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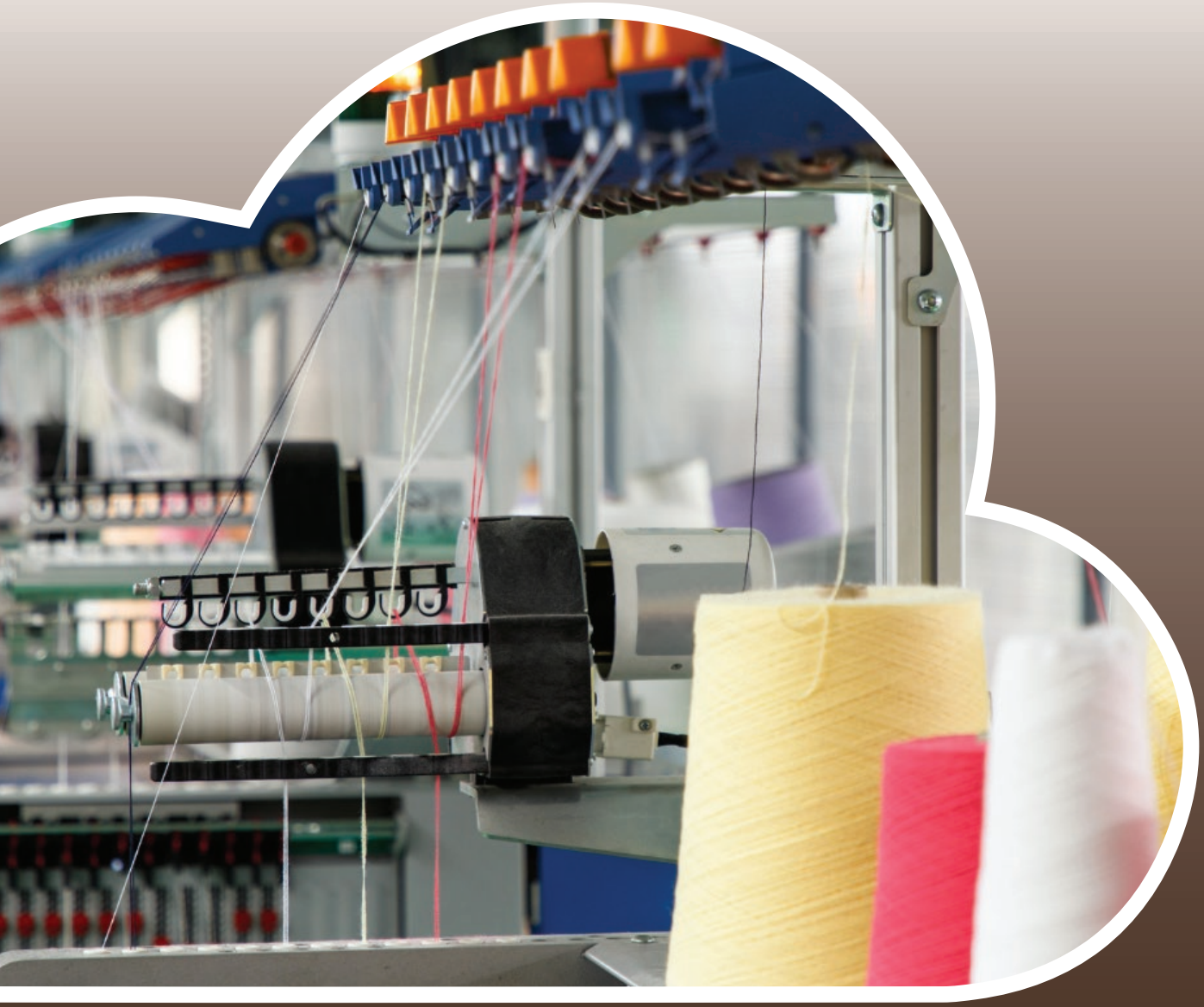


# Scope for deep decarbonisation in MSME manufacturing sectors: Cluster report

Textiles, Ludhiana

## Cluster Profile

The textiles industry is one of India's largest manufacturing sectors. It can be broadly classified into yarn preparation, fabric preparation, and processing/finishing items. Ludhiana has a well-established and large textile cluster consisting of almost 15,000 MSME units that employ over 4 lakh people. Ludhiana's MSME cluster, therefore, has a large consumption of water, energy, and other raw materials for its processes. The cluster primarily caters towards the domestic market.

**Location**: Ludhiana

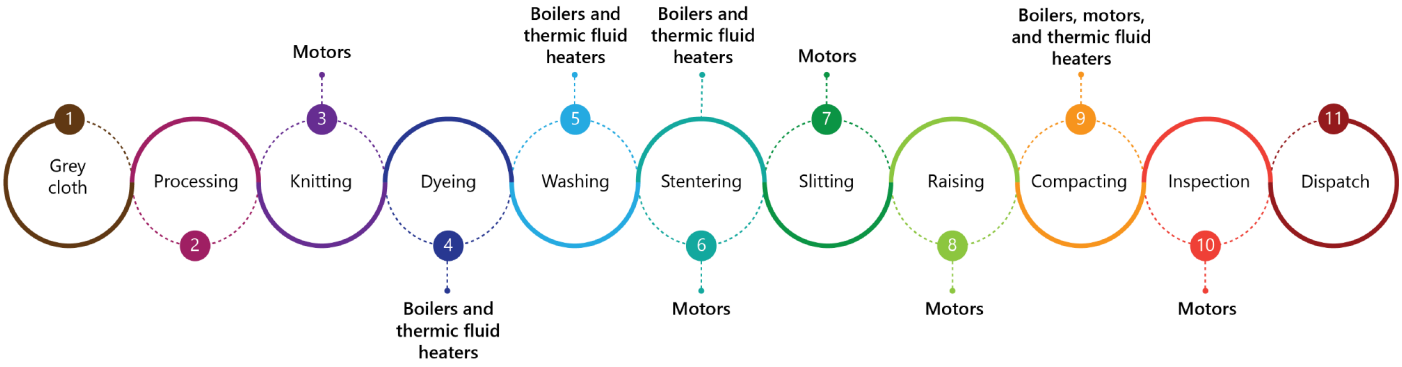
**Sector**: Textiles

**MSME sample size**: 12 (a mix of micro, small, and medium)

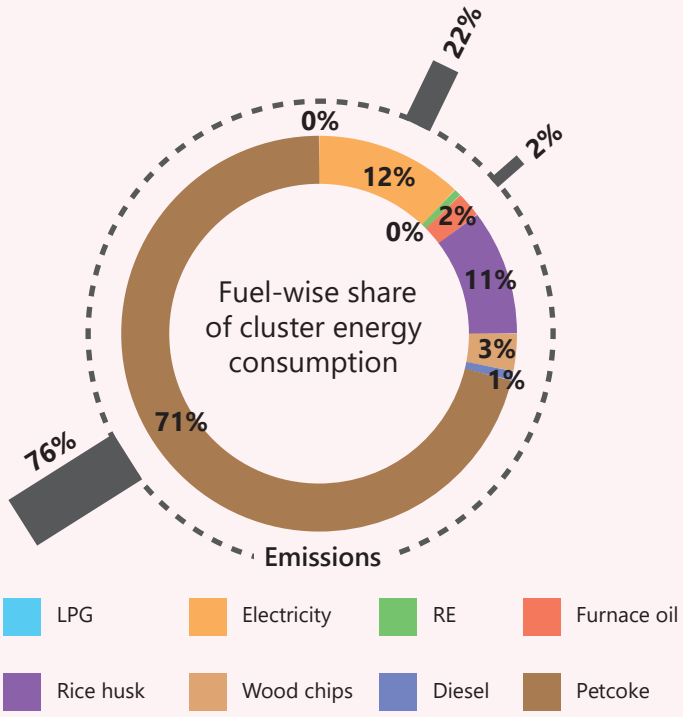
**Products**: Hosiery items, shawls, blankets, winter wear (mufflers, cardigans, pullovers, etc.), and caps

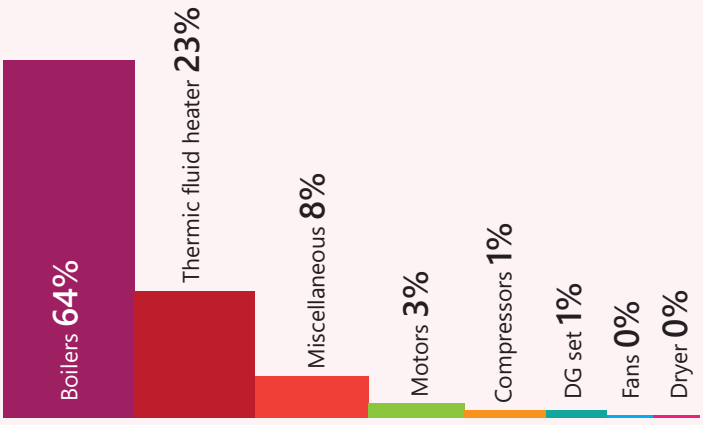
| MSME classification | Turnover (in INR crore) | Investment (in INR crore) |
|---|---|---|
| Micro | 0–5 | 0–1 |
| Small | 5–50 | 1–10 |
| Medium | 50–250 | 10–50 |

### Unit process diagram




## Energy Consumption Profile

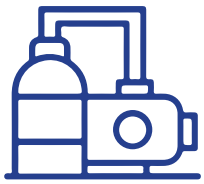



Equipment-wise share of cluster energy consumption

*Note: Miscellaneous equipment consists of lighting, fans, additional process equipment, and so on*

# Energy- and Emission-Intensive Equipment



## Boilers

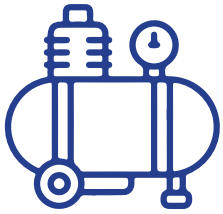
Boilers are the primary source of steam generation, an important prerequisite in manufacturing processes such as dyeing. Most boilers in Ludhiana are solid fuel–fired and use petcoke and biofuels such as woodchips and rice husk. Furnace oil is also used.

| Furnace fuelled by: | Efficiency |
|---|---|
| Petcoke | 80%–85% |
| Biofuels (rice husk and woodchips) | 75%–85% |
| Furnace oil | 75% |

## Thermic fluid heaters

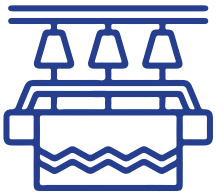
Like boilers, thermic fluid heaters meet several process heating requirements in the manufacturing units but without the use of steam. They are used for dryers, printers, and stenters and are powered by petcoke in Ludhiana.

| Furnace fuelled by: | Efficiency |
|---|---|
| Petcoke | 80%–85% |



## Air compressors

Air compressors are another energy-intensive component in textile units. Compressed air is a reliable means of running a variety of pneumatic actuators, ejection processes, and other tools in machining. Ideally, 0.16–0.18 kW is required for every cubic feet per minute (CFM) of compressed air, given the pressure requirements of the sector.



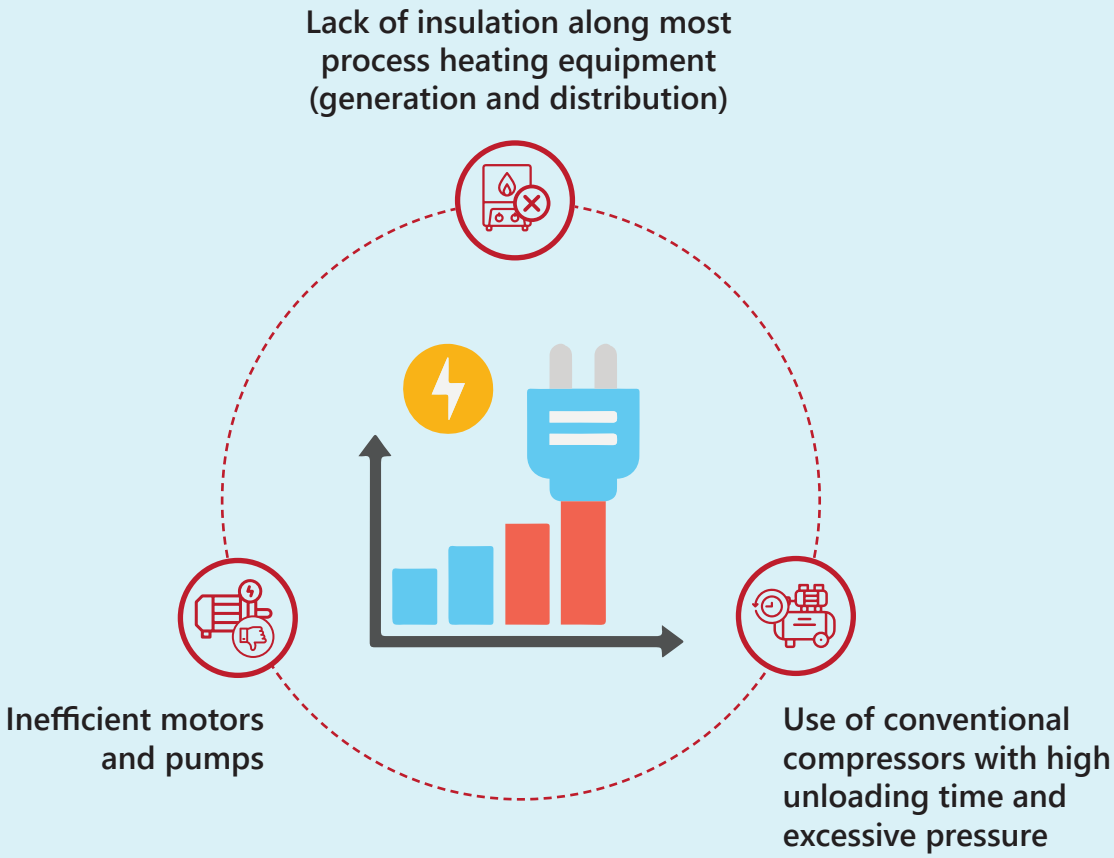
## Process equipment

Various process equipment within textile units such as extractors, tumbler dryers, dyeing machines, and knitting machines require electricity to run the motors, pumps, and so on.

## Diesel generator sets

A diesel generator (DG) set is primarily used as backup power if there is a power outage. It is a large consumer of HSD in units, operating with typical efficiencies of 25%–45% depending on the age of the equipment.

## Reasons for High Specific Energy Consumption (SEC)




## Energy Efficiency (EE) Recommendations

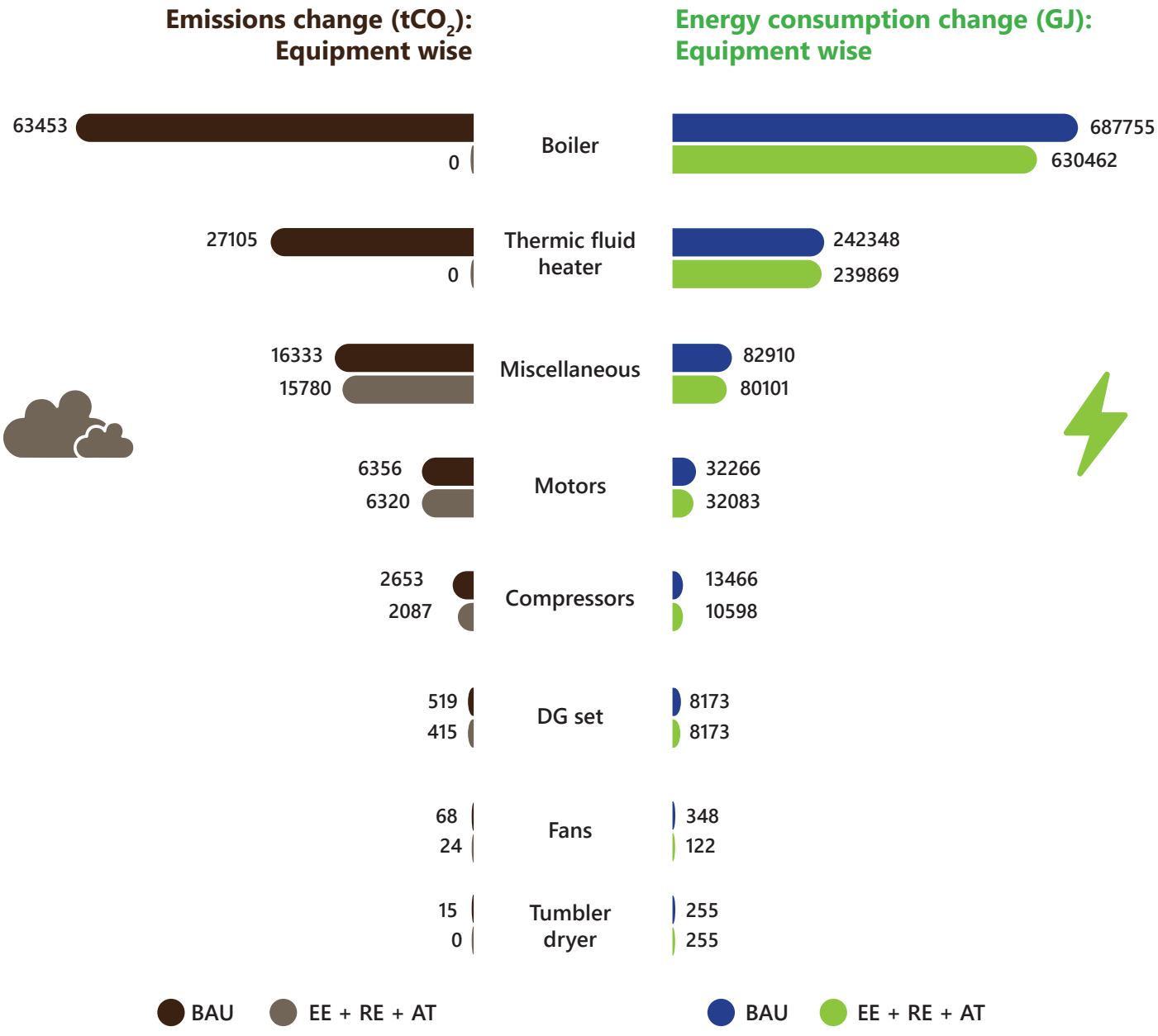
- Optimisation of air-to-fuel ratio for boilers and thermic fluid heaters **(short term)**
- Reducing compressor air leakage **(short term)**
- Compressor pressure optimisation **(short term)**
- Insulation of hot water and condensate lines **(short term)**
- Insulation of dyeing machines, boilers, and thermic fluid heaters **(short term)**
- Installing VFD to avoid power consumption during compressor unloading **(medium term)**
- Flash steam recovery to preheat boiler feed water **(medium term)**
- Installation of BLDC fans **(long term)**

| Decarbonisation measure | Short term: <1 year | Medium term: 1-2 years | Long term: >2 years |
|---|---|---|---|

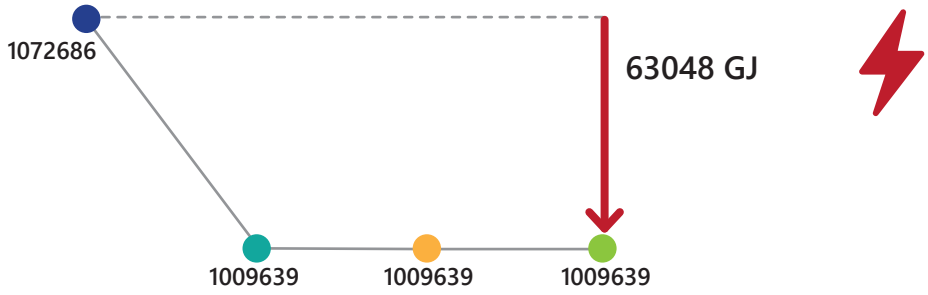
## Techno-economic Analysis

A techno-economic analysis is carried out for a sample size of 12 units where energy, emission, and energy cost are modelled across four scenarios. The analysis shows the difference in each scenario and the impact of decarbonisation measures at various levels. The scenarios are as follows:

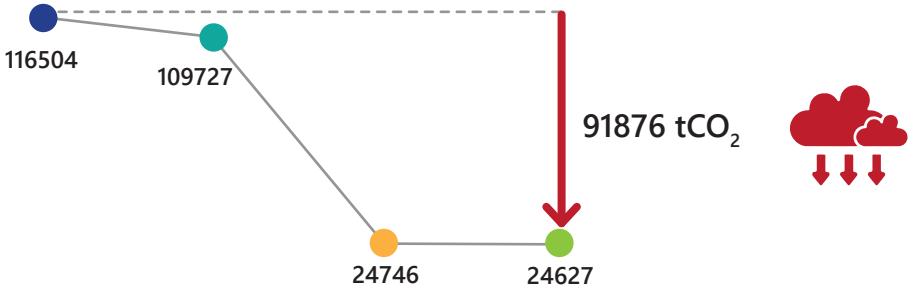
- **Business as Usual (BAU):** Without any interventions
- **Energy Efficiency (EE):** EE measures on existing equipment
- **Energy Efficiency with Renewables (EE + RE):** EE measures and renewables for electricity generation
- **Advanced Technologies (EE + RE + AT):** EE + RE measures and advanced decarbonisation technologies (clean fuels, process electrification)



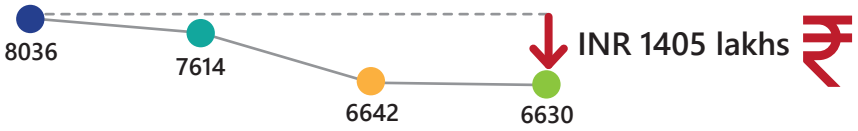
Scenario-wise reduction in cluster energy consumption (GJ)




Scenario-wise reduction in cluster GHG emissions ($tCO_2$)



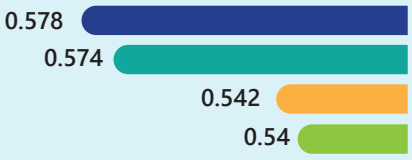

Scenario-wise reduction in energy cost within cluster (INR in lakhs)




BAU EE EE + RE EE + RE + AT

For a typical unit in the cluster, the change in energy and emission intensity of production is given:

**Scenario-wise reduction in emission intensity ($tCO_2$/tonne)**




**Scenario-wise reduction in Specific energy consumption (GJ/tonne)**

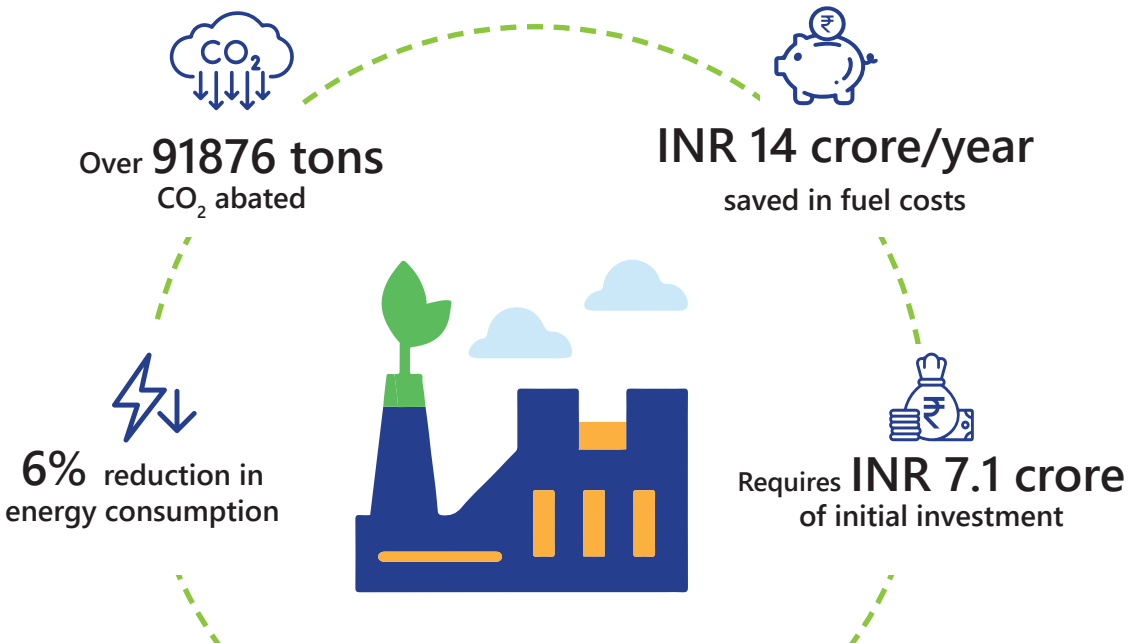

BAU EE EE + RE EE + RE + AT

## Advanced technology measures considered for cluster and impact

| Equipment | Decarbonisation measure | Energy reduction | Emissions reduction | Investment cost | Payback period |
|---|---|---|---|---|---|
| All electric equipment | Installing rooftop solar | - | High | High | <5 years |
| All electric equipment | Using open access green energy from the grid | - | High | Low | Immediate |
| DG set | Biodiesel blending (20%) in DG set | - | Medium | Low | Immediate |
| DG set | Use of 100% biodiesel generator | - | High | Medium | <3 years |
| DG set | Conversion of DG set to battery | Medium | None | High | Not feasible |
| TFH | Petcoke TFH to electricity | Low | None | High | Not feasible |
| TFH | Petcoke TFH to biomass briquettes | None | High | Low | 0.2 to 4 years* |
| Boiler | Coal boiler to electric | Low | None | High | Not feasible |
| Boiler | Coal boiler to biogas | Low | High | High | Not feasible |
| Boiler | Coal boiler to green hydrogen | Low | High | High | Not feasible |
| Boiler | Petcoke boiler to biomass briquettes | None | High | Low | 0.2 to 4 years* |

**Depending on petcoke prices*

## Potential impact of decarbonisation measures

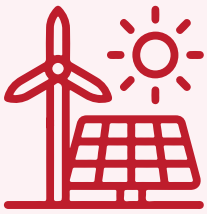


## Way Ahead

### Energy efficiency

Limited scope for energy efficiency measures (<10% emissions and energy reduction ). However, changes in the form of insulation and equipment replacement (motors and compressors) helpful. Further actions in EE side can be facilitated by:

- Utilise the Amended Technology Upgradation Scheme for the textile sector
- Set local benchmarks for energy consumption
- State government support through the upcoming RAMP scheme



### Potential for using RE in units and increasing usage

- Rooftop solar installation and use of RE-specific financing schemes (e.g., MNRE)
- Utilise RE open access and aggregate demand from multiple MSME units

### Demand aggregation

Given similar processes and proximity of units, possibility to utilise the MSME Cluster Development Programme and Integrated Processing Development scheme funds for common:

- Centralised steam distribution and compressed air systems
- Centralised RE systems

### Strengthen the supply chain of bioenergy for MSMEs

The switch to biomass briquettes for boilers/ TFH has high decarbonisation potential. Punjab Industrial Policy 2022 only highlights the use of bio-CNG in industries

- Potential for biomass briquettes/pellets policies to expand beyond thermal power plants and include use in boilers/TFHs (e.g., mandates)
- Facilitate direct bio-CNG sales to MSME clusters
- Include biodiesel under Pradhan Mantri JI-VAN Yojana
- Regulatory incentives (Ex: consent time period)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