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# Cluster Profile Report

## JamshedpurChemical 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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| | |
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| ASIA | Adityapur Small Industries Association |
| BEE | Bureau of Energy Efficiency |
| CLCSS | Credit Linked Capital Subsidy Scheme |
| CSIR | Council of Scientific and Industrial Research |
| DIC | District Industries Centre |
| EE | Energy Efficiency |
| ETP | Effluent Treatment Plant |
| FI | Financial Institutions |
| FD | Forced Draft |
| GEF | Global Environment Facility |
| GVA | Gross Value Added |
| HDFC | Housing Development Finance Corporation |
| HSD | High Speed Diesel |
| IBR | Indian Boilers Regulations |
| ICICI | Industrial Credit and Investment Corporation of India |
| ID | Induced Draft |
| IDBI | Industrial Development Bank of India |
| ITI | Industrial Training Institutes |
| JBVNL | Jharkhand Bijli Vitran Nigam Limited |
| JREDA | Jharkhand Renewable Energy Development Agency |
| JSIA | Jharkhand Small Industries Association |
| JUSCO | Jamshedpur Utility Services Company Limited |
| KPI | Key Performance Indicators |
| MSME | Micro Small and Medium Enterprise |
| MSME-DI | MSME- Development Institute |
| NIC | National Industries Classification |
| SAPCC | State Action Plan on Climate Change |
| SCCI | Singhbhum Chamber of Commerce & Industry |
| SWOT | Strength, Weakness, Opportunities, and Threats |
| TERI | The Energy and Resources Institute |
| TFH | Thermic Fluid Heater |
| TSUIS | Tata Steel Utilities and Infrastructure Services Limited |
| UNDP | United Nations Development Programme |

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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 Adityapur Small Industries Association (ASIA), Singhbhum Chamber of Commerce & Industry (SCCI), and Laghu Udyog Bharti Jamshedpur 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 Mr S.N. Thakur President ASIA, Mr Santosh Khetan Vice president ASIA, Shri Ashok Bhalotia President (SCCI), Nitesh Dhoot Vice president (SCCI), Mr Hansraj Jain President Laghu Udyog Bharti.

Last, but not the least, interactions and deliberations with MSME-DI, Jharkhand Renewable Energy Development Agency (JREDA), 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.

**Table1.3: 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).

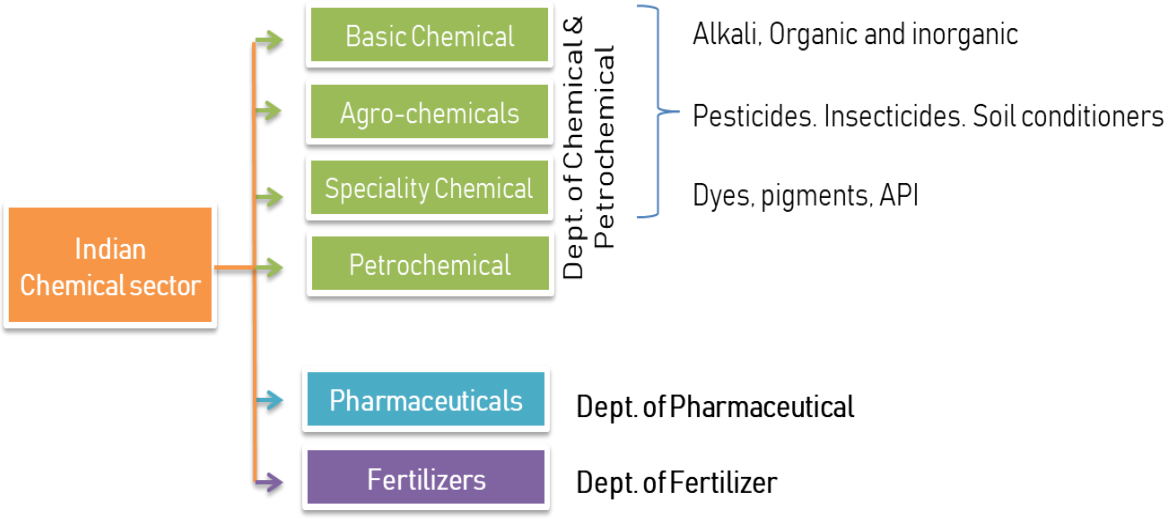



**Figure 2.1: Classification of Indian chemical clusters**

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.

[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 Jamshedpur Chemical cluster

Jamshedpur chemical cluster is one of the important chemical clusters in Jharkhand. The Jamshedpur chemical cluster comprises 80 MSME units of which about 72 are in operation. All these chemical manufacturing units are located in Adityapur, Gamharia, Sonari, Sidhgora, Mango, Baridih, Sakchi and Bistupur industrial areas. Most of these manufacturing units are operational for the last 20 years. Some of the leading large scale industries like Hi-Tech Chemicals, Promis industries, Jharkhand Grindchem Pvt. Ltd. are also located in Jamshedpur.

The other industries under micro, small and artisan categories include engineering & fabrication, mineral, leather, paper products, rubber goods, etc. The major cluster in this region is auto components cluster which has more than 600 units.

### 2.2.1 Classification of Chemical units

The chemical units in Jamshedpur cluster can be classified either on the basis of the type of products or production capacities. The total production of the cluster is estimated to be 99,950 tonne per annum. There are about 20% industries in the cluster that have production capacity less than 200 tonnes per annum while 40% of the industries fall under the range of 200 -1000 tonnes per annum and more than 1000 tonnes per annum. The classification of industries according to the production capacity is shown in Figure 2.2.1.

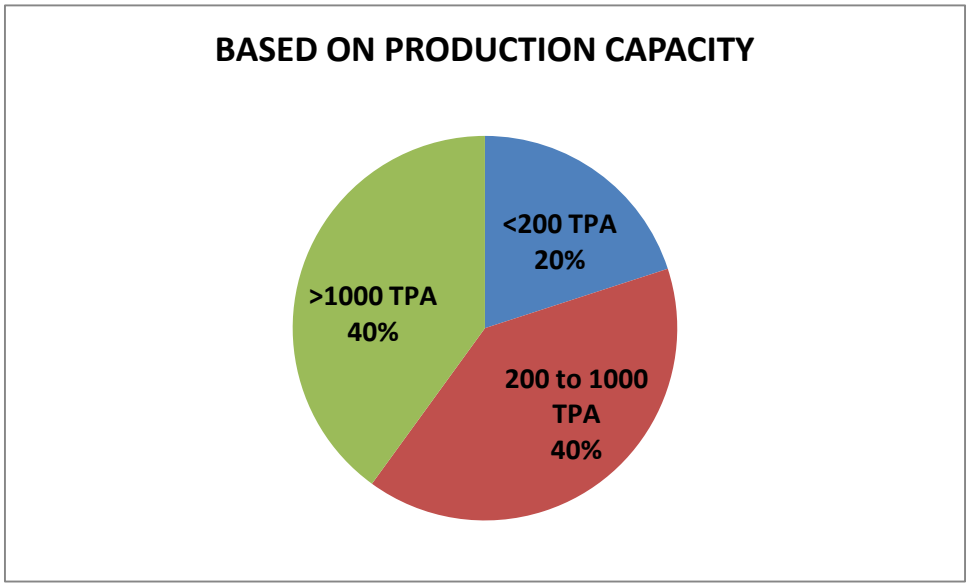



**Figure 2.2.1: Capacity wise production chart**

### 2.2.2 Major products

The chemical industries in Jamshedpur cluster manufacture a diverse range of products like pharmaceuticals, pigments, pesticides/ insecticides, agrochemicals, paints, etc. 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 Jamshedpur cluster**

| Category | Products |
|---|---|
| Paint and resin | Cement paints, thinner, varnish, |
| Inorganic chemicals | Sulphuric acid, sodium hypochlorite, hydrochloric acid, bleaching powder, dry and liquid alum |

### 2.2.3 Market scenario

The various products produced in the chemical units of Jamshedpur are majorly consumed within the country. Tata steel is a major consumer of various types of inorganic chemicals produced within the cluster. In organic chemicals, sulphuric acid is used as battery acid. Sodium Hypochlorite is used for surface purification, water disinfectants, bleaching, odour removal etc. Most of the units located in Jamshedpur are producing various types of paints. Most of the micro units located in Jamshedpur cluster sell their produce to the local distributors or the local industries located in Jamshedpur itself.

### 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 raw material used in paint industry is colour pigment, binders, solvent and resin. Cement paint making industries use the raw material such as hydrated lime, dolomite powder andcalcium chloride. Inorganic chemicals (like bleaching powder, alum, sodium hypochlorite) requires the raw material such as limestone, chlorine, sulphuric acid, caustic soda, alumina hydrate, bauxite etc. Some units, under other chemicals category, producing rubber oil or rubber require natural rubber or old tyres for its production.

### 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 |
|---|---|---|---|
| Jharkhand Small Industries Association (JSIA) | Innovation Facilitation Cell | Introducing enterprises to Innovative practices & helping them to develop system of Innovation by bringing together Industry and Academia (academic, R&D institutes; technical experts etc) | Operational |
| Adityapur Small Industries Association (ASIA) | Common Effluent Treatment Plant | Developed by the ASIA | Operational |
| MSME–DI, Ranchi | Credit Linked Capital Subsidy Scheme | • Encourage MSMEs in adopting energy efficient technologies<br>• Encourage to improve product quality | Operational |

| Organisation | Programme/ initiatives | Brief description | Status |
|---|---|---|---|
| | (CLCSS) | of manufacturing in MSMEs<br>• Facilitate technology up-gradation in MSEs by providing an up-front capital subsidy of 15 % (on institutional finance of up to INR 1 crore) for induction of well-established and improved technology in the specified 51 sub-sectors/products approved<br>• Upgrade the MSME plant & machinery with state-of-the-art technology, with or without expansion and also for new MSEs which have set up their facilities with appropriate eligible and proven technology duly approved under scheme guidelines. | |
| UNDP (United Nations Development Programme) | State Level Climate Change Action Plans | UNDP in partnership with MoEFCC and with support from Global Environment Facility (GEF) is implementing a project on "Market Transformation and Removal of Barriers for Effective Implementation of the State Level Climate Change Action Plans" with an overall goal to reduce GHG emissions achieved through the implementation of Renewable Energy and Energy Efficiency solutions at the state level as identified in the State Action Plan on Climate Change (SAPCCs) of Jharkhand | Operational |

# 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 Jamshedpur chemical industry cluster along with their roles and activities are briefed below.

## 3.1 Industries associations

There is major industry associations active in Jamshedpur chemical cluster. The contact details of the industries associations are given in table 3.1.

**Table 3.1: Details of Industries associations**

| Name of organisation | Contact detail |
|---|---|
| Singhbhum Chamber of Commerce & Industry (SCCI), Jamshedpur | Chamber Bhawan, Bistupur, Jamshedpur- 831001 Jharkhand, India<br>Email: scci1950@gmail.com<br>Contact person: Shri Ashok Bhalotia (President), Nitesh Dhoot (Vice President)<br>Contact no: 9431111981, 9431117719 |
| Laghu Udyog Bharti, Jamshedpur | 407, Fourth floor, Ashiana Trade Center, Adityapur, Jamshedpur<br>Contact Person: Sh. Hansraj Jain (President)<br>Contact no: 9431704941 |
| Adityapur Small Industries Association (ASIA), Jamshedpur | M-5, 7th, Phase Asia Bhavan, Adityapur Industrial Area, Tata Kandra Road, Jamshedpur, 831001<br>Contact Person: Shri S.N. Thakur (President), Mr Santosh Khetan (Vice President)<br>Contact no: 9234603805, 9334817741 |
| Jharkhand Small Industries Association | Udyog Bhavan, Industrial Area, Kokar, Ranchi – 834001<br>Email: jsiaranchi2009@gmail.com<br>Contact person: Mr. Philip Mathew (President) |
| Singhbhum Chamber of Commerce & Industry (SCCI), Jamshedpur | Chamber Bhawan, Bistupur, Jamshedpur- 831001, Jharkhand, India<br>Email: scci1950@gmail.com<br>Contact person: Shri Ashok Bhalotia (President), Nitesh Dhoot (Vice president)<br>Contact no: 9431111981, 9431117719 |

## 3.2 Government bodies

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

**Table 3.2: Goverment bodies and key responsibilities**

| Name of organisation | Key roles |
|---|---|
| Micro, Small & Medium Enterprises Development Institute (MSME-DI), Ranchi | Development of Micro, Small & Medium Enterprises sector of state of Jharkhand through counselling, consultancy, training, different awareness programme, market promoting programme among MSMEs |
| District Industries Centre (DIC), Jamshedpur | • To promote Small, Medium and Large scale Industries in the State.<br>• Regulate the growth of Industries in the state.<br>• Generate employment and self employment.<br>• Contribute for the growth of GDP in the state economy. |
| Jharkhand Renewable Energy Development Agency | An autonomous body under the Societies Registration Act 21, 1860 registered on 19th February 2001 for the development and deployment of New and Renewable Energy resources for supplementing the energy requirements of the state and to generate public awareness in facilitating deployment of new and renewable energy systems |

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

Both public and private academic and technical institutions, testing laboratories are available in Jamshedpur and in the surrounding areas of the city. Some of the major engineering and polytechnic institutes like National Institute of Technology Jamshedpur, RVS College of Engineering and Technology, BA College of Engineering and Technology offer a variety of courses in chemical engineering and chemical sciences relevant for the cluster. CSIR- National Metallurgical Laboratory, Jamshedpur is one of the most prestigious research Laboratories nationwide. These organizations provide technical workforce to the cluster and also aid in innovation through research and development. A number of Industrial Training Institutes (ITIs) in Jamshedpur like Rabiya Industrial Training Institute, Specon Technical Training Institute, Gulf Training Institute etc. offer industrial training courses like chemical plant operators, laboratory attendants, chemists, process attendants, and ETP operators etc.

## 3.4 Financial institutions

There are about 33 nationalized, commercial, and cooperative banks operating in the cluster. Some of the important banks in the cluster include Bank of India, Canara Bank, Central Bank of India, State Bank of India, Axis Bank, Allahabad Bank, IDBI Bank, Punjab National Bank, ICICI Bank, HDFC Bank, Small Industries Development Bank of India and Dena Bank. The State bank of India is serving the Chemical industries of Jamshedpur and is ensuring credit flow to MSMEs and addresses both financial and developmental gaps in the MSME eco-system. Most of these banks provide financial assistance towards expansion and infrastructural upgradation 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

The manufacturing process of the chemical industries varies widely depending on the type of products. The generic production of chemicals involves dissolving of raw materials, mixing, drying and classification. A brief description of various processes followed in a typical chemical manufacturing unit is provided in this section and the same is represented in Figure 4.1.

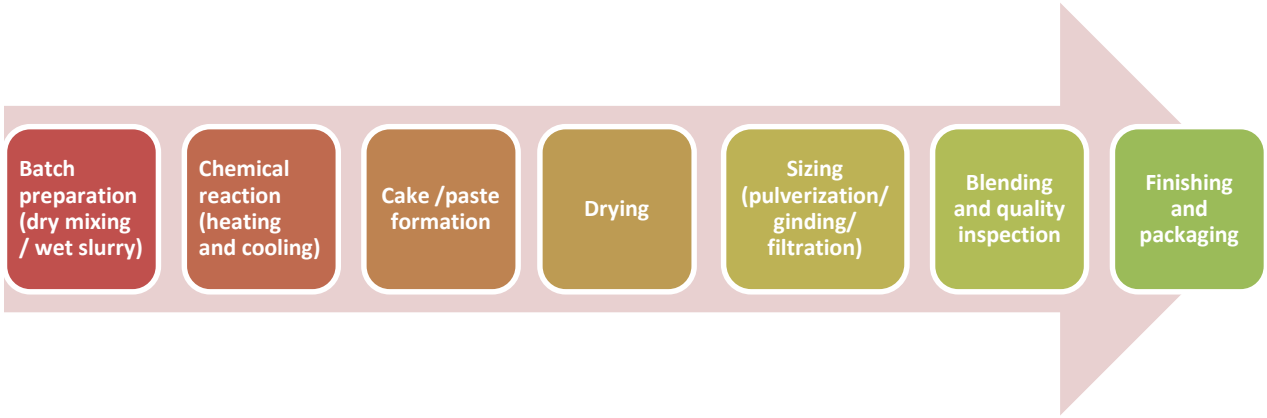



**Figure 4.1: Process flow in a typical chemical manufacturing unit**

### 4.1.1 Batch Preparation

The raw materials in the desired proportion by weights are poured into reaction vessel. The mixture is continuously stirred; as per the specific requirement of the product, the temperature is maintained using jacket heating/ cooling arrangement. The overall processing time in the reaction vessel depends on the desired output in terms of temperature or intermediate product concentration. The process uses both thermal energy and electricity. The thermal energy requirement is met through a boiler or thermic fluid heater (TFH).

### 4.1.2 Primary Filtration

After mixing, the intermediate products i.e. liquid and/or suspended solid particles are separated from the slurry. The filtration is carried out using centrifuge or filter press. This process takes about 1–2 hours for completion.

### 4.1.3 Purification

Purification helps in improving or modifying the basic properties of the intermediate product as per the requirement of final product. For example, to neutralise the alkaline natured intermediate product, sulphuric acid is added in the intermediate product and the desired temperature is maintained using jacket cooling/ heating. The product is continuously stirred using an agitator system.

### 4.1.4 Secondary filtration

In secondary filtration process, the intermediate product is separated from the slurry using a centrifuge or filter press. The secondary filtration process takes about 1-2 hours for completion.

### 4.1.5 Drying

The drying process is generally applicable for organic chemical products in which the final product is of powder form. The cakes from filtration process are loaded into tray/ spin flash dryers for removal of moisture and drying using hot air. Drying is thermal energy intensive and most time-consuming process and takes about 20–36 hours per batch. The hot air is supplied by natural gas or wood-fired hot air generator.

### 4.1.6 Grinding/crushing (Pulverization)

The granules/ blocks of dried products are crushed or ground in a pulverizer, as per the desired particle size of the final product. The process takes about 3–5 hours per batch.

## 4.2 Major technologies and equipment

A variety of chemical products like paints, acid, bleaching powder, pigments, rubber oil are manufactured in Jamshedpur cluster. However, the technology use and type of process equipment used in manufacturing of these chemicals are different. The major technologies and equipment used in process areas and utility sections are provided in table 4.2.

**Table4.2: Major technolgies/equipment used in chemical industries**

| | |
|---|---|
| Manufacturing process | ▪ Reaction vessels<br>▪ Mixer drum<br>▪ Ball Mill |
| Auxiliaries/utilities | ▪ Pumps<br>▪ Steam boilers<br>▪ Blowers<br>▪ Air compressors |

### 4.2.1 Details of process equipment

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

#### 4.2.1.1 Mixer Drum

The mixer drum carries grinding stones inside, which help to break down the coagulation of raw materials while the drum is being rolled/ rotated for mixing. The mixing process is an exothermic reaction and is carried out for 7 to 10 hours to attain adequate homogeneity. The chemical units have different capacities of mixer

drum varying in the range of 100-400 litre . 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 Ball Mill

A ball mill consists of a hollow cylindrical shell rotating about its axis. The axis of the shell may be either horizontal or at a small angle to the horizontal. It is partially filled with balls. The grinding media are the balls, which may be made of steel (chrome steel), stainless steel, ceramic, or rubber. The inner surface of the cylindrical shell is usually lined with an abrasion-resistant material such as manganese steel or rubber lining. Less wear takes place in rubber lined mills. The length of the mill is approximately equal to its diameter.

#### 4.2.1.3 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. The capacities and number of vessels in a chemical unit are dependent on type of manufacturing process, production capacity and batch size.

### 4.2.2 Details of auxiliaries equipment

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

#### 4.2.1.4 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 coal is the major fuel used in boilers to generate the steam. 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.

#### 4.2.1.5 Pumps

The pumps are one of the major energy consuming equipment in chemical industries and the pumps are installed for boiler feed water pumps, process circulation pumps and plant water supply pumps. Majority of the pumps installed are of local make or old and pumps are found to be highly inefficient.

#### 4.2.1.6 Blowers/Fan

The bowers or fan are used for different purposes in the chemical units like exhaust blower, FD fan ID fan etc. The capacity of blowers varies according to its purpose of use and capacity of the system.

#### 4.2.1.7 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.

# Chapter 5

# 5.0 Energy consumption profile and conservation measures

## 5.1 Details of energy use

The chemical industries in Jamshedpur 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 Jamshedpur cluster. The share of energy cost is 5–7% of the manufacturing cost for inorganic chemicals and about 12–15% for paint and chemicals. The level of energy consumption in these units is dependent on the type of products and the process followed. Different types of energy used in the cluster include coal, biomass, 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 requirements**

| Energy type | Source | Calorific value | Landed cost |
|---|---|---|---|
| Coal | Local market | 4,200-4,800 kCal/kg | Rs 6-8 /kg |
| Biomass | Local market | 3200-3,700 kCal/kg | Rs 2.5-3.5 /kg |
| HSD | Retail outlets | 10,580 kCal/kg | Rs 77-80/lit |

### 5.1.2 Electricity

Electricity is used in electric motors to operate equipment such as pumps, blowers, ball mills, drum mixers. Most of the micro category chemical units use LT connection, whereas the small and medium category units use HT connection. Electricity is supplied by Tata Steel Utilities and Infrastructure Services Limited (TSUIS) and Jharkhand Bijli Vitran Nigam Limited (JBVNL). The applicable tariff structure of various such categories is given in Table 5.1.2.

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

| Availability | Tariff Details | |
|---|---|---|
| | Category | Charges |
| Jharkhand Bijli Vitran Nigam Limited (JBVNL) | **LTIS** | Voltage supply: 0.415 kV<br>Fixed charges: Rs 100 per kVA<br>Energy charges: Rs 5.75 per kVAh |
| | **HTS** | Voltage supply: 11 kV<br>Fixed charges: Rs 350 per kVA |

| Availability | Tariff Details | |
|---|---|---|
| | Category | Charges |
| | | Energy charges: Rs 5.50 per kVAh |
| Tata Steel Utilities and Infrastructure Services Limited (TSUIS) [formerly known as Jamshedpur Utility Services Company Limited (JUSCO)] | **LTIS** | **Installation Based**<br>Voltage supply: 0.415 kV<br>Fixed charges: Rs 125 per HP per month<br>Energy charges: Rs 4.05 per kWh<br><br>**Demand Based**<br>Voltage supply: 0.415 kV<br>Fixed charges: Rs 170 per kVA per month<br>Energy charges: Rs 4.05 per kWh |
| | **HTS** | Voltage supply: 11 kV<br>Fixed charges: Rs 195 per kVA per month<br>Energy charges: Rs 5.00 per kVAh |
| | **HTSS** | Voltage supply: 11 kV<br>Fixed charges: Rs 370 per kVA per month<br>Energy charges: Rs 3.75 per kVAh |

## 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 Jamshedpur chemical industries are summarised below.

### 5.2.1 Unit level

The energy consumption of "other chemicals" industries in Jamshedpur cluster widely varies from 0.1 to 110 tonnes of oil equivalent (toe) per year for different range of products. The average energy consumption of the units is given in table 5.2.1. Most of the chemical industries use mainly electricity in production processes. A few units in the cluster use coal and biomass for process heating requirements. HSD is used for backup power generation.

**Table 5.2.1: Unit level energy consumption**

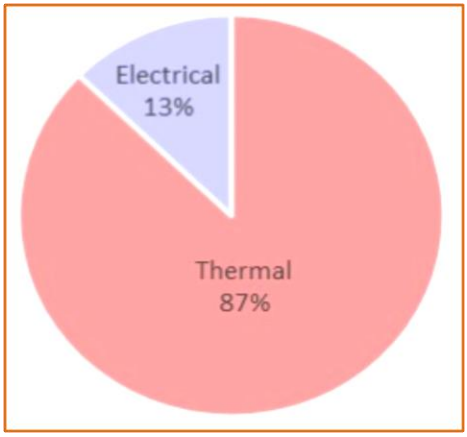
| Category | Thermal energy (toe/year) | Electricity (toe/year) | Total energy consumption (toe/year) |
|---|---|---|---|
| **Other Chemicals** | 53.5 | 6.5 | 60 |

### 5.2.2 Cluster level

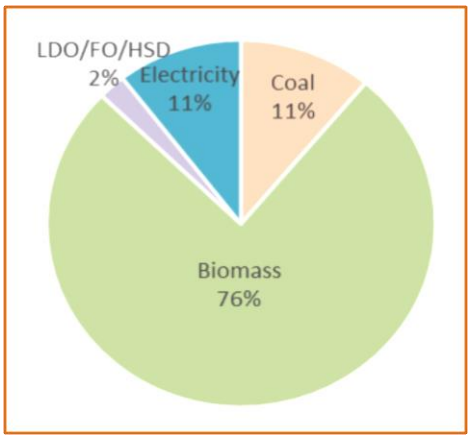
The total energy consumption of the cluster is estimated to be 1,056 tonne of oil equivalent (toe) (Table 5.2.2). Biomass accounts for maximum share in the total energy consumption (76%) followed by electricity and coal (11%) as shown in figure 5.2.2.

**Table 5.2.2: Cluster level energy consumption**

| Energy Source | Annual energy consumption | Equivalent energy consumption (toe/year) |
|---|---|---|
| Coal (tonne per year) | 259 | 117 |
| Biomass (tonne per year) | 2,160 | 805 |
| LDO/FO/HSD (kL per year) | 28 | 24 |
| Electricity (million kWh) | 1.3 | 110 |
| Total | | 1,056 |




Thermal vs electrical energy share




Fuel wise energy share

**Figure 5.2.2: Cluster level energy share**

## 5.3 Other resources

Apart from thermal energy and electricity, the chemical industries in the Jamshedpur cluster consume other resources such as raw water and treated water in the manufacturing process.

## 5.4 Energy conservation opportunities

The chemical units in Jamshedpur 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 Jamshedpur 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 |
| Hot air generator | – Optimisation of air-to-fuel ratio<br>– Improvement in insulation |

| Equipment/section/utility | Energy conservation measures |
|---|---|
| | – Improved hot air distribution and circulation system<br>– PLC based control system for drying |
| 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 |
| Electrical motors | – Replacement of rewound, old inefficient electrical motors with IE3 efficiency class motors |
| Other areas | – Improvement in pumping system<br>– Use of energy-efficient LED lighting<br>– Use of cogged type poly V belt |

# Chapter 6

# 6.0 Major challenges in the cluster

The cumulative energy consumption of Jamshedpur 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 can be broadly grouped into technical, financial, skillsets, policy related and infrastructure. The specific challenges and impacts are depicted in table 6.0.

**Table 6.0: Key challenges in chemical sector**

| Key challenge | Specific challenge | Impact |
|---|---|---|
| Technical | Lack of awareness on efficient technology options | • 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 |
| | MSME is not the priority sector for technology providers | |
| | Limited knowledge of entrepreneurs and focus on low hanging fruits | |
| Financial | Higher transaction costs for financing low value loans by banks | • 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 |
| | Mandatory collateral requirements for financing and low credit rating of MSMEs | |
| | Lack of updation to banks on EE technologies/ equipment | |
| Skillsets | Non-availability of sub-sector specific training institutes at cluster level for skillset improvements | • 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 |
| | Lack of in-house technical capabilities | |
| 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 |

| 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>• Uncertain landed cost, interruption in operation |
| | 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 Jamshedpur 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 few years, there has not been any capacity expansion in the chemical units of the cluster. Most of the industries are over 20 years old so the technology used by them is not upgraded. The MSME units also face challenges due to the higher cost of coal as compared to neighbouring state which results the industries to shut down due to unable to stand in the competitive market. Jamshedpur chemical cluster has many regional advantages like the availability of raw material 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 and increasing the capacity of production by adoption of automation in their processes. A SWOT (Strength, Weakness, Opportunities, and Threats) analysis of the chemical manufacturing units in the Jamshedpur cluster was performed to understand the cluster situation. The SWOT analysis of the Jamshedpur chemical cluster is given below.

**Table 7.0: SWOT Analysis**

| Strength | Weaknesses |
|---|---|
| • Large number of self-reliant & independent chemical units in Jamshedpur<br>• Active industry associations.<br>• Locally available raw materials<br>• Locally available technology suppliers and fabricators<br>• Common effluent treatment plant<br>• Entrepreneurship zeal in local community<br>• High scope for expansion in the cluster | • High cost of coal compared to neighbouring state leading to closure of several units<br>• Polluting nature of chemical industries leading to closure of several units<br>• Escalating raw material prices<br>• Acute shortage of skilled manpower<br>• Inadequate supply of electricity.<br>• Use of conventional technologies leading to inefficient production processes<br>• Short product life cycle |
| **Opportunities** | **Threats** |
| • High energy cost for individual unit<br>• Significant potential for energy saving<br>• Potential for expansion and automation of processes<br>• Huge domestic and international market | • Competition due to low cost imported products/material<br>• Soaring prices of coal<br>• Shortage of skilled manpower<br>• Recent entry of substitute products in the market |

# Chapter 8

# 8.0 Conclusions

Jamshedpur chemical cluster has about 80 units is an important industry cluster under MSME sector in the country. The chemical units of inorganic chemicals, rubber oil, and some chemical allied products use both thermal energy and electricity to meet their energy demands. The analysis of Jamshedpur chemical cluster shows that electrical 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 the higher cost of coal as compared to neighbouring state increases the production cost which results the industries to shut down due to unable to stand in the competitive market.

Optimum use of energy and resource conservation emerge as appropriate solutions for Jamshedpur 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.

In order to stand in the competitive market of China, the units also needs to increase its production capacity with the adoption of automation system. This will enable the units to increase its production and decreasing the per unit production cost.

The technical assistance with the support of the project would help the chemical industries in Jamshedpur 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 (iii) identify the units which has the capacity to increase production by adopting automation.

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