Cluster Profile
Jetpur textile industries

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Promoting Energy Efficiency in SMEs
SAMEEKSHA

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Jetpur textile industries

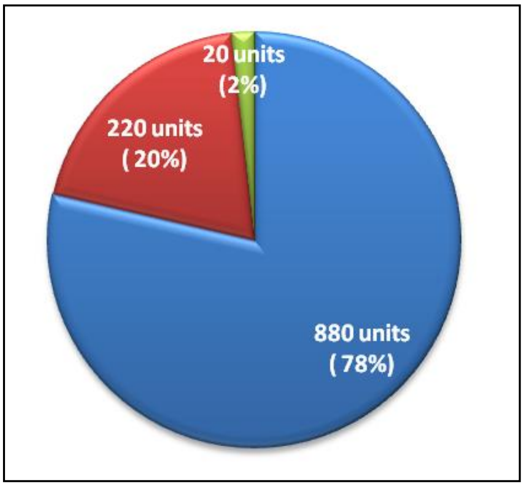
Overview of cluster

Jetpur lies in the heart of Saurashtra, the western Kathiawar peninsula which juts into the Arabian Sea between the Gulf of Kutch to the north and the Gulf of Khambaat to the southeast. Jetpur is one of the largest centers for screen-printing, block printing and yarn dyeing workshops in the country. Jetpur is located on National Highway 8D. Located 70 km from Rajkot on the way to Junagadh lies Jetpur, a town renowned in history as a center for Block printing and dyeing. The city is build-up at riverfront of the BHADAR. The city Jetpur is known as the city of Mini Dubai because largest number of cotton printing work is done here. Jetpur is also known as "Capital of Kathiawad".The city is famous for cotton saree udyog and is major exporter of khanga and kitange (fabric used by native African for various use).

There are around 1,120 dyeing and printing units in the town having an average annual turnover of more than 1500 million Rs. Apart from this, there are around 500 ancillary units all of which combine to produce, on an average, two million metres of printed cloth per day which is enough to make 40,000 cotton saris. Apart from direct employment, the Textile dyeing & printing cluster provides indirect employment to about 40,000 people.

Product types and production capacities

The Textile dyeing & printing industry in Jetpur, though traditionally catered to Cotton Sarees printing, Curtain printing, Lungi Printing & Turban Printing, It has diversified its supply base to a variety of consumers from African subcontinent for printed cloth named as "khanga" and "kitange". However, still a majority of the units in the cluster cater to the Cotton Sarees Printing. There are about 1120 Dyeing & printing units located in the Jetpur & nearby areas. Majority of these units falls under the MSME definition of the Ministry of MSME.



Distribution of units in Jetpur textile cluster

Based on the annual production capacity, the dyeing & printing units are also categorized into the following:

- *Micro units*: Annual production up to 3,000 metre per day
- *Small units*: Annual production between 3,000-20,000 metre per day
- *Medium units*: Annual production between 20,000–100,000 metre per day

All the units are located in Jetpur city of Rajkot District. About 78% of the units in the cluster fall under 'micro' category 20% of the units in the cluster fall under 'small'.

Production capacity

Category	Production capacity range (metre/day)	Number of units	Total production capacity (million metre/year)
Micro	up to 3000	880	154
Small	3000-20,000	220	193
Medium	20,000–100,000	20	220
	Total	1120	

Raw material usage in cluster

The major raw materials used in the cluster include gray cotton cloth and white cotton cloth. The sourcing of raw materials and prices are shown in the table.

Sources and prices of major raw materials

Raw material	Source	Price (Rs/metre)
White cotton cloth	• Maharashtra (Bhiwandi) • Tamil Nadu	• 20-24 (general) • 30-150 (for rich quality)
Gray cotton cloth	• Maharashtra (Bhiwandi) • Tamil Nadu	16-23

About 70-80% of units in micro and small categories work on job work i.e. not directly purchasing cotton cloth but receive from traders for printing.

Production process

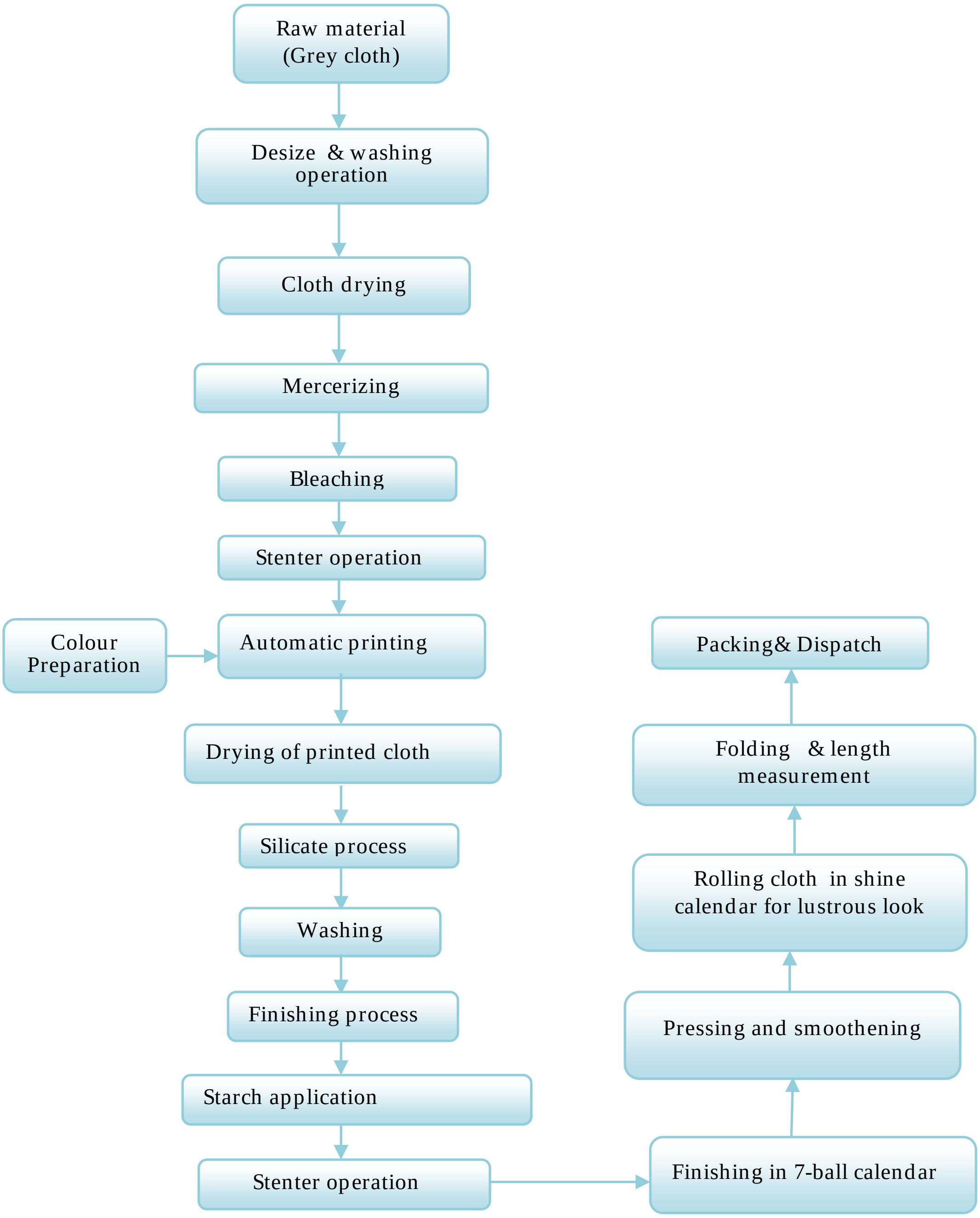
The general production process followed in the cluster is briefed below.

i) Process-house with automatic machine printing

The raw material, grey cloth is dipped in chemical solution of ASI-EZR. Steam is used to heat the chemical solution upto 60 °C followed by simultaneous washing and de-sizing operation for removal of starch and unnecessary chemical from grey cloth, Then drying of cloth is done at about 50 °C using steam as indirect heating medium. Mercerizing with caustic soda is done after drying to provide cloth a better resistance to multiple washings, keeping the colors bright and unchanged over time. Mercerizing is followed by bleaching operation to remove impurities using acids, ammonia and peroxides after which washing is done to remove excess bleach. In stenter, cloth width is set as well as dried using indirect heat from thermic fluid at 200 °C.

The cloth is sent for colour printing on 'Automatic Printing Machine' which is also called 'Flat bed Printing Machine and operated hydraulically or using electricity. After printing, the cloth is sent to drying chamber which is in-line with flat bed printing machine, In drying chamber, indirect drying is done using thermic fluid at about 250 °C. Drying is followed by silicate operation so that colours get deeply impregnated into the cloth. The cloth is bundled and kept for about 12-24 hours after silicate process. The cloth is then taken out for washing to remove excess colours. About 85-90% of colour gets fixed to the cloth whereas 10-15% is removed during washing.

Finishing operation is done followed by starch application on cloth. The cloth is sent to stenter for drying of starch and setting up width again. The cloth is made smooth, shining and lustrous by rolling it through various calendar rollers. The cloth is folded, length measurement is done and sent for packing and dispatch.

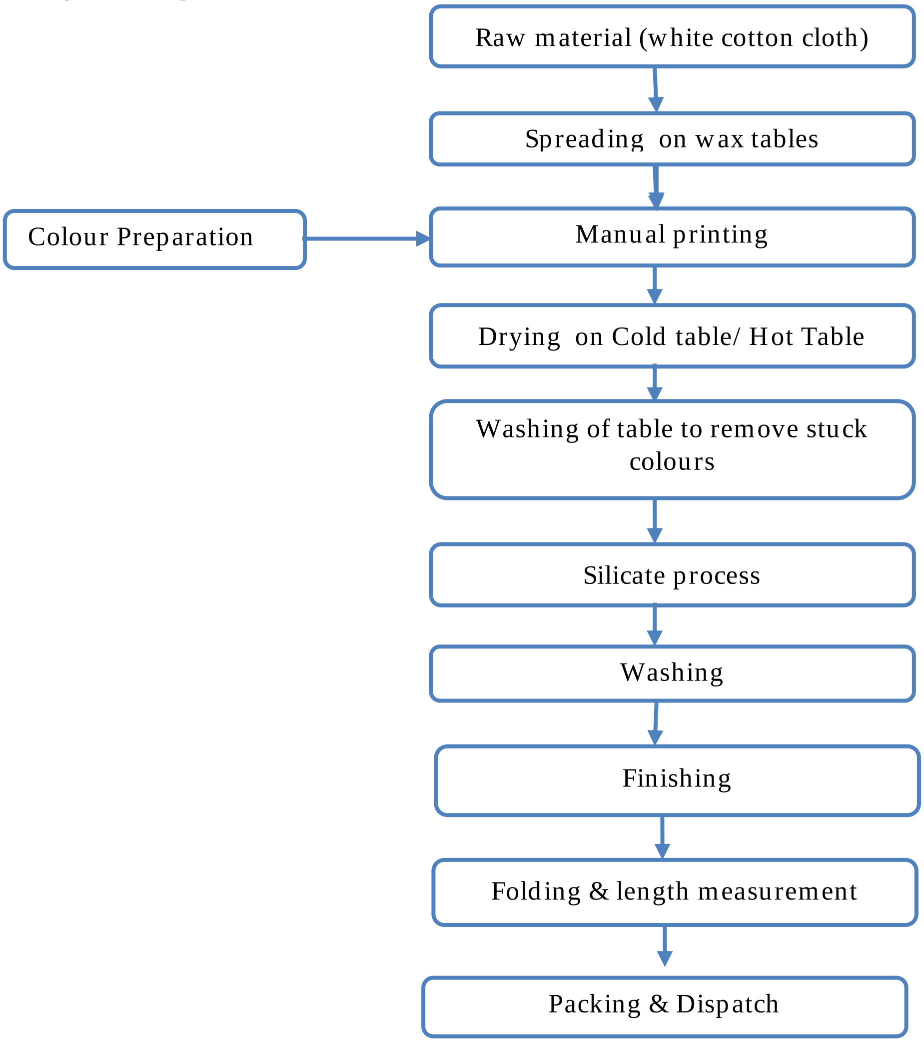


Process-house with automatic machine printing

ii) Cold/ hot table manual hand printing

The raw material, white cotton cloth is spread on wax tables. After colour preparation by proper mixing of colours in gum, printing on the cloth is done manually. The printed cloth is dried at ambient temperature and fans are used for drying. In case of hot table printing, printed cloth is dried using fans (direct) as well as hot thermic fluid at 100 °C which is circulated below the table (indirect). After drying silicate operation is done for impregnation of colour in the cloth. The cloth is bundled and kept for about 12-24 hours after silicate process. The cloth is then taken out for washing to remove excess colours. About 85-90% of colour gets fixed to the cloth whereas 10-15% is removed during washing.

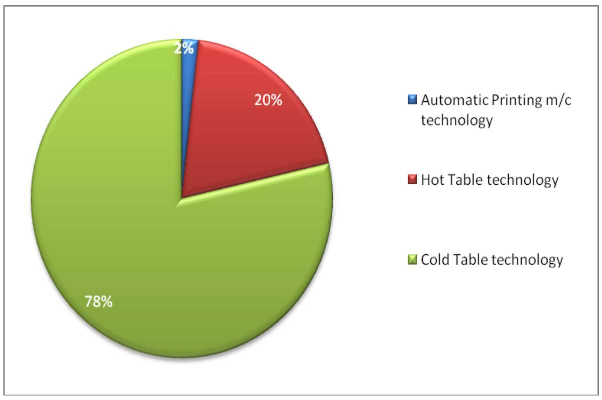
The cloth is bundled and kept for12-24 hours after silicate process. Then clothes are taken out on various Ghats for washing purpose to remove Excess colours. After washing it is found that near about 10- 15% Excess colour get removed & near about 85-90% colour fix in the cloths. Finishing operation is done. The cloth is folded, length measurement is done and sent for packing and dispatch.



Cold/ hot table manual hand printing

Technologies employed

The main technologies used in the cluster include (1) Automatic printing machines and (2) Manual screen printing. Drying of printed cloth is done in drying chamber in case of automatic printing machines and cold table units use fans. Steam boilers are used for generating steams in medium scale units for various processes like desizing, indirect chemical solution heating, drying



Technology share in cluster

clothes on drying ranges and indirect heating of colours. Thermopacs are used for heating thermic fluid which is used for indirect heating to dry printed clothes in drying chamber, stenter and hot tables.

i) Automatic Printing Machines with inline drying chambers

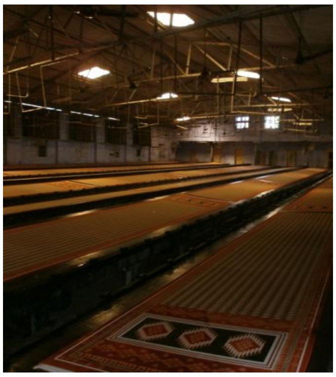
Automatic printing machines (Flat bed) with in-line drying chambers are a better option for higher production capacities . These units use thermic fluid heaters for heating thermic fluid upto 250 °C which is used for indirect heating in drying chamber.

Drying chamber

Automatic printing machine/ flat bed

ii) Manual screen printing with cold/hot table

This technology is conventional and most of the micro units use screen printing manually using cold table for drying of printed clothes. Printed clothes get dried faster in hot table printing in less than one hour, whereas, drying takes about 1.5-2.0 hours in cold table. Cold table printing units operate only in day time (between 8.00 am to 5.00 pm) to ensure proper impregnation of colours. Cold table units remain closed during rainy season. This problem is eliminated in hot table units and hence productivity of hot table unit is always more than cold table units.



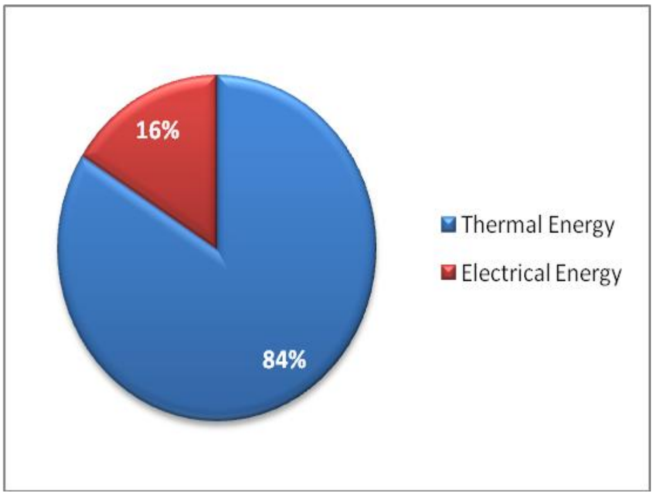
Cold table

Hot table

Boiler and thermopac

Energy consumption

Jetpur textile dyeing & printing cluster uses two major forms of energy namely (1) electricity and (2) thermal energy. The fuels used include wood, biomass briquettes and lignite. The fuels are used in boilers and thermopacs. The share of thermal energy used in the cluster is estimated to be 84% and electricity accounts for about 16% of total energy consumption. Electricity is used mainly in auxiliaries and utilities. Electricity from grid is mainly used in the cluster and during power failure diesel based generator sets are used.



Share of energy consumption

i) Unit level consumption

The typical energy consumption of cold table, hot table and process house units are given below. The process house along with automatic printing machine technology is quite energy intensive as compared to other types of units.

Cold table technology

Energy form	Unit	Consumption		GCV	Equivalent energy	Annual energy cost (Rs)	
		Month	Annual		(toe/yr)	per unit	Total
Electricity	kWh	1667	15003	860	1.3	7	105021
SEC :				7.4 toe/ million metre			
Total					**1.3**		**105021**

Hot table technology

Energy form	Unit	Consumption		GCV	Equivalent energy	Annual energy cost (Rs)	
		Month	Annual		(toe/yr)	per unit	Total
Electricity	kWh	9143	91430	860	7.9	7	640010
Wood	tonne	10.7	107	3500	37.5	4500	481500
SEC				45.3 toe/ million metre			
Total					**45.3**		**1121510**

Hot table & Automatic printing machine technology

Energy form	Unit	Consumption		GCV	Eq. energy	Annual energy cost (Rs)	
		Month	Annual		(toe/yr)	per unit	Total
Electricity	kWh	22389	223890	860	19.3	7	1567230
Biomass briquettes	tonne	31.8	318	3800	120.8	4200	1335600
SEC				63.7 toe/ million metre			
Total					**140.1**		**2902830**

Process house along with automatic printing machine technology

Energy form	Unit	Consumption		GCV	Eq. energy	Annual energy cost (Rs)	
		Month	Annual		(toe/yr)	per unit (Rs)	Total (Rs lakh)
Electricity	kWh	238247	2858965	860	246	7	200
Lignite	tonne	750	4500	4000	1800	4000	180
Biomass briquettes	tonne	750	4500	3800	1710	4200	189
SEC				209 toe/ million metre			
Total					**3756**		**569**

ii) Cluster level consumption

The total energy consumption of the cluster is estimated to be 1,01,387 toe per year. The energy consumption pattern of the cluster shows process house units with automatic printing machines account for the major share of energy consumption followed by hot table units with automatic printing machines. Thermal energy accounts for major share of energy consumption in the cluster. On an average, boilers and thermopacs based units consume about 138 to 1500 toe for steam generation and heating of thermic fluids. Electrical energy consumed in the units varies from 2 toe to 148 toe for various auxiliaries and utilities.

Cold table technology

Energy form	Unit	Annual consumption	Equivalent energy (toe)
Electricity	Million kWh	13.2	1135
Total			**1135**

Hot table technology

Energy form	Unit	Annual consumption	Equivalent energy (toe)
Electricity	million kWh	5.5	472
Wood	tonne	6420	2247
Total			**2719**

Hot table technology with automatic printing machine

Energy form	Unit	Annual consumption	Equivalent energy (toe)
Electricity	kWh	35.8	3081
Biomass briquettes	tonne	50880	19334
Total			**22415**

Process house along with automatic printing machine technology

Energy form	Unit	Annual consumption	Equivalent energy (toe)
Electricity	million kWh	57.2	4917
Lignite	tonne	90000	36000
Biomass briquettes	tonne	90000	34200
Total			**40917**

Cluster level summary

Energy type	Annual consumption	Equivalent energy (toe)	Annual energy bill (million INR)
Thermal			
- Wood (tonne)	6420	2247	29
- Biomass briquettes (tonne)	140880	53534	592
- Lignite (tonne)	90000	36000	360
Electricity (million kWh)	111.7	9605	782
	Total	**101387**	**1762**

Energy type	Annual consumption	Equivalent energy (toe)	Annual energy bill (million INR)
Thermal (tonne)	237300	91781	981
Electricity (million kWh)	111.7	9605	782
Total		**101387**	**1762**

Energy saving opportunities and potential

There exists a significant energy saving potential in all type of units. Large savings through temperature controls in boilers and thermopacs, heat loss reduction, etc. are possible in hot table and automatic printing machine units. There is also considerable scope for improving other process technologies e.g. stenter operation, finishing operation, etc. Most of the units still use conventional machines for these processes and the level of penetration of energy efficient (EE) designs is quite low at present. In addition to process technologies, dyeing and printing also use numerous cross-cutting technologies such as compressors, motors, pumps, etc. It is observed that these types of technologies are generally outmoded and inefficient, especially in smaller units. Overall, there are only a few units that are mechanized and automated, while a majority of the units still employ conventional and manual processes and hence there is good scope for technology enhancement. Textile printing units offer significant scope for energy efficiency improvements both in thermal and electrical areas. Thermal energy centres such as boilers and thermopacs contribute for highest share of energy consumption. Some of the potential energy saving options applicable in the cluster are summarised below.

(i) Waste heat recovery in thermopacs

Process house units having thermopacs use Waste Heat Recovery (WHR) systems and utilise the waste heat available in flue gases. However, most of the hot table units having thermopacs do not have WHR system. As a thumb, every 20 °C preheat of combustion air helps in improving thermal efficiency by about 1%. The hot table units have an energy saving potential of about 5- 8%.

(ii) Economiser for boilers

A majority of process house units with automatic printing machines use three-pass boilers and use lignite/ biomass briquette as fuel. There is absence of waste heat recovery system in these boilers. For example, an economiser incorporated in a boiler will utilize the waste heat in flue gases for preheating of boiler feedwater. As a thumb rule, about 6 oC preheating of feedwater would result in an energy saving of 1%. Considering the feedwater to boiler is preheated upto 90 °C, through preheating in economiser and improving condensate recovery, it would lead to about 10% saving in fuel.

(iii) Insulation of thermic fluid heaters and pipe lines

Most of the hot table units have installed thermic fluid heaters which are quite old. Relining/ repair of insulation both in heater and pipe lines was also not done in these units. Most of the safety valves and gate valves are also not provided with any insulation. By improving the insulation of these systems, it is possible to achieve an energy saving of 3-5%.

(iv) Replacement of old inefficient ceiling fans with high EE fans

All cold table units in the cluster use ceiling fans for drying hand-made screen printed cloths. Replacement of inefficient fans with EE fans can result in an energy saving of about 5-10% as well as help in reducing time for drying.

(v) Solar water heater

Almost all hot/ cold table units use electrical water heaters or wood/ biomass briquette fired vessels for water heating required for colour and gum preparation. There is a good scope to use solar water heaters during non-rainy season which may lead to an energy saving of 4-6%.

(vi) Fuel switch to natural gas

All hot table and automatic printing machine units use lignite/ wood/ biomass briquettes in thermopacs and boilers. Considerable scope exists to switch over to natural gas (NG) which will improve the thermal efficiency of the systems. The estimated energy saving potential is 7-10 %.

(vii) Others

A significant reduction in energy losses is possible in areas such as steam distribution including insulation and steam traps. Further, it may be noted that the level of reuse of water from different processes in textile printing is very low which can be enhanced. On electrical side, pumping of thermic fluid can be controlled using advanced temperature control systems and drives for thermic fluid pump depending upon the pattern of operation. There is also a large scope to improve the 'best operating practices' (BOP) in the cluster. For example, a majority of the units keep the fuels in open which leads to moisture pick up and poor combustion.

A list of energy efficiency options applicable for Jetpur Textile Printing cluster is provided below. Based on the applicability and priorities, the cluster can adopt the options that would help in saving energy resulting in monetary benefits and reduction in GHG emissions.

Energy efficiency options in Jetpur Textile Printing Cluster
Technology
Replacement of inefficient fans with EE fans
Replacement of inefficient pumps with EE pumps
Use of EE motors in different drives
Switching over to EE lighting and controls
Solar water heater for colour water heating and gum heating
Replacement of thermic fluid heated dryers with electrically dryers
Retrofits
Insulation improvement of thermopacs and associated pipelines
Insulation improvement of boiler and steam distribution system
Switch from to natural gas fired systems
Incorporating 'variable frequency drives' (VFD) for thermic fluid circulation pumps
Incorporating WHR systems e.g. economizer and air preheaters
Best operating practices
Improved storage facilities for fuels to avoid moisture pick-up
Condensate recovery
Air pressure reduction of compressed air used for pneumatic actuators
Effective use of day lighting facility

Major stakeholders

There are four major industry associations in the cluster (refer table). Jetpur Dyeing & Printing Association has about 1120 members comprising cold table, hot table, automatic printing units and other dyeing industries; it also has members such as individual consultants, equipment suppliers, and 'local service providers' (LSPs). The government body includes District Industries Centre (DIC), Rajkot & Gujarat Pollution Control Board (GPCB, Jetpur). There are about 30 LSPs comprising fabricators, equipment suppliers, technology providers in the cluster.

Major industry associations in Jetpur cluster

Name of association	Location
Jetpur Dyeing & Printing Association	Jetpur
Jetpur Chamber of Commerce	Jetpur
Jetpur Cotton Dress Traders Association	Jetpur
Dhareshwar GIDC Area Association	Navagarh, Jetpur

Cluster development activities

Jetpur Dyeing & Printing Association has setup a common facility centre (CFC) for all dyeing and printing industries i.e. common effluent treatment plant (CETP). There are 2 numbers of CETPs and these facilities have a capacity to handle 6 million litres per day and 7 million litres per day respectively. Jetpur Dyeing & Printing Association is also setting up a new CETP located at Bhatgam located at about 20 km from Jetpur with financial support from the central government & DIC. The capacity of the new CETP will be 30 million litres per day. GSPC and GAIL are exploring supply of piped natural gas to 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

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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