Bangladesh Water PaCT:
Partnership for Cleaner Textile

Cleaner Production Assessment Report

Prepared for:

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Supported by:
Asia Society for Social Improvement and Sustainable Transformation (ASSIST)

May 10, 2015

Acknowledgement

ERI Team acknowledges with gratitude to Mrs AyshaSiddika., Assistant General Manager, Admin, HR & Compliance – IndesoreSweaterLtd., Dhaka. Mrs AyshaSiddikaand her teams of Indesore Sweater Ltd. for the excellent co-operation during the visit and for providing necessary information to carry out the assessments.

# #

About PaCT

PaCT is a partnership between textile wet processing factories in Bangladesh, international apparel buyers, wet processing technology suppliers, the Embassy of the Kingdom of the Netherlands (Dhaka), the International Finance Corporation (IFC), and the NGO Solidaridad.

The PaCT partners share a commitment to bring about systemic, positive environmental change for the Bangladesh textile wet processing sector, its workers and surrounding communities, and to contribute to the sector's long-term competitiveness.

To this end, the PaCT partners are collaborating to develop harmonized resource-efficiency procurement requirements, build factory capacity, technical knowledge, and access to finance for investments for Cleaner Production, and create a platform for community and national dialogue on sustainable use of water in the textile sector.

IFC has commissioned Asia Society for Social Improvement and Sustainable Transformation (ASSIST), India to support the local service provider Engineering Resources International (ERI) Ltd. based in Dhaka, Bangladesh for the execution of 50 basic CP assessments.

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This report has been based on the available documents and verbal communication with factory staff and management. It is important to notice that although some compliance issues related to WASH and OHS are discussed, this report has not been prepared for compliance purposes. The content is based on voluntary information provided by the factory management and test data generated by the local service provider and factory staff. The information is time dependent, and the relevance of data, conditions of site and observations may change.

List of Acronyms and Abbreviations

BDT	Bangladeshi Taka
BOD	Bio-chemical Oxygen Demand
COD	Chemical Oxygen Demand
CPA	Cleaner Production Assessment
dB	Decibel
DoE	Department Of Environment
EMS	Environmental Management System
GHG	Green House Gas
ETP	Effluent Treatment Plant
ISL	Indesore Sweater Ltd
IFC	International Finance Corporation
IPPC	Integrated Pollution Prevention Control
KPI	Key Performance Indicator
kVA	Kilo Volt Ampere
kVAr	Kilo Volt Ampere (Reactive)
kW	Kilo Watt
kWh	Kilo Watt Hour
MSDS	Material Safety Data Sheet
MWh	Mega Watt Hour
NAV	Not Available
NG	Natural Gas
OHS	Occupational Health & Safety
PFI	Power Factor Improvement
pH	Power of Hydrogen
PPE	Personal Protective Equipment
REB	Rural Electrification Board
RPM	Revolution per Minute
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
VFD	Variable Frequency Drive
WASH	Water Sanitation & Hygiene
WHRB	Waste Heat Recovery Boiler
WTP	Water Treatment Plant

Executive Summary:

Indore Sweater Ltdis a washing processing unit,havingawashingcapacity of 5000 pcs (1520 kg) per day.

Except wet process, the factory has set up for washing units within the same premise. The washing and finishing units run for approximately301 days in a year over 1shift (general) per day. The total number of workers in the dyeing and finishing section is 35,nofemale workers.

Resource and Energy:

The consumption summary is given below:

Parameter	Unit	Annual consumption	Remarks
Power consumption	MWh/year	335	Based on data provided by the factory
Natural Gasconsumption	m^3/year	203,216	Based on data provided by the factory
Water consumption	m3/year	65,919	Based on available water flowmeter readings

**Based on 2014 data*

Assessment outcomes:

The Cleaner Production Assessment (CPA) at ISL showed that significant reduction can be achieved in the consumption of water (3%) and natural gas (19%). Based on the findings of the CPA, 5 cost-effective measures for achieving significant water and energy reductionhave been identified.The summary is given below:

Area	Total number of options	Estimated investments, *USD	Economic benefits, USD/year	Environmental benefits/year
Utility	5	3,059	5,147	Water savings: 2,164 m^3 NG savings: 37,655 m^3 Electrical energy savings: 19 MWh GHG emission reduction: 75 ton
Total	5	3,059	5,147	Water savings: 2,164 m^3 NG savings: 37,655 m^3 Electrical energy savings: 19 MWh

				GHG emission reduction: 75 ton

**1 USD = BDT. 78.00*

KPI:

Implementing the improvements lead to the following reductions in the consumption dominant resources:

Parameter (based on 2014 data)	Unit	Current KPI	Future KPI	Reduction %
Water consumption	m^3/year	65,919	63,755	3%
Natural Gas consumption	m^3/year	203,616	165,961	19%
Steam consumption	ton/year	4,328	4,323	0.13%
Power consumption	MWh/year	335	309	6%

Cleaner Production Measures:

The details of the options generated for their benefits along with investment requirement is grouped below for implementations:

#	Measure	Estimated investment USD	Economic benefits USD/year	Environmental benefits/year	Payback time, month
Utility Area					
1	Feed tank insulation	82	44	• NG savings: 410 m3/year • GHG emission reduction: 1 ton/year	22
2	Heat recovery from all condensate	256	1,165	• Water savings: 2,164 m3/year • NG savings: 13,347 m3/year • GHG emission reduction: 25 ton/year	3
3	Provide lighting control switch at accessible position and switch off lights	Nil	803	• Electrical energy savings: 7 MWh/year • GHG emission reduction: 2 ton/year	Immediate

#	Measure	Estimated investment USD	Economic benefits USD/year	Environmental benefits/year	Payback time, month
4	Installation of VFD for deep pump	1,438	1,338	• Electrical energy savings: 12 MWh/year • GHG emission reduction: 8 ton/year	13
5	Air preheater for boiler	1,282	1,795	• NG savings: 23,898 m3/year • GHG emission reduction: 45 ton	9
6	Improving metering system	Minor	Process improvement	-	-
Total		**3,059**	**5,147**		**7**

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1 Introduction

1.1 Company Overview

Company name:**Indesore Sweater Ltd.**

Address:

Head office:	Factory:
Degerchala, National University, Gazipur Sadar, Gazipur-1704	Degerchala, National University, Gazipur Sadar, Gazipur-1704

Year of establishment: 2008

Company structure: This factory is the only establishment of the company forsweaterwashing production.

Production overview: Indesore Sweater Ltd. was establishedsweaterwashing production facility.Presently, the factory has an installed capacity of around 1.25 lakh pcs/month for washing.

Clients: The major clients are H&M

Expansion plan: Indesore Sweater Ltd.

Number of employees: Presently, about 2600 employees including 520 female employees are engaged in the factory. In addition there are 10 management staffs includingafemalestaff.

Existing pollution control facilities: Factory discharges effluent water for treatment at a rate of 15 m^3/hr to the Effluent Treatment Plant,which is operated only 3-4 hrs. Currently, there is no monitoring arrangementto measure air emission pollutions.

Certifications: The factory has applied foranenvironmental clearance certificate from the Department of Environment (DoE), Government of Bangladesh. The factory's product range is certified against Oekotex 100 standard. They are also certified by ISO 14001, OHS 18000, SA 8000 and GOTS.

1.2 CP Team

Factory CP Team:

In order to carry out the CP assessment, a CP team was established at the factory level. Following are the members of the CP team:

Name	Designation	Designated Role in CPA
Mrs.AysaSiddika	Assistant General Manager, Admin, HR & Compliance	Coordinator
Md. Delwar	Supervisor	ProcessCoordinator
Md. Abdur Rob	Electrical Incharge	Utility Team Member
Md. Akter Ali	Senior Executive, Admin , HR & Compliance	Compliance Coordinator

The factory's CP team wasvery co-operative during the assessment.However, there is scope for strengthening the awareness on CP concept and benefits among the core team members. Sharing a standard paper prior to and during assessment can be helpful to get them involved and committed. CP core team can further disseminate the basic concepts and benefits across the factory staff.

Assessor CP Team:

The CP Assessment was carried out by following the team.

Name	Designation	Designated Role in CPA
Md. Shamsul Islam Khan	Senior Manager (Engineering Service)	ProjectCoordinator
Amin Al maksud	Senior Engineering Consultant	Utility Member
Md. SamiulHoque	Senior Engineering Consultant	Team Leader
Sathappan S	Sr. Technical Expert	OHS, WASH & EMS Consultant
Nageshkumar J	Sr. Technical Expert	Utility Consultant
Rajachidmabaram T	Sr. Technical Expert	Chemical & Safety Consultant

2 Overview& Current Baselines

2.1 Description of ProductionProcesses

ISL is a washing processing unit (washing& finishing) and capacity 1,520 kgper day.

The major production sequences of the factory are given in Figure 1.

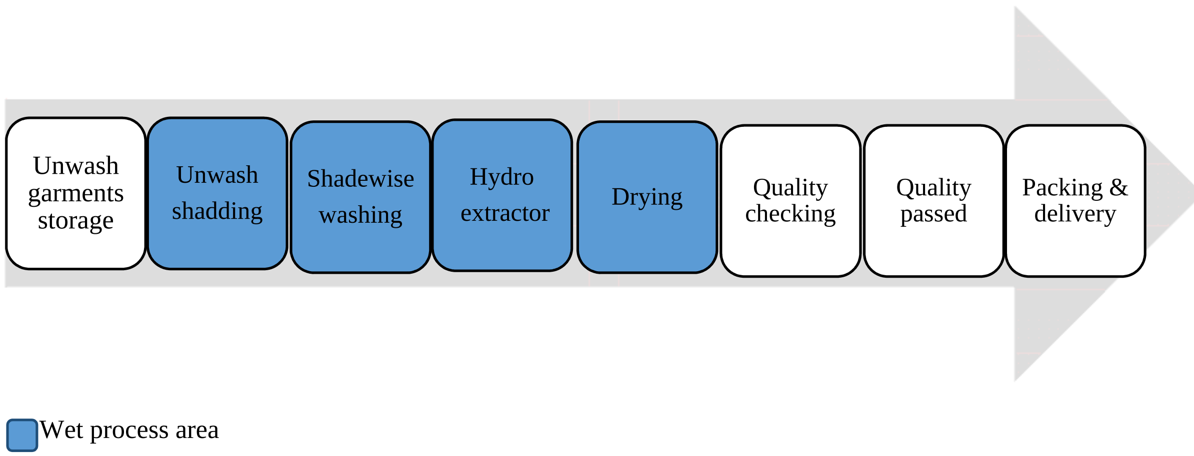

Figure 1: Process sequence for sweater washing

2.2 Actual Production

The average yearly productions for 2013-14 are shown below:

Product type	Yearly production	%	Products
Washing	456,000kg	100	Sweater washing

**based on 301 days/year. (Filled in data are based on 2013-14 year)*

2.3 Main Inputs

2.3.1 Water

The source of water for the factory is ground water. Submersible pumps are used to abstract water.

Source	Average consumption/year	Cost/year, USD
Ground water	65,919m^3	7,103

**1 USD = BDT. 78.00*

***Water cost: 36.9 BDT/m^{3}which includes water pumping & distribution cost, treatment cost and effluent treatment cost & only water pumping & distribution cost BDT 5.9 and ETP Cost BDT 31.(Filled in data are based on 2013-14 year)*

Water Baseline (KPI):

The water consumption KPI for the wet section has been calculated and presented below:

Product	Average water consumption	Average water cost/kg of product, USD
Sweater washing	14l/kg	0.01

Metering & Water Management:

ISL has installed 4 water flowmeters to partially measure the water extraction, water consumption in major processes and ETP discharge volumes. Meter readings are recorded and no water balance diagram has been established so far. As a result, no consumption analysis is carried out to establish baseline performances against different sections.No calibration plan exists for water flowmeter.

Water Balance Diagram

A water balance diagram has been established based on flowmeter readings and on-site assessment. A total of4water flowmeters are available in the factory at different points. Since water consumption data in different sections is not available water flowmeter readings are taken during assessment and these are matched with estimates of water consumptions for various operations provided by factory CP team. Clearly, the accuracy of the water balance depend on theflowmeter accuracy and the consumption data provided .

Figure 2: presents the corresponding water balance diagram:

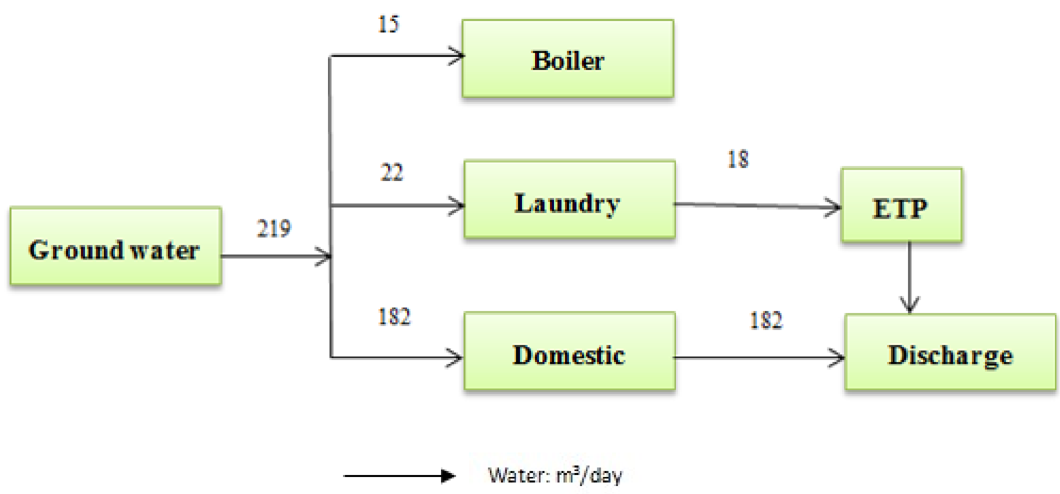

Figure 2: Water Balance Diagram

From the water balance diagram,it is perceived that the major portion of water is being consumed at the washing section.

2.3.2 Energy:

The factory is dependent on the national natural gas supply for running major equipment like boilers and few process machineries. The factory has a power supply connection from REB. Diesel are used at emergency situation to run generators.

Fuel type	Average consumption/year	Cost/year (2014), USD
Gas	203,616 m^3	15,297
Diesel	7,200 ltr	6,277

**Combined power cost: 10.33 BDT/kWh.(Filled in data are based on 2013-14 year)*

Electrical Energy Baseline (KPI):

The electrical energy consumption KPI for the wet processing section has been calculated and the value is shown below:

Product	Average power consumption	Average power cost/kg of product, USD
Washing	0.73 kWh/kg	0.08

Metering &Power Management:

Currently, no meter is available at the factory to measure power consumption at user point, except energy meter at REB power grid supply system.In the diesel generation side, the readings are not captured and no analysis is carried out.

Electrical Energy Balance Diagram

Electrical energy balance diagram is established using the actual power generation data taken during assessment period and load balance data given by factory. The data accuracy for the generation side should be reliable whereas consumption data would have some uncertainty.

Figure 3 presents the electrical energy balance diagram determined for the factory:

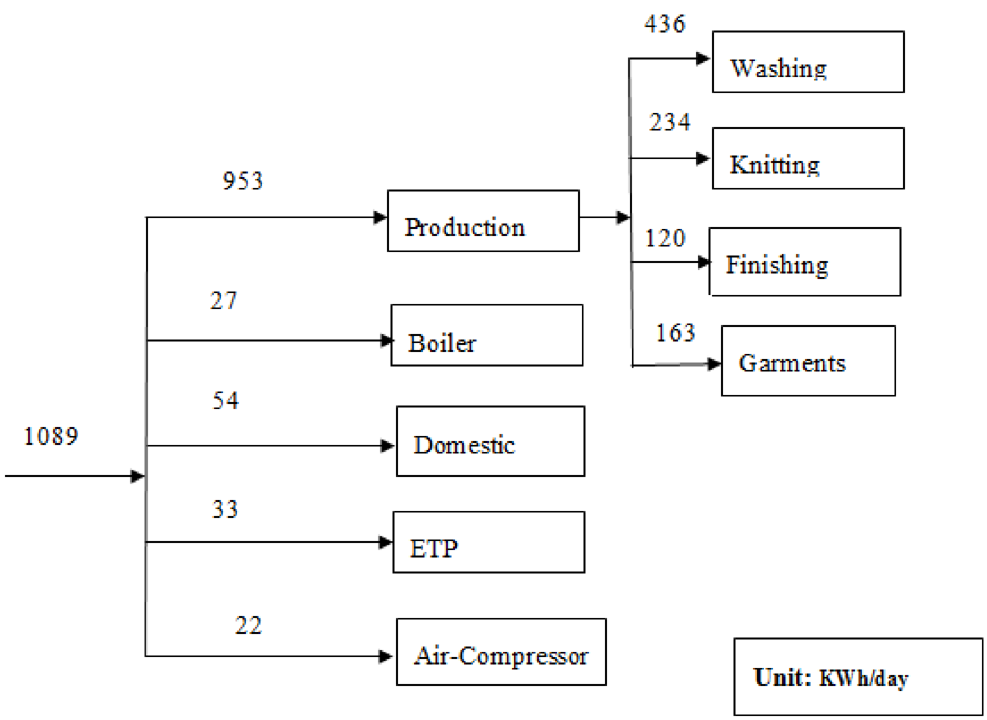

Figure 3: Electrical Energy Balance Diagram

From the energy balance diagram, it is clear that production units arethemajor consumersof energy.

Steam Baseline (KPI):

The steam consumption KPI for the wet processing section has been calculated and presented below:

Product	Average steam consumption	Average steam cost/kg of product, USD
Washing	9.49 kg/kg	0.08

Since no metering is available, figures have been generated from calculations based on the data collected on-site.

Metering & Steam Management:

Currently, no meter is available in the factory to measure steam generation as well as steam consumption.

Steam Energy Balance Diagram

No meter is available in the factory to measure the steam generation as well as steam consumption. Steam balance diagram is established considering boiler specifications, running hour, feedwater consumption pattern and steam flow parameters at consumer ends.

Figure4 presents the steam balance diagram created for the factory:

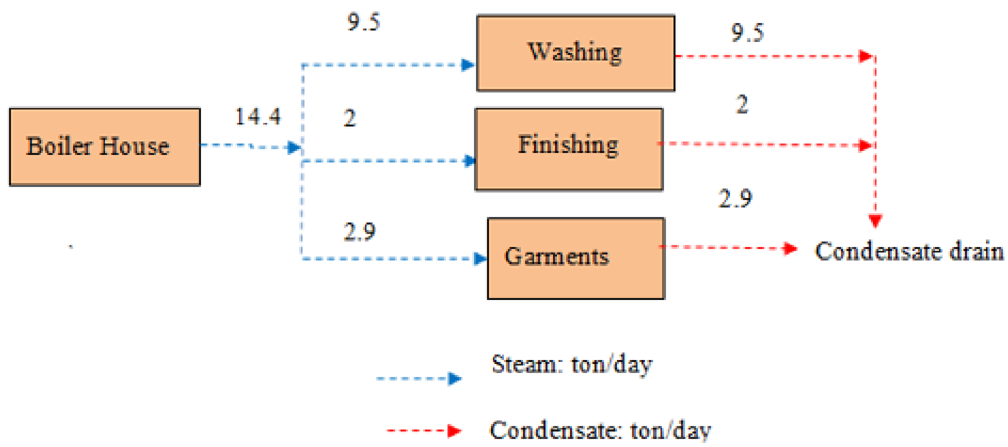

Figure 4: Steam balance diagram

2.3.3 Process Chemicals & Dyes:

The quantity and cost of the chemicals and dyes used for the process are given below,

Raw materials	Average consumption/year	Cost/year, USD
Chemical & dyes for washing*	9ton	NAV

**From ISL management.(Filled in data are based on 2013-14 year)*

2.4 Main Equipment

Process:

The required automation is built-in with new machines. There is no metering system with the machines. There are eight sets of washingand finishing range machineswhich have manual and automated operation capabilities. A maintenance team is working in the factory and preventive maintenances are done periodically. Establishing a preventive maintenance schedule, generating breakdown reports and analysing data would help minimizing the recurrences.

<u>Washing Section Machines</u>:

#	Name of Equipment	Origin	Model/Capacity	Year of manufacture	Quantity
1	Washing Machine	China, NGAI	110 lbs	NAV	8 sets
2	Hydro Extractor	China, NGAI	200 lbs	NAV	8 sets
3	Auto Gas Dryer	China, NGAI	200 lbs	NAV	2 sets
4	Dryer	China, NGAI	200 lbs	NAV	7 sets
5	Moisture Meter	Germany	NAV	NAV	1 set

**NAV = Not Available*

Utility:

ISL is used as a prime source of electricityREB grid while diesel generator used as standby. Both gas fired boiler with no economizerrunsaround the clock. Compressed air is supplied by air compressors. Preventive maintenance schedules are maintained.

#	Equipment type	Number of Machine	Installed Capacity	Unit
1	Boiler	2	2	ton/hr
2	Diesel Generator (Stand by)	2	1,056	kw

3	Air Compressors	1	7.5	kW
4	Major pump Motors	2	22	kW

2.5 Waste Streams

Waste Stream	Average generation	Remarks
Wastewater	18 m^3/day	From ETP Flow meter reading
COD in discharging water	0.52 ton/day	From ETP outlet water quality report
Solid waste (ETP sludge)	4 kg/day	Sold to authorized buyers and 3rd parties
Solid waste (others)	0.2 ton/day	Sold to authorized buyers and 3rd parties
CO_2 emission (GHG effect)	02 ton/day	CO_2 emission factor: 0.000203 ton CO_2/kWh CO_2 emission factor: 0.001888 ton CO_2/m^3 NG

Waste Stream Characterisation

Wastewater analysis is carried out by outside agencies and one report is available on wastewater characteristics. Some minor variations are observed in the various parameters in these reports. The analysis presented in the last available report is shown below.

Factory provided report results (done by BUET, on 19/6/2014):

Waste stream/Parameters	TDS, (ppm)	pH	Temperature (^{0}C)	COD (mg/l)	BOD (mg/l)	DO (mg/l)
Inlet water to ETP	NA	NA	NA	NA	NA	NA
Outlet water from ETP	NA	7.32	NA	44	12	NA
DoE Requirements	<2,100	6.0-9.0	*NS	<200	<50	4.5-8.0

**NS: Not specified*

2.6 Water Footprint

Factory uses ground water to meet all its processing needs.Generatedwastewaters are discharged into the canal after treatment in the ETP.

Water Footprint has been calculated from the available data. The following table shows the values of various Blue and Grey water footprint of the factory.

Blue Water Footprint:

Parameter	m^3/day	m^3/kg of product
Blue water footprint for factory	219	0.17
Blue water footprint for washing	18	0.014

Post data source: Factory flow meter

2.7 Water Sanitation & Hygiene (WASH)

Overall Drinking Water Supply System:

- Source of the drinking water: Underground water.
- Water treatment of drinking water (filtration, cooling): Water treatment is available and 1 dispenser is provided for water.
- Water quality: Drinking water tested twice in a year form BUET.
- Test report is available and water parameters are within acceptable limits.
- Drinking water management: Workers collect drinking water from a container transferred by a tank.
- Drinking water frequency: 5-6 times by each worker per day.
- The responsibility for proper functioning: There is a responsible person in the factory for maintaining the drinking water facilities.

Existing Sanitation Facilities:

- Labour law: Currently the toilet to worker ratio is 1:7 for males.
- Showers and washing rooms: Not available.
- Responsibility for sanitation**:** There is a responsible person in the factory for maintaining the sanitation facilities.

2.8 Occupational Health & Safety (OHS)

The factory has established an operating structure to manage health and safety issues. The following good practices are in place:

- A health and safety policy is in place.
- PPE are provided to workforce.
- Fire equipment like fire extinguishers and fire hydrant systemsareavailable in sufficient number.
- Floor demarcations are done andwell maintained.

- First Aid boxes are available in the process area.
- Emergency exit sign,evacuation plan and safety awareness posters are available in the process area.
- Trainings are conducted when required.
- Factory maintains a common register for all accident records; dyeing section accidents are not kept separately. For 2014 the overall accident rate was 4/month.
- An emergency response team (Fire and First Aid team) has been established.
- Mock emergency drills are organized frequently.

There are some observations for "Occupational Health & Safety (OHS)" which are given below:

- The main chemical store is well organized. The following were observed in the chemical sub-store, although these could be easily improved:
    a) Labelling is not consistent
    b) Secondary containment is missing for liquid chemicals
    c) MSDS is not displayed for all chemicals and dyes
    d) Eyewash and shower need improvements
    e) Chemical handling procedure is not available
- Materials were stored on the walkway and behind the machines in some of the places in the wet processing zone.
- Appropriate number of PPE is supplied, but workers often appeared reluctant to use it properly.
- A number of electrical panels were found open in which dust accumulation could increase the fire and safety hazards.
- Appropriate number of fire extinguishers and fire alarms are available in the factory premises; however, no visual signalling deviceis present in the high noise areas such as the generator room.

2.9 Chemical Inventory

- The factory is aware of the banned chemicals and collects compliance statements from all of their suppliers in order to avoid unintentional use.
- Their product range has been certified against Oekotex standard 100 which warrants that textiles are free from harmful substances.
- An inspection of the chemical storage and available MSDS didnot reveal any banned chemicals.

2.10 Environmental Management System (EMS)

The factory has established a simplified environmental policyandprocedure. General awareness programs are organized for the workforce on water use reduction and waste management.

The factory has the clearance certificate from the Department of Environment (DoE). Periodic checks are being carried out as per law. An operational ETP treats the wastewater generated in the factory before discharging.

Some observations are found during the assessments which are given below:

- There are designated areas to store wastes; however, segregation and labelling are not always in place. A waste management procedure needs to be developed.
- HR & Admin officer have shared responsibilities for the environmental issues; however, no specific person is assigned to work on it.
- No structural approach to address environmental issues.

3 Assessment and Cleaner ProductionOptions

3.1 Opportunities in Utility Area:

Option 1:Feed Tank Insulation

Observation: Feed tank un-insulated

Description of option	Technical feasibility	Environmental feasibility	Economic feasibility
Un-insulated tank reduce heat loss.	• Proven technology	• NG saving: 410 m^3/year • GHG emission reduction: 1 ton/year	• Estimated investment: 82 USD • Annual saving: 44 USD • Payback: 22 months

Option 2: Heat Recovery from Condensate

Observation: It is noted during assessment that condensate is drained instead of recovering it from the garments Iron section& dryer because of condensate return system available.

Description of option	Technical feasibility	Environmental feasibility	Economic feasibility
Adapting a complete system to recover all possible condensates and utilize both heat and water.	• Proven technology	• Water saving: 2,164m^3/year • NG saving: 13,347m^3/year • GHG emission reduction: 25 ton/year	• Estimated investments: 256 USD • Annual savings : 1,165 USD • Payback: 3 months

Option 3: Providing Lighting Control Switch at Accessible Position & Switch off Lights

Observation: At daytime unnecessary lights switch are on.

Description of option	Technical feasibility	Environmental feasibility	Economic feasibility
The switches for the lamps are provided near the roof making it difficult for switching off & daytime switch on where no need lights.	• Known technology and available materials	• Electrical energy saving:7 MWh/year • GHG emission reduction: 2	• Estimated investment: Nil • Annual saving: 803 USD • Payback: Immediate

		ton/year	

Option 4: Installation VFD for Deep pump

Observation: There is no VFD for deep pump.

Description of option	Technical feasibility	Environmental feasibility	Economic feasibility
Installation of VFD for deep pump willsave significant amount of electrical energy.	• Known technology and available materials	• Electrical energy saving: 12 MWh/ year • GHG emission reduction: 3 ton/year	• Estimated investment: USD 1,438 • Annual saving: USD 1,338 • Payback: 13 months

Option 5: Air Preheater for Boiler

Observation: Currently, exhaust gas heat of boiler are not utilised.

Description of option	Technical feasibility	Environmental feasibility	Economic feasibility
Significant amount of gas can be saved by installing an air pre-heater.	• Known technology and available materials	• NG saving: 23,898 m3/ year • GHG emission reduction: 45 ton	• Estimated investment: 1,282 USD • Annual saving: 1,795 USD • Payback: 9 months

Option 6: Improving metering system

Observation: Presently the factory has the following metering systems;

- Total 4 water flowmeters are installed onthedistribution lines across different sections and at ETP inlets.
- Energy meters are available with theNationalPower Supply system, but are not available in each section or with major equipment& diesel generator.

No steam meters are available

Description of option	Technical feasibility	Environmental feasibility	Economic feasibility
A proper metering system will help understanding the consumption patterns and allow	Meters available	No impact	No straight forward payback, but metering will help to set benchmarks, allow data

analysis which could be used to determine corrective measures for any unusual resource usage.			collection and analysis, monitor and identify unusual resource usage and help determiningnecessary corrective actions.

Measuring consumption will automatically lead to an improved awareness and a strengthened resource management. Similar textile industries have shown that water consumption could be reduced between 20 to 40% and energy consumption between 10 to 20%.

3.2 Opportunities in Water Sanitation & Hygiene (WASH)

Suggestions for Drinking & sanitation Water Facilities Supply System:

Factory management can arrange awareness sessions to improve the hygiene practices of workers in a healthy environment.

#	Description of option	Investment Category	Environment Impact
1	Ensure drinking water quality and testing frequency as per regulatory standard	Minor	Regulatory Compliance
2	Ensure cleanliness of toilets and availability of hand wash materials at toilets	Minor	Ensure healthy and hygienic environment
3	Raise awareness among workforce on hygiene practices	-	Ensure healthy and hygienic environment

3.3 Opportunities in Occupational Health & Safety (OHS)

From the assessment, following few areas have been identified where an improvement can enhance the safety standards:

#	Description of option	Investment Category	Environment Impact
4	Improve housekeeping	Minor	Ensure safe working environment
5	Improve electrical safety and machine guarding	Minor	Ensure safe working environment
6	Strengthen the accident investigation procedure	Minor	Ensure safe working environment
7	A monitoring system could be in place to ensure usage of PPE.	Minor	Ensure safe working environment

8	Briefing sessions and trainings could be arranged for the associated workforce on electrical hazards, their consequences, safe practices and corresponding mitigation actions	Minor	Ensure safe working environment
9	Forced ventilation could be ensured to avoid high temperature	Minor	Ensure safe working environment
10	A housekeeping check sheet and periodic monitoring program could be developed and used to create a sustainable system	Minor	Ensure safe working environment

Note: Relevant checklist is showninthe Annex

3.4 Opportunities in Chemical Inventory

#	Description of option	Investment Category	Environment Impact
1	Improve labelling and MSDS display	Minor	Ensure safe handling
2	Standardize the chemical sub-stores	Minor	Ensure safe working environment
3	Secondary containment needs to be ensured for liquid chemicals	Minor	Ensure safe working environment
4	User friendly eye wash and shower with continuous water supply facility needs to be ensured	Minor	Ensure safe working environment

3.5 Opportunities in Environmental Management System (EMS)

The factory has established a simplified environmental policyandprocedure. General awareness programs are organized for the workforce on water use reduction and waste management.

The factory has applied fortheclearance certificate from the Department of Environment (DoE). Periodic checks are being carried out as per law. An operational ETP treats the wastewater generated in the factory before discharging.

#	Description of option	Investment Category	Environment Impact
1	Establish specific environmental policy and procedures	Minor	Ensure environmental awareness and compliance
2	Proper labelling and segregation of waste	Minor	Ensure environmental awareness and compliance

3	Waste management procedures' development and training	Minor	Ensure environmental awareness and compliance
4	Assign roles and responsibilities to achieve environmental improvement targets	Minor	Ensure environmental awareness and compliance

4 Conclusion

4.1 Impact Summary of Measures Recommended

Total 5 options have been identified in the utility section. A summary is given in the table below:

Area	Total number of options	Estimated investments, *USD	Economic benefits, *USD/year	Annual environmental benefits
Utility	5	3,059	5,147	Water savings: 2,164 m^3 NG savings: 37,655 m^3 Electrical energy savings: 19 MWh GHG emission reduction: 75 ton

**1 USD: BDT. 78.00*

The total amount of savings calculated is 5,147 USD. The savings are based on the reduction in costs of water, steam, natural gas and electricity usage. The total estimated investment to realize all the recommended benefits is 3,059 USD, with an estimated payback period of about 7 months.

4.2 Impact Measures on Savings (Percentage Reduction)

The main objective of the CPA is to assess Water, Energy, Chemicals, Occupational Health & Safety (OHS), WASH, Water Footprint and the Environmental Management System (EMS). The chart described below gives a qualitative assessment in the above mentioned major four areas. The general assessment of the industrial set up is given in the centre. The factory team and the senior management were found to be very cooperative and have supplied the required data to the best of their abilities.

At ISL,thirteen options have been identified in the process and utility areas, which have the potential to save approximately 5,147 USD with an investment of 3,059 USD.The resource savings compared to the consumption is shown in the table below:

Resource/impact	Annual savings	Annual consumption/generations
Water, m^3	2,164	65,919 (3% reduction)
Electricity, MWh	19	335 (6% reduction)
NG, m^3	37,655	203,616 (19% reduction)
Steam, ton	6	4,328 (0.13% reduction)
GHG, ton CO_2e	75	466 (16% reduction)

5 Annex

The following documents are available upon request:

- Pre-assessment checklist
- Water footprint checklist
- WASH checklist
- OHS/EMS checklist
- CP checklist
- Certifications: DoE Clearance Certificate, Oekotex
- Water test reports (raw, WTP outlet, boiler feed water)
- Confirmatory certificates from Suppliers against non-existence of bannedchemicals
- Relevant Photographs against options
- Layouts (Electrical distribution, Compressed air, Cooling water, Steam and condensate, ETP, water etc.)
- Solid waste list
- Saving calculations against the options