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Clean Energy Accelerator
Stories of Change

A Collection of Case Studies from the Clean Energy Accelerator

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Message from ISC

Our core mission at the Institute for Sustainable Communities is to help communities, around the world address environmental, economic, and social challenges to build a better future, shaped and shared by all. We drive innovative solutions and aim to bring lasting change in climate and sustainability by working closely with communities, cities, and factories. The Clean Energy Accelerator works towards fulfilling this vision.

The Clean Energy Accelerator was launched in Tirupur, Tamil Nadu, to enable one of the largest textile manufacturing clusters in India to transition towards low carbon, energy efficient and cleaner production. We worked with over 200 factories, 4000 factory managers and technicians, and numerous other stakeholders to drive clean technology adoption, achieve significant energy improvements, improve profitability, and lower greenhouse gas emissions in textile manufacturing. The results from these efforts are truly transformational and lead the way into a new future for manufacturing in India.

In this journey, we formed lasting partnerships that were invaluable in providing support and guidance in realizing our goals and leave a lasting impact. I would like to acknowledge:

- Anurag Mishra, U.S. Agency for International Development
- R. Kannan, District Industries Center-Tirupur, Tamil Nadu
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- Dr. Nagesh Kumar, Center for Environment, Energy and Productivity

Besides these, we collaborated successfully with SIDBI, Thermax, Forbes Marshall, Lloyd Insulation, Grundfos Pumps, Alfa Laval, H&M, Gap Inc. among many others, to create opportunities for learning, creating awareness and disseminating knowledge among the small and medium factories in Tirupur.

Lastly, the impact created by the Clean Energy Accelerator would be incomplete without the rigour and dedication of the program team, both in the office and on field. Their formidable contribution paves the way for continuing strategic interventions in sustainability and climate change with clarity, ingenuity and tenacity.

Suresh K. Kotla
Director- Energy and Environment
Institute for Sustainable Communities

About this Booklet

This booklet curates the impact and success stories of the Clean Energy Accelerator (CEA) project in the textile manufacturing industries located in the Tirupur industrial cluster, Tamil Nadu. A short case study format is followed to highlight the different clean technologies and energy efficiency measures adopted by the factories. The positive impact from these adoptions is showcased in terms of aspects like improvements in energy performance, reduced cost of production, enhanced profitability for small and medium factories, decreased use of non-renewable resources (coal and firewood) and overall reduction in greenhouse gas emissions, among others.

These impacts arise from a series of detailed energy audits and technical assistance services provided to wet processing textile factories by the energy experts from the Institute for Sustainable Communities (ISC). These efforts are a part of Clean Energy Accelerator under the EHS+ Center Program implemented by ISC and supported by the U.S. Agency for International Development (USAID).

Background

Tirupur, "The Knitwear Capital Of India"

Tirupur is a bustling industrial town in Tamil Nadu widely known for its numerous textile manufacturing industries. As the "Knitwear Capital of India", Tirupur's textile industries contribute to over 90% of the total cotton knitwear exports from the country. More than 28,000 manufacturing units are involved in various processes of the textile value chain like knitting, dyeing, bleaching, printing, compacting and calendaring, among others. These factories provide employment to over 600,000 people directly and 1,000,000 people indirectly, and generate Rs. 55,000 crores worth of business annually. Migrant workers from across the country form a significant part of the workforce in these industries. The large volumes of textile export production are bought by international retail brands like H&M, Gap, Marks & Spencer, Adidas, Nike, Walmart, Ralph Lauren, and Dorothy Perkins to name few.

Tirupur's large textile production volumes are innately indicative of a significant resource demand as well as large waste and emission footprint. Water and energy are the primary resources utilized widely in textile manufacturing. Specifically, wet processing in textiles which includes stages of bleaching, dyeing, printing, and wet compacting, places a huge demand on natural resources like groundwater, firewood, coal, furnace oil and high-speed diesel (HSD). Dyeing and compacting units alone consume 96% (over 713,600 TOE) of the aggregate annual energy consumption of Tirupur's textile cluster. This subsequently results in a large greenhouse gas (GHG) emissions footprint and negative environmental impact of these factories.

ISC in Tirupur: Clean Energy Accelerator, EHS+ Center Program

ISC's analysis of the ground realities in Tirupur, along with in-depth perusal of previous studies, revealed a number of prevailing factors present within factories – lack of awareness, poor institutional capability, limited availability of skilled technicians, and improper monitoring and verification methods among others – that directly contribute to poor energy management and inefficiency in the cluster. A strategic approach was outlined by ISC to address these issues; partnering with local industry associations and academic institutions, targeted activities like capacity building workshops, energy audits, pilot technology demonstrations, and skill training programs were carried out for textile factories, with a focus on SMEs in and around Tirupur. The key objective was to develop enhanced specialized skills and disseminate best operating practices for energy management that could be implemented at the factory level. Along with changes in their day-to-day operating and maintenance practices, the factories were encouraged to adopt clean energy and energy efficient technologies in their production. Close technical assistance services and one-on-one interaction with factory managers were also conducted to ease this process of change.

In the subsequent sections, the successful transitions of these factories to clean energy and energy efficient practices and technologies is covered. The resulting benefits from these changes are captured through parameters like fall in resource consumption (of coal and firewood), increase in energy savings (both thermal and electrical), lowered monetary savings and reduced GHG emissions.

[1]Brief Industrial Profile – Tirupur (2015-16), Development Institute, Ministry of MSME, Govt. of India.
http://dcmsme.gov.in/dips/2016-17/DIP.TIRUPUR.2015.16.pdf

[2]ibid

[3]Raja Shanmughan, Textile Exporters' Association. The New India Express Coronavirus outbreak leaves Tirupur garment industry high and dry
https://www.newindianexpress.com/business/2020/mar/23/coronavirus-outbreak-leaves-tirupur-garment-industry-high-and-dry-2120374.html

[4]Manual on Energy Conservation Measures in Textile Cluster Tirupur. Bureau of Energy Efficiency (BEE), Ministry of Power, Govt. of India.
http://sameeeksha.org/pdf/clusterprofile/Tirupur_Textile_Industries.pdf

Case Studies

The textile industry is highly diversified in nature. It consists of various processes such as spinning, weaving, knitting, dyeing, printing, finishing, etc. About 34% of energy is consumed in spinning, 23% in weaving, 38% in chemical processing and another 5% in miscellaneous processes. The textile industry uses large quantities of both electrical and thermal energy. Electrical energy dominates the consumption pattern in spinning and weaving, while thermal energy a major for wet processing and heating.

During the EHS+ Center energy audits in the textile industries of Tirupur, various energy efficiency measures were identified. The table below summarizes the energy efficiency opportunities, percentage energy savings and typical pay-back period for the industry in Tirupur region.

Sr. No.	Energy Efficiency Opportunities	Payback Period
1	Waste Heat Recovery system in boiler or Thermopac	1 year to 3 years
2	Excess air controller and auto blow down controller in Boiler	Less than 1 year
3	Energy efficient Motors	1 year to 3 years
4	Energy efficient Pumps	Less than 1 year
5	VFD for Fans, Blower, Pumps, Compressor	Less than 1 year
6	Insulation	Less than 1 year
7	Energy efficient Lighting	Less than 1 year
8	Energy efficient Compressor	1 year to 3 years

There are various energy efficiency opportunities in textile factories, of which many are cost-effective. However, even cost-effective options are often not implemented; mainly because of the limited information available to textile factories on implementing these options.

This case study booklet consists of various case studies of energy efficient technologies implemented in textile industries. They are shortlisted based on higher savings, low cost implementation, innovative projects, and high replication potential across the sector. The analysis of energy efficiency improvement opportunities in the textile industry includes both, opportunities for retrofit/process optimization as well as the complete replacement of the current machinery with state-of-the-art new technology.

Story One:
Modify Feed Water Tank Condensate Inlet Line

Issue: The process of Textile Bleaching and Compacting is energy intensive, involving large consumption of thermal energy. During the energy audit, ISC's experts found that the return condensate water line was exposed to the atmosphere, and the heat content was lost in the form of flash steam. There was potential to recover the heat lost – in order to preheat the water or for any similar, useful purpose. Thereby highlighting the potential to reduce fuel consumption.

Intervention: Based on the findings from the on-site energy audit at the unit, it was proposed that a sparge pipe arrangement be installed in the condensate pipeline, to save the flash steam. This intervention would ensure reduced utilization of live steam and lower the fuel consumption as well.

*Unit showing steam lines (Representative Image)**

Impact: The implementation of the suggested measures led to a reduction in wood consumption by over 33.6 MT annually, and an equivalent reduction in GHG emissions as shown below:

33.6 MT (Wood)
Annual Fuel Saving

Rs. 1.34 lac
Annual Monetary Saving

58.5 TCO_2
Annual GHG Emission Reduction

*Picture from another unit with the same implemented measure

Story Two:
Add Combustion Enhancers/Additives to Coal

Issue: The process of Textile Bleaching and Dyeing is energy intensive, involving large consumption of thermal energy. During the energy audit, ISC's experts observed that the daily coal consumption in the boiler and thermic-fluid heater was around 25 MT. The coal was a mix of big lumps and fine particles. This resulted in improper combustion of coal, and led to a substantial wastage of coal that was unburnt.

Intervention: Based on the measurements and findings made during the on-site energy audit at the unit, it was proposed to add combustion enhancers/additives before feeding into the respective combustion zones. This would likely reduce the unburnt carbon losses when used continuously and in the right dose. This intervention would ensure improved combustion efficiency, along with reduced fuel wastage.

Auto Coal Feeder System with Combustion Additives

Impact: The implementation of the suggested measures led to a reduction in coal consumption by over 180 MT annually, improved heat transfer rate, improved thermal efficiency of the system, reduced stack emission, and an equivalent reduction in GHG emissions as shown below:

180 MT (Coal)
Annual Fuel Saving

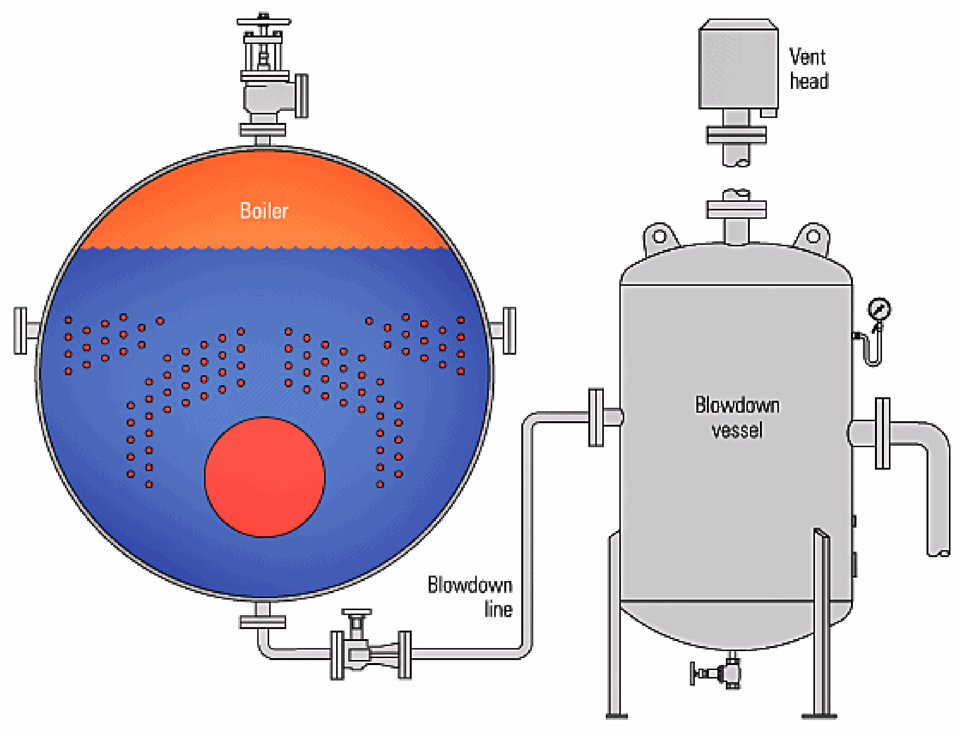
Rs. 3.38 lac
Annual Monetary Saving

327 TCO_2
Annual GHG Emission Reduction

Story Three:
Optimize Boiler Blow-Down Quantity

Issue: The Yarn Dyeing process is energy intensive, involving large consumption of thermal energy. During the energy audit, ISC's experts found that the blow-down is carried out manually twice or thrice in a shift, for 2-3 minutes each time. This meant, the overall blow-down was carried out 5-6 times a day from 2 nos. boilers through a 1.5-inch pipe line.

Intervention: As per the maximum allowable TDS, the required blowdown quantity is around 40 lit./hr. During the trial test, it was observed that the actual blow-down was 187 lit./hr (which was very high). Excess blow-down indicates excess requirement of fresh water and wastage of fuel - for the same process requirement. By regulating the frequency of the boiler blow-down, the intervention would ensure optimum utilization of live steam and fuel consumption as well.



Boiler Auto Blowdown System and Blowdown Cylinder

Impact: The implementation of the suggested measures led to a reduction in wood consumption by over 76 MT annually, and an equivalent reduction in GHG emissions as shown below:

76 MT (Wood)
Annual Fuel Saving

Rs. 2.66 lac
Annual Monetary Saving

132.2 TCO_2
Annual GHG Emission Reduction

Story Four:
Provide Thermal Insulation in Certain Identified Areas

Issue: The process of Textile Bleaching and Dyeing is energy intensive, involving large consumption of thermal energy and electrical energy, in key utility and process machinery. Hence, it is important to conserve heat energy at every possible section – like the steam mains, oil mains, condensate return lines etc. During the energy audit, ISC's experts found that there were certain areas where the hot surface carried steam as well as those carrying the condensate, were exposed to the surrounding atmosphere due to missing or faulty thermal insulation.

Intervention: Based on the measurements and findings during the on-site energy audit at the unit, it was proposed that thermal insulation of suitable thickness be put at the identified sections totalling 40 m2 areas. This would not only prevent heat loss from the steam or condensate line, but would also help save a substantial quantity of coal.

Insulation on pipeline and on outer surface

Impact: The implementation of the suggested measures led to a reduction in coal consumption by over 53.5 MT annually, and an equivalent reduction in GHG emissions as shown below:

53.5 MT (Coal)
Annual Fuel Saving

Rs. 3.20 lac
Annual Monetary Saving

97.2 TCO_2
Annual GHG Emission Reduction

Story Five:

Install Separate Tank for Multi-Effect Evaporator (MEE) Condensate

Issue: The process of Yarn Bleaching is an energy intensive one, involving large consumption of thermal energy. During the energy audit, ISC's experts found that the MEE condensate water (usually at a temperature range of 85-90° C) was getting mixed with the process water at room temperature. The quantity of MEE condensate was quite high, at about 15-20 KLPD (indicates a good potential for waste heat recovery). This could be used to preheat the process water and reduce the steam and fuel consumption thereafter in the boiler.

Intervention: Based on the findings during the on-site energy audit at the unit, the matter was brought to the notice of the management. It was proposed that a separate tank for MEE condensate be provided, which could be used for other useful processes, as and when needed. This intervention would ensure reduced wastage of steam and fuel.

*Boiler, Water and Steamlines in a unit (Representative Image)**

Impact: The implementation of the suggested measures led to a reduction in wood consumption by over 85.7 MT annually, and an equivalent reduction in GHG emissions as shown below:

85.7 MT (Wood)
Annual Fuel Saving

Rs. 3.85 lac
Annual Monetary Saving

149.1 TCO_2
Annual GHG Emission Reduction

*Picture from another unit with the same implemented measure

Story Six:
Reduce Excess Air in Boiler and Thermic-Fluid Heater

Issue: The process of Textile Bleaching and Dyeing is energy intensive, involving large consumption of thermal energy. During the energy audit, ISC's experts found that the combustion efficiency in the Boiler and Thermic-Fluid Heater was on the lower side, due to excess air in the combustion zone. The oxygen level in the Coal-Fired Boiler was found at a higher range of 16.5%, while in the Thermic-Fluid Heater, it was found at 13%. The temperature of the flue gas was also found to be at a very higher value of 202° C. The excess air on entering the combustion zone of boiler and thermic-fluid heater, would heated up and escape into the atmosphere without contributing to the process, thereby resulting in increased fuel wastage and reduced combustion efficiency.

Intervention: Based on the measurements and findings during the on-site energy audit at the unit, it was proposed that an oxygen sensor/excess air controller be installed, to bring down the oxygen level to 6% in each case. This intervention would not only ensure an optimum and efficient combustion, and improve combustion efficiency, but would also reduce fuel wastage substantially.

ID Fan of a Boiler and Thermic-fluid Heater

Impact: The implementation of the suggested measures led to a reduction in coal consumption by over 621.3 MT annually, and an equivalent reduction in GHG emissions as shown below:

621.3 MT (Coal)
Annual Fuel Saving

Rs. 31.06 lacs
Annual Monetary Saving

1128.26 TCO_2
Annual GHG Emission Reduction

Story Seven:

De-soot the Thermic-Fluid Heater by Centrifuge, to Improve Heat Transfer

Issue: Textile bleaching and dyeing is an energy intensive process, involving large consumption of thermal energy. During the energy audit, ISC's experts found a large deposition of soot on the oil tubes, on the fire-side in the combustion zone. Soot deposition acts as an insulator and prevents the heat transfer, leading to reduced performance and increased fuel consumption. As a thumb rule, a 3mm deposition of soot results in increased fuel consumption by 2.5%.

Intervention: Based on the measurements and findings during the on-site energy audit at the unit, it was proposed to de-soot the Thermic-Fluid Heater by Centrifuge action. This intervention would ensure an improved heat transfer rate, and improved combustion efficiency along with reduced fuel wastage.

De-scaling of Boiler Tubes

Impact: The implementation of the suggested measures led to a reduction in coal consumption by over 13 MT annually, and an equivalent reduction in GHG emissions as shown below:

13 MT
Annual Coal Saving

Rs. 0.65 lacs
Annual Monetary Saving

23.61 TCO_2
Annual GHG Emission Reduction

Story Eight:

Operate the Induced Draft (ID) Fan of Thermax Boiler At 40 Hz And Provide Variable Frequency Drive (VFD) for Forced Draft (FD) Fan

Issue: Textile processing is energy intensive, involving large consumption of thermal energy in equipment such as Boilers and Thermo-Pac Units, as well as in processes like conditioning and drying, followed by electrical energy consumption in several utility and process machineries. During the energy audit at the unit, ISC's experts found that there was no control on the FD Fan during the low demand of steam, which led to excess air in the 8 TPH Boiler Combustion Chamber. The ID Fan though, was provided with a VFD but was not synchronized with the FD Fan.

Intervention: Based on the observations and on-site measurements at the unit, it was proposed that the ID Fan be operated at a 40 Hz frequency, and another VFD be provided for the FD Fan as well. They needed to be synced in a way that when the ID fan speed was controlled, the FD fan speed would also be controlled - to balance the pressure inside the boiler.

ID Fan of Boiler

VFD Panel

Impact: The implementation of the suggested measures led to a reduction in the electricity consumption by over 75,480 kWh annually, and an equivalent reduction in GHG emissions as shown below:

75,480 kWh
Annual Electricity Saving

Rs. 4.90 lacs
Annual Monetary Saving

62.0 TCO_2
Annual GHG Emission Reduction

Story Nine:
Supply Coolest Water to Condenser of Multi-Effect Evaporator (MEE)

Issue: Textile processing is an energy intensive process, involving large consumption of thermal energy in equipment such as Boilers and Thermo-Pac units as well as in processes like conditioning and drying, followed by electrical energy consumption in several utility and process machinery. During the energy audit at the unit, ISC's experts found that the supply water to MEE was at 37° C, while the return water to the Cooling Tower was at 42° C. The high temperature was due to the inadequate capacity of the existing Cooling Tower.

Intervention: Based on the findings, and discussions with the management during the on-site energy audit at the unit, it was decided that the spare Cooling Tower (which was already available) be shifted to the ETP, and the flow of the cooling water be bifurcated to both the towers. The supply cooling water temperature to MEE should be targeted at 3° C above the prevailing wet bulb temperature. The wet bulb temperature measured during the study was 22° C, which meant a cooling water temperature of 25° C could be achieved. This would lead to substantial steam savings.

Cooling tower at the unit

Impact: The implementation of the suggested measures led to a reduction in coal consumption by over 354 MT annually, and an equivalent reduction in GHG emissions as shown below:

354 MT
Annual Coal Saving

Rs. 16.6 Lacs
Annual Monetary Saving

642.9 TCO_2
Annual GHG Emission Reduction

Story Ten:

Reduce Compressed Air Pressure from 8.4 Kg /Cm² to 7.3 Kg /Cm²

Issue: The process of Textile Bleaching and Dyeing is energy intensive, involving large consumption of thermal energy, as well as electrical energy in key utility and process machinery. During the energy audit, ISC's experts found that the operating pressure of the Air Compressors was too high. This was likely to cause higher power consumption, and an increased Specific Energy Consumption of the Air Compressors.

Intervention: On the consent of the management and upon discussing the issue, the measurement was carried out again, by reducing the operating pressure. A reasonable amount of reduction in the instantaneous power consumption was observed, without affecting the product quality and process.

Air Compressors

On-screen Pressure Settings

Impact: The implementation of the suggested measures led to a reduction in electricity consumption by over 43,920 kWh annually, and an equivalent reduction in GHG emissions as shown below:

43,920 kWh
Annual Electricity Saving

Rs. 3.41 lacs
Annual Monetary Saving

35.5 TCO_2
Annual GHG Emission Reduction

Negligible Investment

Story Eleven:
Replace Conventional Compressed Air Nozzle with Energy Efficient Trans-Vector Nozzle

Issue: During the energy audit, ISC’s experts observed a common practice on the shop floor regarding the usage of compressed air for floor and body cleaning, apart from cleaning the fabric surface. Four conventional air guns were used on a workstation, and just 3 mm diameter tubes were used in other locations. This led to substantial wastage of compressed air, and increased wastage of electrical energy as well. This led to an increased Specific Energy Consumption at the Air Compressor (the point of generation of compressed air, and must be taken due care of). Besides, the use of compressed air for body cleaning by the shop floor worker should be discouraged, as there is a high risk of damage to the eyes, ears, as well as the presence of potential cancer causing agents, due to the penetration of fine dust particles in the human skin.

Intervention: Based on the recommendations made from the findings (during the on-site energy audit at the unit), the management decided to replace all the four conventional air guns for cleaning the shop floor, with energy efficient trans-vector nozzles. By using these nozzles, a direct reduction of 30% in compressed air usage was achieved. In turn, these trans-vector nozzles used only 70% of the compressed air, while the remaining 30% was used by sucking the surrounding atmospheric air.

Trans-vector Compressed Air Nozzle

Impact: The implementation of the suggested measures led to a reduction in electricity consumption by over 5,206 kWh annually, reduced specific energy consumption by the air compressor, and an equivalent reduction in GHG emissions as shown below:

5,206 kWh	Rs. 0.46 lacs	4.3 TCO_2
Annual Electricity Saving	Annual Monetary Saving	Annual GHG Emission Reduction

Story Twelve:
Arrest Compressed Air Leakage from Over 20% to 10% Level

Issue: Textile processing is energy intensive, involving large consumption of thermal energy in Equipment Boiler and Thermo-Pac Units, as well as in processes like conditioning and drying, followed by electrical energy consumption in several utility and process machinery. During the energy audit at the unit, ISC's experts found that the compressed air leakage from IR make Centrifugal Compressor of rated capacity 3891 CFM is over 20%.

Intervention: Based on the observations made during the on-site energy audit at the unit, it was proposed to arrange for a leak test of compressed air network on the day of the Plant Shut-down, and use 75 kW ELGI make Air Compressor on standby mode.

Air Compressor and Receiver from the unit

Impact: The implementation of the suggested measures led to a reduction in electricity consumption by over 462,400 kWh annually, and an equivalent reduction in GHG emissions as shown below:

4,62,400 kWh Annual Electricity Saving	**Rs. 30 lacs** Annual Monetary Saving	**379.2 TCO_2** Annual GHG Emission Reduction

Story Thirteen:

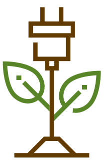
Avoid Compressed Air for Agitation in Homogeneous Tank of Effluent Treatment Plant (ETP)

Issue: Textile processing is energy intensive, involving large consumption of thermal energy in equipment such as Boilers and Thermo-Pac Units, as well as in processes like conditioning and drying, followed by electrical energy consumption in several utility and process machinery. During the energy audit at the unit, ISC's experts found that air agitation was being provided by the Compressor Air from the Centrifugal Air Compressor, in the homogenous tank of the ETP. This was an expensive mode to provide air, and could be discarded.

Intervention: Based on the observations and findings made during the on-site energy audit at the unit, it was proposed that a tapping from the existing twin-lobe blower be provided for homogenization, and stop using Compressed Air.

*Agitation Process (Representative Image)**

Impact: The implementation of the suggested measures led to a reduction in electricity consumption of over 1,11,520 kWh annually, and an equivalent reduction in GHG emissions as shown below:



1,11,520 kWh
Annual Electricity Saving

Rs. 7.30 lacs
Annual Monetary Saving

91.5 TCO_2
Annual GHG Emission Reduction

*Source: https://www.tpomag.com/g/weftec-product-preview/2013/08/new_technology_slated_for_weftec_2013

https://cole.imgix.net/https%3A%2F%2Fwww.tpomag.com%2Fuploads%2Fimages%2Fbio-microbics_myfast_system_180122_084800.jpg?fit=clip&ixlib=php-1.1.0&q=75&w=1000&s=30859c62c3d61904f7c9fee1e2b65eb3

Story Fourteen:

Replace Conventional 36W and 28W Fluorescent Tube Lamps (FTLs) with Light Emitting Diodes (LEDs)

Issue: The textile industry involves precision work and requires proper lighting levels at every section of the shop floor - to avoid any defects on fabrics. During the energy audit, ISC's experts found that the unit was still using the conventional 36W tube lights (151 nos.) and 28W tube lights (640 nos.) on the shop floor and in the workstation area. These lights were highly inefficient and were prone to frequent failure. On the other hand, energy efficient LEDs would provide better efficiency, low power consumption and have lower failure rates.

Intervention: It was proposed to replace all such lights with 18W LED tube lights, in a phased manner. Additionally, certain areas where daylight was well-utilized, the lights could be switched off during the daytime.

Use of day light on the shop floor

Use of LEDs in the production area (post-implementation)

Impact: The implementation of the suggested measures led to a reduction in electricity consumption by 39,804 kWh annually, and an equivalent reduction in GHG emissions as shown below:

39,804 kWh
Annual Electricity Saving

Rs. 3.10 lacs
Annual Monetary Saving

32.6 TCO_2
Annual GHG Emission Reduction

Story Fifteen:

Reduce the Number of Lamps in Use, by Modifying Fixture Arrangement and Location

Issue: Textile processing is an energy intensive process, involving large consumption of thermal energy in equipment such as the Boilers and Thermo-Pac units, as well as in processes like conditioning and drying, followed by electrical energy consumption in several utility and process machinery. During the energy audit, ISC's experts found that each room in the unit had an average of 8 LED lamps of 18W each, providing adequate lux uniformly, across the weaving shed. However, it was observed that lighting was needed closer to the machines.

Intervention: Based on the observations made during the energy audit at the unit, it was proposed that the lamps be relocated just over the machine on the beams. This positioning would provide better illumination, and help save energy by switching off 50% of the lamps.

Impact: The implementation of the suggested measures led to a reduction in electricity consumption by over 42,432 kWh annually, and an equivalent reduction in GHG emissions as shown below:

42,432 kWh
Annual Electricity Saving

Rs. 2.75 lacs
Annual Monetary Saving

34.8 TCO_2
Annual GHG Emission Reduction

Story Sixteen:

Install Variable Frequency Drives (VFDs) For Humidification Fans and Pumps with Relative Humidity (RH) Control

Issue: Textile processing is an energy intensive process, involving large consumption of thermal energy in equipment such as Boilers and Thermo-Pac units as well as in processes like conditioning and drying, followed by electrical energy consumption in several utility and process machinery. During the energy audit, ISC's experts found that there were 2 humidification plants, each consisting of 2 supply air fans of rated capacity 18.5 kW each, and 2 exhaust fans each of rated capacity 18.5 kW. Besides these, there were 2 pumps for each plant as well. All of these fans and pumps were operating at full speed, without control. This led to high power consumption.

Intervention: Based on the observations and on-site measurements at the unit, it was proposed that a VFD (Variable Frequency Drive) be installed for fans and pumps, and adjust the air change by maintaining RH of 75-82%. This intervention would likely reduce power consumption substantially.

Conditioned room in the unit

*RH Sensor to control humidity levels (Representative Image)**

Impact: The implementation of suggested measures led to a reduction in electricity consumption by over 171,360 kWh annually, and an equivalent reduction in GHG emissions as shown below:

1,71,360 kWh
Annual Electricity Saving

Rs. 11.14 lacs
Annual Monetary Saving

140.5 TCO_2
Annual GHG Emission Reduction

*Picture from another unit with the same implemented measure

Story Seventeen:

Replace High Pressure Pump in Reverse Osmosis (RO-3) Plant with New and Energy Efficient Pump

Issue: The Yarn Bleaching process is an energy intensive process, involving large consumption of thermal energy. During the energy audit and measurement at each of the RO systems, ISC's experts observed that the efficiency of the RO-3 main motor was substantially low at 44% (since these motors are of piston-type, hence of low efficiency). Additionally, the pumps were being operated at a high pressure continuously. Based on these observations, it was identified that there was potential to save electricity by replacing the existing motor with an energy efficient pump.

Intervention: Based on the measurement of pumping head and flow, the efficiency of the motor was found to be very low - at a level of 44%. The issue was brought to the notice of the management, and the measured values and results were discussed in detail. It was therefore proposed to replace the old piston-type pump of low efficiency (by design), and install a new, vertical-type energy efficient pump.

Old pumps used in the process

Impact: The implementation of suggested measures led to reduction in electricity consumption by over 13,902 kWh annually, and an equivalent reduction in GHG emissions as shown below:

13,902 kWh	Rs. 0.83 lacs	11.4 TCO_2
Annual Electricity Saving	Annual Monetary Saving	Annual GHG Emission Reduction

Story Eighteen:
Eliminate the Stabilizer in All Sub-Switch Board (SSB) Incomers

Issue: Textile processing is an energy intensive process, involving large consumption of thermal energy. During the energy audit, ISC's experts observed that all SSB Incomers near the voltage stabilizer were used for maintaining a constant voltage level. However, in the LT Panel room, an On-Load Tap Changer (OLTC) was also installed. It was proposed that all voltage stabilizers be switched off and the OLTC be used to regulate the fluctuation in voltage, in Auto Mode.

Intervention: Based on the recommendations made from the findings during the on-site energy audit at the unit, the management decided to switch off the Voltage Stabilizer.

LT Panel room from the unit

Impact: The implementation of the suggested measures led to a reduction in electricity consumption by 1,42,896 kWh annually, and an equivalent reduction in GHG emissions as shown below:

1,42,896 kWh	**Rs. 10.97 lacs**	**117.2 TCO_2**
Annual Electricity Saving	Annual Monetary Saving	Annual GHG Emission Reduction

ISC's EHS+ Center in India aims to provide factory managers with information and tools to improve environment, health and safety conditions for workers and surrounding communities. These trainings focus on increasing resource efficiency, enhancing gender equity and empowerment, and reducing greenhouse gas emissions.

Since 1991, the Institute for Sustainable Communities (ISC) has led more than 115 transformative community-driven sustainability projects in 30 countries including the United States, China, India, and Bangladesh. ISC helps unleash the existing power of local people and institutions to address immediate social, economic, and environmental challenges and opportunities – all while building those on-the-ground solutions into national and international best practices and policy. At the heart of the organization's approach is results-focused, authentic, and pragmatic engagement with all stakeholders, which unearths locally-driven and equitable solutions to the biggest challenge we face – global climate change. Learn more at sustain.org