Cluster Profile
Dehradun pharmaceutical industries

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Promoting Energy Efficiency in SMEs
SAMEEEKSHA

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TERI team is indebted to Drug Manufacturing Association (DMA), Dehradun and Industries Association of Uttarakhand (Dehradun Chapter) for providing support and information related to foundry units in Dehradun Pharmaceutical cluster. TERI extends its sincere thanks to Mr Pramod Kalani, President, DMA, Mr A K Chatterjee and unit entrepreneurs for organizing field visits and interactions with MSME units during the study for the preparation of this cluster profile report.

Last but not least, our sincere thanks to MSME entrepreneurs and other key stakeholders in the cluster for providing valuable data and inputs that helped in cluster analysis.

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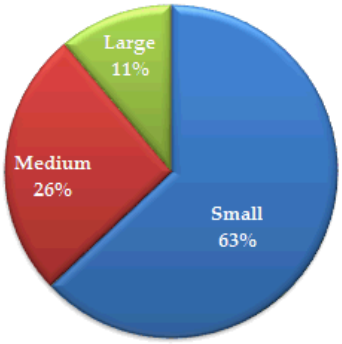
Dehradun pharmaceutical industries

Overview of cluster

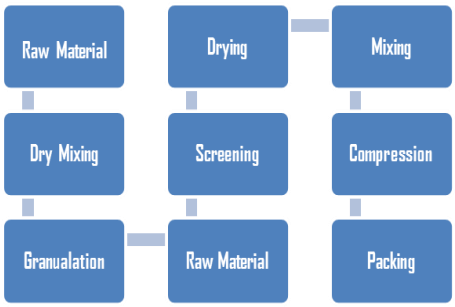
Dehradun is capital city of the state of Uttarakhand in Northern India. The pharmaceutical cluster is located at about 25 kilometers from Dehradun known as "Pharma City" in Selaqui industrial area. The industrial is area is spread in about 50 acres of land. The pharmaceutical industries were set up during 2003-04 when a policy stimulus package including new industrial policy and other concessions were announced for the state of Uttarakhand, Himachal Pradesh and Jammu & Kashmir to encourage the setting up of industry in these states and help in creating jobs. The main highlight of the package was 100% excise benefits for the first ten years and income tax benefit for 5 years from the date of establishment. The units in the cluster are mainly engaged in production of allopathic formulation in various dosage forms such as tablets, capsules and liquid orals. About 52 pharmaceutical units are situated in the cluster of which more than 30 units belong to small scale category. About 5 cluster units come under large scale.



Classification of industries in cluster

Product types and production

The major product of the cluster is allopathic formulation in various dosage forms such as tablets, capsules, liquid orals, ointments and injectable. The cluster falls within the Doon valley region, as such the production of bulk drug is restricted by the state environment protection and pollution control board. The tablets are produced by direct compression, dry granulation and wet granulation process. The typical flow diagram for granulation process is shown in figure.



Granulation process

A large number of units in the cluster are engaged in the export of the products. The units have obtained necessary certifications to meet the export requirements (table).

Certification obtained by cluster units

Type of certification	Number of units
WHO - GMP (Goods manufacturing practices)	32
US – Food and drug administration	01
UK – Medicines and healthcare products regulatory agency	01

Majority of the units in the cluster procure "Active Pharmaceutical Ingredients" (API) and carry out job work for larger pharmaceutical industries. The typical production of different products at cluster level is shown below.

Typical annual production by cluster unit

Product type	Annual production (million)
Tablet	379.1
Capsule	106.1
Sachet	11.5

Energy scenario in the cluster

The cluster uses HSD/LDO, LPG and electricity from grid for its energy use. The costs of different energy types used in the cluster are shown below.

Prices of major energy sources

Type	Price
HSD/LDO	Rs 52 per litre
LPG	Rs 65 per litre
Electricity	Average energy charge : Rs 6.5 per kWh

Technologies employed

The conversion of APIs into final drugs involves following key equipment and system.

(i) Boiler

Boiler is used for generation of steam and hot water for process requirements. Coil type vertical baby boilers are used in the cluster. Steam is generated at a pressure of about 8-10 kg/cm^2(g). The average capacity of boilers used in pharma units of cluster is 1 tonne per hour (tph). The boilers are generally LPG or LDO fired. Majority of the boilers do not have air to fuel ratio controller or burner system to maintain the optimum combustion. A forced draught fan is used for supply of combustion air and oil pump is used to provide fuel in case of LDO fired boilers. The average operating hours of boiler is estimated to be 8–12 hours per day.

Apart from pressure gauge and water level controller, the boiler system have not been equiped with any instrumentation for monitoring and control of operating parameters. The units also do not collect condensate, which is generally drained out. Steam is used mainly for drying purposes in formulation and is used in coils to provide indirect heating in fluidised bed dryers and tray dryers.

Fluidised bed dryer

(ii) Fluidised bed dryer

Fluidized bed dryer (FBD) is widely used equipment in pharmaceutical manufacturing. It is used in granulation process for drying of material to get desired moisture content in tablet

formulation granules. The installed capacities of FBDs is 50–250 kg per batch. Some of the units have provided the temperature based steam flow controller to maintain the temperature of hot circulation air for material drying. However, most of the units manually control steam flow for temperature control. The hot condensate generated from FBD heating coils is not being recovered but drained out. Apart from steam, FBDs use compressed air and electricity.

(iii) HVAC system

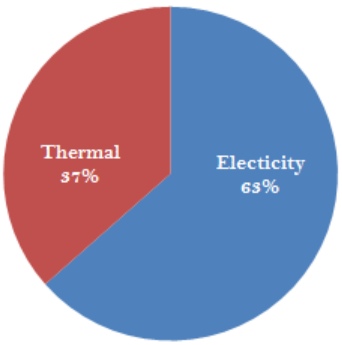
The heating ventilation and air conditioning system installed in final drug manufacturing units are mainly used to maintain the temperature and humidity level of the process areas. The units have generaly installed the centralized chiller system (capacities of 20–75 TR) and air handling units to maintain space conditioning. Few large units have installed direct type air conditioning system (air handing unit with inbuilt compressor unit). Effective control of chilled water circulation and maintenance of space conditioning profile are absent with existing HVAC systems.

(iv)Air compressors

Compressed air is mainly used to operate the pneumatic system of the manufacturing/ process machinery like fluidised bed dryers and formulation system. It is also used in the bag filters associated with the dryers. The connected load of air compressors ranges from a 5 kW (single air compressor) for a small size unit to 50 kW (2-3 air compressors) for a medium size unit. Rotary screw compressors are commonly used by the units; however, no "Variable Speed Drive" (VSD) has beeen installed with air compressor system to manage fluctuating demands. A limited number of units have also installed reciprocating type air compressors in the cluster.

Energy consumption

The major energy forms used by pharmaceutical units in Dehradun Pharma cluster include electricity, LPG and HSD/LDO. Electricity from grid is used for different motive loads in the processing sections, chillers and air compressors. Thermal energy in the form of steam/ hot water is used for formulation process and drying. HSD/LDO and LPG is primarily used as the fuel in boiler for generating steam. Apart from steam generation, HSD is also used in the DG sets to cater the necessary power requirements during grid staggering.



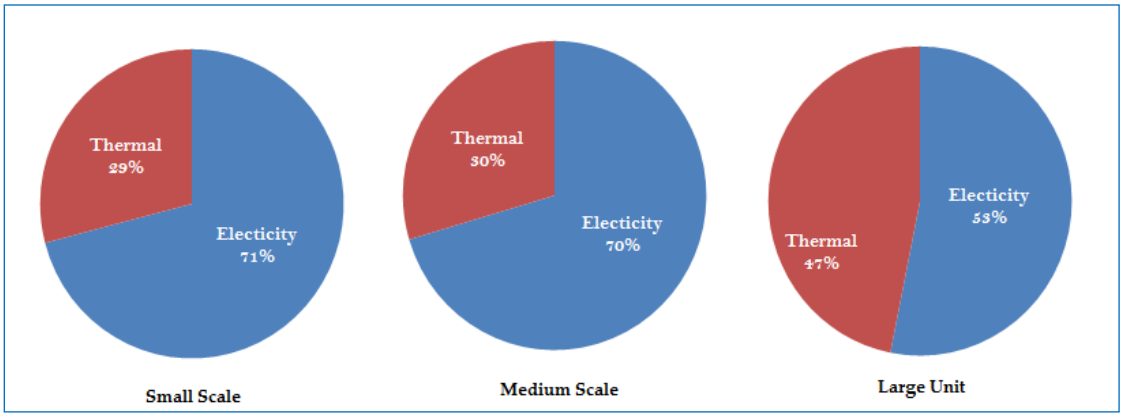
Share of energy consumption

(i) Unit level consumption

The typical energy consumption and share of thermal and electrical energy for different capacities of pharma units are shown in table.

Unit level energy consumption

Unit size	Electricity (kWh)	HSD (Litre)	LPG (kg)	Equivalent energy (toe)
Micro	5,90,712	15,500	6,497	72
Small	13,62,720	42,000	11,571	167
Medium	34,06,800	76,364	1,63,636	552



Energy consumption of pharma units

(ii) Cluster level consumption

The energy consumption pattern shows a majority share (63%) is accounted by electricity. The average specific energy consumption (SEC) at cluster level is estimated to be 16.2 toe per million pieces final drug (tablet, capsule and sachet).

Energy consumption of Dehradun pharma cluster (2015)

Energy type	Annual consumption	Equivalent energy (toe)	Annual energy bill (million INR)
Electricity	59.6 million kWh	5,126	387.4
HSD/LDO	1,573 kL	1,332	81.8
LPG	1365 tonne	1,616	88.7
	Total	8,074	557.9

* *Annual average landed cost of HSD/LDO and LPG is considered*

Energy saving opportunities and potential

The energy consumption level and technologies used in Dehradun pharmaceutical units indicates significant scope for energy efficiency improvements which are discussed below.

(i) Combustion optimization/ burners in boiler

The boilers in pharmaceitucal units are not provided with combustion control system for maintaining optimum air to fuel ratio. The sequential firing control mechanism is also not provided in some of the steam boilers. Installation of two stage/ modulating type burner will help in reducing flue gas as well as unwanted operation of boiler auxiliaries during non-firing time.

(ii) Condensate recovery system

Heat exchangers are used to transfer heat from steam in the drug manufacturing process. The condensate released after heat exchanger is routed to effluent treatment plant in most of the units. The temperature of condensate drained out is quite high in the range of 85–95 ^{0}C equivalent to 15-20% of heat input to boilers and can be reused. Pressure powered pumps and condensate heat recovery systems may be installed in steam distribution system to extract and reuse condensate.

(iii) Automation of chilled water system and associated AHUs

One of the key elements in a multi-product facility is cleanroom design and associated HVAC system. The major energy consuming is in any final drug manufacturing unit is space conditioning. Non-availability of monitoring and control system will not lead to increased production costs but also affects the process. The automation system requires the ability to monitor and control the set points as per design parameters. The automation system must be capable of indicating and recording alerts and alarms for critical parameters such as temperature, humidity or pressurization with respect to design specifications.

(iv) Replacement of old and efficient air compressors

The compressors used by pharmaceutical units are generally old and inefficient. Most of the units have installed reciprocating type air compressor with loading and unloading mechanism based control. Installation of new energy efficient screw type air compressor in place of reciprocating air compressors will help in reducing SEC of compressed air system as well as avoiding electricity losses during unload conditions with the help of inbuilt variable speed drives.

(v) Installation of VFD/VSD in air compressors

The air compressors in drug manufacturing process are designed to cater the full load requirements. During the normal course of operation, plants operate at 50-60% of installed capacities. During normal operation, air compressor operates on unloading position for more than half the time. Reciprocating type air compressors can be replaced with VFD (Variale Frequency Drives) enabled screw compressors. Installation of "Variable Frequency Drive" (VFD) to air compressors will minimise unloding power consumption.

(vi) Others

A significant reduction in energy losses is possible in areas such as steam distribution including insulation. On electrical side, pumping of (chilled water and cooling water) water and drives constitute important energy consuming areas which have potential for EE improvements. Use of energy efficint LED lighting may also help to reduce energy costs.

Major stakeholders

The major stakeholders include district level and state level industry associations, State Industrial Development Corporation and development bodies of MSMEs. The major stakeholders in the cluster are as follows.

- Drug Manufacturers Association
- Industries Association of Dehradun
- State Industrial Development Corporation of Uttarakhand
- MSME-Development Institute, (DI) Haldwani

Cluster development activities

There are no major cluster development activities in the cluster.

About TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI (The Energy and Resources Institute) is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to tackling issues of global climate change across many continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local and national level strategies to suggesting global solutions to critical energy and environmental issues. The Industrial Energy Efficiency Division of TERI works closely with both large industries and energy intensive Micro Small and Medium Enterprises (MSMEs) to improve their energy and environmental performance.

About SDC

Schweizerische Eidgenossenschaft
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Swiss Agency for Development and Cooperation SDC

SDC (Swiss Agency for Development and Cooperation) has been working in India since 1961. In 1991, SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC India, in collaboration with Indian institutions such as TERI, conducted a study of the small-scale industry sector in India to identify areas in which to introduce technologies that would yield greater energy savings and reduce greenhouse gas emissions. SDC strives to find ways by which the MSME sector can meet the challenges of the new era by means of improved technology, increased productivity and competitiveness, and measures aimed at improving the socio-economic conditions of the workforce.

About SAMEEEKSHA

Promoting Energy Efficiency in SMEs
SAMEEEKSHA

SAMEEEKSHA (Small and Medium Enterprises: Energy Efficiency Knowledge Sharing) is a collaborative platform set up with the aim of pooling knowledge and synergizing the efforts of various organizations and institutions - Indian and international, public and private - that are working towards the development of the MSME sector in India through the promotion and adoption of clean, energy-efficient technologies and practices. The key partners are of SAMEEEKSHA platform are (1) SDC (2) Bureau of Energy Efficiency (BEE) (3) Ministry of MSME, Government of India and (4) TERI.

As part of its activities, SAMEEEKSHA collates energy consumption and related information from various energy intensive MSME sub-sectors in India. For further details about SAMEEEKSHA, visit http://www.sameeeksha.org