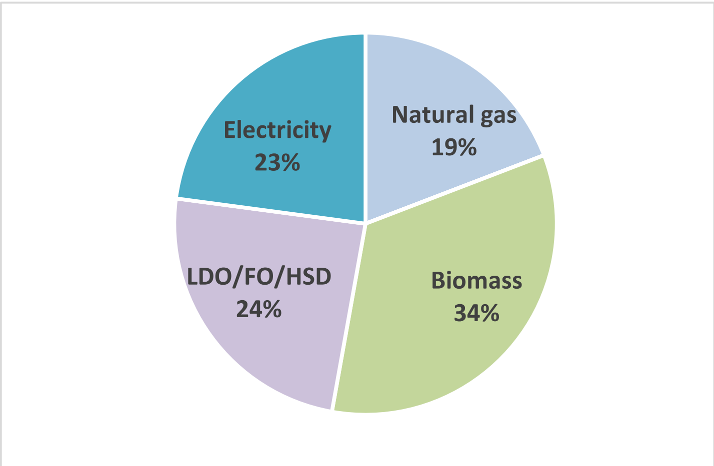


**Figure 5.5.2: Share of energy on Thane cluster**

## 5.3 Other resources

Thane Cluster is not using any other resources for processing.

## 5.4 Energy conservation opportunities

The chemical units in Thane cluster mostly use locally fabricated technologies, especially for thermal and process equipment. These technologies/equipment are invariable energy in-efficient and polluting. The electrical motors are rewound multiple times that leads to inefficiencies in many of the motor driven systems. Accordingly, the chemical units in the cluster offer significant scope for energy saving. A list of different energy conservation measures applicable for Thane chemical units is provided in table 5.4.

**Table 5.4: Major energy conservation opportunities in cluster**

| Equipment/section/utility | Energy conservation measures |
|---|---|
| Steam generation and distribution system | – Optimisation of air-to-fuel ratio<br>– Improvement in insulation<br>– Condensate recovery<br>– Waste heat recovery |
| Thermic fluid heater | – Optimisation of air-to-fuel ratio<br>– Automation with VFD and temperature control mechanism. |
| Technology Retrofit | – Fuel switchover from LDO to PNG firing system in TFH. |
| Compressed air system | – Upgrade in existing technology (reciprocating to screw/PMSM air compressors)<br>– Leakage reduction/seamless distribution network<br>– Improvement in operating practices |
| Reaction vessels and process | – Replacement of belt driven horizontal agitator with direct drive vertical agitator<br>– Two-way valve with temperature control mechanism for heating and cooling process<br>– Improvement in insulation system in vessels using jacket heating/cooling<br>– Installation of electrical chiller machine to eliminate the use of ice-based chilling system<br>– Application of VFD in centrifuge and ball mills |
| Electrical distribution system | – Improvement of billing power factor<br>– Load management<br>– Optimize voltage level by adjusting transformer tapping |
| Other areas | – Replacement of rewound, old inefficient electrical motors with IE3 efficiency class motors<br>– Improvement in pumping system<br>– Use of energy-efficient LED lighting |

Chapter 6

# 6.0 Major challenges in the cluster

The cumulative energy consumption of Thane chemical cluster is quite significant. The analysis of energy consumption by various sub-processes indicate the use of inefficient technologies and equipment by the cluster units. There exists a significant scope for energy saving in the cluster. However, the cluster needs to address a number of challenges for large scale adoption of energy and resource conservation measures. Some of the major challenges relates to technology, finance, skillset, policies and infrastructure, etc. are mentioned in the table 6.0.

**Table 6.0: Key challenges in Thane cluster**

| Key challenge | Specific challenge | Impact |
|---|---|---|
| Technical | Lack of awareness on efficient technology options<br>MSME is not the priority sector for technology providers<br>Limited knowledge of entrepreneurs and focus on low hanging fruits | • Use of outdated technologies<br>• Higher capital costs for efficient technologies<br>• Longer period for adoption of energy efficient technologies<br>• Reluctance of entrepreneurs on technology upgradation<br>• Apprehension in loss of production |
| Financial | Higher transaction costs for financing low value loans by banks<br>Mandatory collateral requirements for financing and low credit rating of MSMEs<br>Lack of updation to banks on EE technologies/ equipment | • MSMEs are not able to reap the benefits from technology promotion schemes of banks<br>• Lack of technology adoption on a wide scale among MSMEs<br>• Poor disbursement of loans on EE projects by banks<br>• Low prospects for large scale adoption of new and modern technologies at cluster level |
| Skillsets | Non-availability of sub-sector specific training institutes at cluster level for skillset improvements<br>Lack of in-house technical capabilities | • Variations in production, productivity, energy performance and quality<br>• Apprehension towards development of new processes and products<br>• Investment by individual units on development of skilled manpower<br>• Lack of in-house innovation on EE projects<br>• Less exposure on new and EE equipment leading to inefficient operation |
| Policies | Non-existence/ availability of sector-specific programs or schemes | • Limited implementation by MSMEs due to high investment required for up gradation of process equipment in targeted sector<br>• |

| Key challenge | Specific challenge | Impact |
|---|---|---|
| Infrastructure & others | Non-availability of cleaner fuels at cluster level e.g. PNG, piped LPG, etc. | • Inefficient use of energy hence high impact on environment<br>• High risk involved in storing gaseous fuel, uncertain landed cost, interruption in operations |
| | Fragmented and geographically dispersed nature of units | • Difficulties in accessing common infrastructure facilities e.g. cleaner fuels (piped natural gas), common facility centers, etc. |

# Chapter 7

## 7.0 SWOT Analysis

The chemical industries in Thane face a number of challenges pertaining to regulations on production capacities and exports that can affect the adoption of energy efficiency measures by the cluster units. Over the past five years, there has not been any capacity expansion in the chemical units of the cluster. The MSME units also face challenges due to the increasing cost of energy and raw materials, resulting in increased level of imports in the domestic market. Thane chemical cluster has many regional advantages that help the cluster remain at the forefront of the Indian chemical industry. There is a need for the chemical units to become efficient and maintain a better profit margin which would require adoption of energy efficient technologies in their processes and auxiliaries. A SWOT (Strength, Weakness, Opportunities, and Threats) analysis of the chemical manufacturing units in the Thane cluster was performed to understand the cluster situation. The SWOT analysis of the Thane chemical cluster is given in table 7.0.

**Table 7.0: SWOT Analysis**

| Strength | Weaknesses |
|---|---|
| • Large number of self-reliant & independent chemical units in Maharashtra<br>• Active industry associations<br>• Adequate supply of energy sources like natural gas, electricity, etc.<br>• Locally available raw materials<br>• Locally available technology suppliers and fabricators<br>• Huge domestic and international market<br>• Common effluent treatment plant<br>• Entrepreneurship zeal in local community | • Polluting nature of chemical industries leading to closure of several units<br>• Limited scope for expansion in the cluster<br>• Escalating raw material prices<br>• Acute shortage of skilled manpower<br>• Use of conventional technologies leading to inefficient production processes<br>• Short product life cycle |
| **Opportunities** | **Threats** |
| • Significant potential for energy saving<br>• Potential for automation of processes<br>• Strong domestic and export market<br>• Inclusion in the Delhi–Mumbai Industrial Corridor (DMIC) zone<br>• Product customization and demand for new and alternative products<br>• Use of clean fuel | • Refusal of expansion plans by MPCB due to environmental compliance levels<br>• Competition due to low cost imported products/material<br>• Soaring prices of natural gas<br>• Shortage of manpower<br>• Recent entry of substitute products in the market |

# Chapter 8

## 8.0 Conclusions

Thane chemical cluster with more than 325 units is an important industry cluster under MSME sector in the country. The chemical units producing dyes, dye intermediates and pigments use both thermal energy and electricity to meet their energy demands. The analysis of Thane chemical cluster shows that thermal energy account for a major share of energy consumption. The energy intensities of these units are also quite high as compared to large units, which may be attributed to the use of inefficient technologies and equipment in both process and utilities. This also results in increased energy costs. Further, limitations such as restrictions on capacity expansions, and environmental related issues have led to the availability of alternate import products and has reduced the market space for local industries.

Optimum use of energy and resource conservation emerge as appropriate solutions for Thane chemical cluster to achieve competitive manufacturing costs through adoption of new and energy efficient (EE) technologies in processes and utilities. However, to ensure large scale adoption, the cluster has to address a number of barriers which includes non-availability of energy efficient technologies, weak linkages with EE technology suppliers, lack of manpower and skillsets, etc.

The technical assistance with the support of the project would help the chemical industries in Thane cluster to (i) identify potential process/ utility areas for energy saving, appropriate EE technologies, energy saving potential through detailed energy audits of cluster units (ii) adopt EE technologies through increased awareness and by strengthening linkages with EE technology providers.

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