STWI Projects in Bangladesh 2016

IRIS Fabrics Ltd.

Zirani Bazar, Kashimpur

Gazipur

Unit Assessment Report
June 2016

Prepared by

Brand Partners

Acknowledgement

ERI expresses its gratitude to Md. RasheedAlam, Managing Director, IRIS Fabrics Ltd. for his supporting and inspiring the factory management for participating in the 'Sweden Textile Water Initiative (STWI)' Program. ERI also appreciates the efforts of Mr. Probir Sarker, Mr. Ahsan Halim and the whole team of IRIS Fabrics Ltd for their excellent co-operation during the visit and for providing useful information needed to carry out the assessments.

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This report has been prepared based on information that consultant believes to be reliable and accurate. Consultant does not warrant the accuracy or completeness of the information or any projections based on current information. The projections are based on assumptions where information is not available to the consultants. The information in these reports is based on the information provided by the factory during assessment period. Consultant cannot guarantee the accuracy either of that information or of our data entry process. All information in these reports may be subject to change. Factory has the responsibility to confirm any information and check any calculations and alert the consultant to any errors.

List of Acronyms

BDT	Bangladeshi Taka
ComMIT	Resource Conservation Monitoring & Management Integrated Tool
CNG	Compressed natural gas
EMS	Environmental Management System
ERI	Engineering Resources International
ETP	Effluent treatment plant
HTHP	High temperature high pressure
IFL	Iris Fabrics Limited
KPI	Key Performance Indicator
kWh	Kilo Watt Hour
M:L	Material and liquor ratio
MWh	Mega Watt Hour
NG	Natural gas
PF	Power factor
PFI	Power factor improment
REB	Rural Electrification Board
SIWI	Stockholm International Water Institute
STWI	Sweden Textile Water Initiative

Executive Summary

IRIS Fabrics Ltd. (IFL) is involved in the knit fabric dyeing & finishing. The factory also has attached garments. It has an annual dyeing & finishing capacity of approximately 6,000 tons of knit fabric and knitting capacity of 4,000 tons of garments.

The factory extracts ground water with four submersible pumps of total 68 kW. Main power source of the factory is captive power generated by two gas generators with a capacity of 1,030 kW each. IFLalso has power connection to the national grid, Rural Electrification Board (REB) as standby. It has three diesel generators with a total capacity of 580 kW as emergency backup. A natural gas (NG) fired boiler is available with 10 tons per hour steam generation capacity for supplying steam for dyeing, finishing and garments section. The unit has one functional effluent treatment plant of capacity1,600m^3/day.

Resources Saving KPI (Baseline and Target):

Following is a summary of the baseline consumption, estimated savings along with the investment and Green House Gas (GHG) savings:

	Water (m^3/year)	Natural Gas (m^3/year)	Power (MWh/year)	Chemical (kg/year)	GHG Saving (ton eCO_2)
					
Baseline Consumption[1]	691,545	5,435,194	7,682	718,800	12,682
Saving Potential Identified	7,498	987,324	831	35,940	1,872
Investment (Estimated)	BDT 22,510,500 (USD 288,596)				
Financial Savings (Projected)	BDT 9,912,069(USD 127,078)				
Payback Period	27 months				

Capacity building target through Awareness Raising session and Workshops 500	Workshops	Awareness Raising Session
	• Proper chemical management and handling • Proper boiler operation and steam management • ETP and wastewater treatment	One general awareness raising session among staff and workers on water, energy and chemical saving

KPIs have been identified for IFL and target is set for 2016:

[1] ***Baseline year has been considered 2015 and all the calculation is based on the production Jan'15-Dec'15***

Parameters	Present KPI	Target KPI	Unit	Estimated Savings
Ground water	142	141	l/kg	1%
Process Water	117	116	l/kg	1%
Natural Gas	1.04	0.85	m^3/kg	18%
Power	1.59	1.42	kWh/kg	11%
Chemicals*	0.144	0.137	Kg/kg	5%

Chemical data provided by the factory seems to be inconsistent considering the production

KPIs have been estimated on the basis of annual production of 4,999,583 kgof knit dyeing fabric (Jan –Dec, 2015)

Projects and savings potential:

The unit has a potential to save 1% water, 18% NG, 11% powerand 5% chemicals from the 9 quantifiable projects identified which show a total saving of BDT 9,912,069/year with an estimated investment of BDT 22,510,500. In addition, 5 unquantifiable projects have been identified which will indirectly generate more savings.

Table 1: List of projects suggested for 2016

Sl. No.	Projects	Investments (BDT)	Financial savings (BDT/year)	Report Section
1.	Clutch motors replaced by servo motors	8,712,000	3,592,115	See 6.4.1
2.	Energy efficient lighting installation	1,147,500	1,295,429	See 6.4.2**Error! Reference source not found.**
3.	Exhaust heat recovery boiler installation	10,000,000	2,065,384	See 6.4.3
4.	Economizer installation to recover heat from boiler stack gas	2,500,000	1,059,240	See 6.4.4
5.	G-Traps installation in steam irons	96,000	462,516	See 6.4.5

6.	Burner tuning for improved combustion efficiency	15,000	1,234,332	See 6.4.6
7.	Dedicated washing facility for dyeing house	40,000	34,334	See 6.4.7
8.	Process chemical consumption reduction by process optimization	-	161,094	See 6.4.8
9.	Adopt automatic dye and chemical dispensing system	-	8,626	See 6.4.9
Sl. No.	**Projects (Non-Quantifiable)[2]**	**Investments (BDT)**	**Financial Savings (BDT/year)**	**Report Section**
10.	Replacing normal water taps with stop taps	-	-	See 6.5.16.5.1
11.	Conducting compressed air leak test regularly	-	-	See 6.5.2
12.	Using air cooler pads in garments floor	-	-	See 6.5.3
13.	Moisture sensor installation for stenter machine	-	-	See 6.5.4
14.	Proper metering and monitoring system development	-	-	See **Error! Reference source not found.**0
TOTAL		22,510,500	9,912,069	

[2]Non-quantifiable projects are the projects where direct savings cannot be estimated.

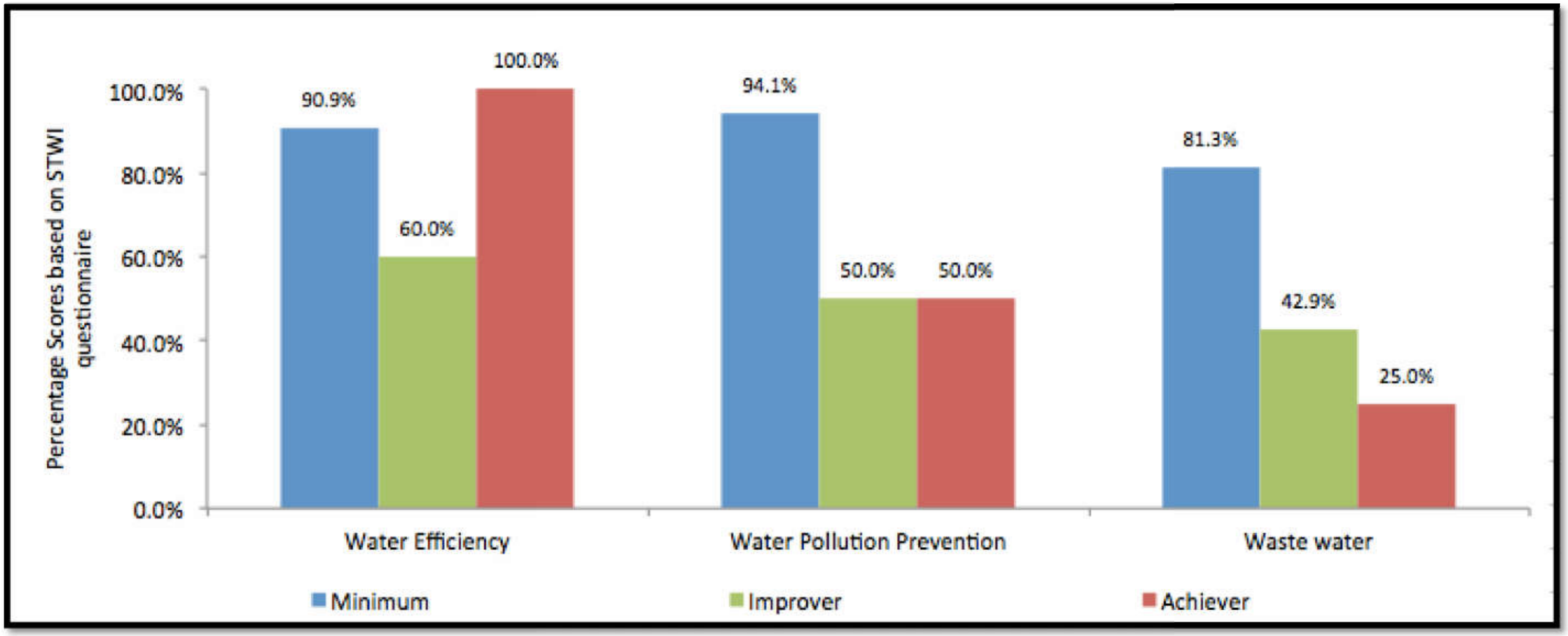

Figure 1: Performance of IFL according to STWI Guideline[3]

[3] Details in Appendix-2

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1 Sweden Textile Water Initiative (STWI)

1.1 STWI Projects and it's Goal

Fresh water is a scarce resource and access to it even scarcer. While the textile sector has been instrumental in the tremendous growth of Bangladesh over the past decade contributing over US$ 24 billion in exports and creating employment for nearly 4.5 million people, it has also been consuming over 1,500+ million m^3 of ground water annually, and is considered the second largest polluter.

In this context, SIWI with 33 leading Swedish firms have come jointly to form STWI program to address water risk in supply chains of these fashion brands. The genesis of the program was seeded in the launch of the Guidelines developed bySTWI. The guidelines will work as a tool for textile and leather factories to improve water management.

During 2013-14 a pilot program was conducted in India to test the guidelines. After successful completion of the pilot projects in India, SIWI is now scaling-up this project in textile intensive regions like- Bangladesh, China, Ethiopia and Turkey. The new scaled-up program is entitled "STWI Projects-Sustainable Water Management Program for Textile Industries". So far, 30 textile wet and RMG processing units have joined STWI program in Bangladesh.

The aim of the 2016 program is to:

a) *Continuously build the capacities of management and workers of production companies on improving the efficiency of water, energy and chemical use systematically in their suppliers' manufacturing processes to achieve pre-set, annual quantitative and qualitative targets.*

b) *Continue to provide support to Production Units to implement recommended projects to achieve these targets at the factory level throughout the year.*

c) *Continue to build out a network of Production Units that work continuously towards sustainable water use in production and water risk mitigation, creating cost-efficiency through scale and collaboration.*

In Bangladesh, the program is being implemented by Engineering Resources International (ERI) Ltd.

ERI is an international design, engineering and consulting firm registered in Bangladesh with a pool of more than fifty national and international professionals/experts with decades of experience in nearly all areas of the industries. The three main areas that ERI concentrates on, out of its six segments, are: Environment & Climate Change, Water & Effluent Treatment and Energy Audit & Energy Efficiency. Currently, ERI is one of the leading consultancy service providers in promoting cleaner production in the textile sector in Bangladesh. In addition to STWI program, ERI is also implementing since 2013 the Cleaner Production (CP) and Bangladesh Water PaCT: Partnership for Cleaner Textile programs of IFC, which include over 100 textile/garment industries in Bangladesh. ERI is also an implementing partner of Nordic Chamber of Commerce and Industries (NCCI) projects. Besides, ERI also provides its engineering/advisory services to various other factories in Bangladesh.

1.2 Approach forthe Program

1. **Management engagement** and buy-in is critical for the on-going support for water and wastewater management beyond this program. The management would be engaged in the planning process as well and be periodically updated.

2. **Outlining details of expectations** that units need to provide. This includes:
   a. Allocating dedicated person(s) and in some cases an entire team
   b. Making investment in longer term projects
   c. Instituting internal awards
   d. Having resource awareness be embedded in the in-house training

3. Formalizing **Key Performance Indicators (KPIs)**
   a. Defining KPIs upfront with the units. These KPIs would be included in the comMIT report that goes to the units.
   b. **Targets:** Formalizing targets once the factories have measurement systems in place.

4. **Customized program approach**based on unit's involvement in the previous resource saving projects. The 'Improver' and 'Achiever' units will be given more focus on developing 'Environmental Management System (EMS)' while 'Minimum' units will get support more on the process optimization and investment grade projects while.

5. **Create factory 'Working Group' which are special interest group** to make peer learning possible in small groups with common interests. Four workshops on four different areas namely EMS, water & energy efficiency, wastewater, ETP and solid-waste treatment and chemical management & toxicity have been planned where members from different sections of each unit would join and share their experience to learn from each other.

6. **Inform and support the units** regarding Energy Efficiency (EE) and Resource Efficiency (RE) financing mechanisms/incentives, if any, offered by the government/private sector to enhance their understanding.

7. **Introducing stakeholders**: As part of the workshops/working group meetings relevant experts and organizations could be pulled in who could serve as a resource for the manufacturers in future.

STWI program elements for 2016:

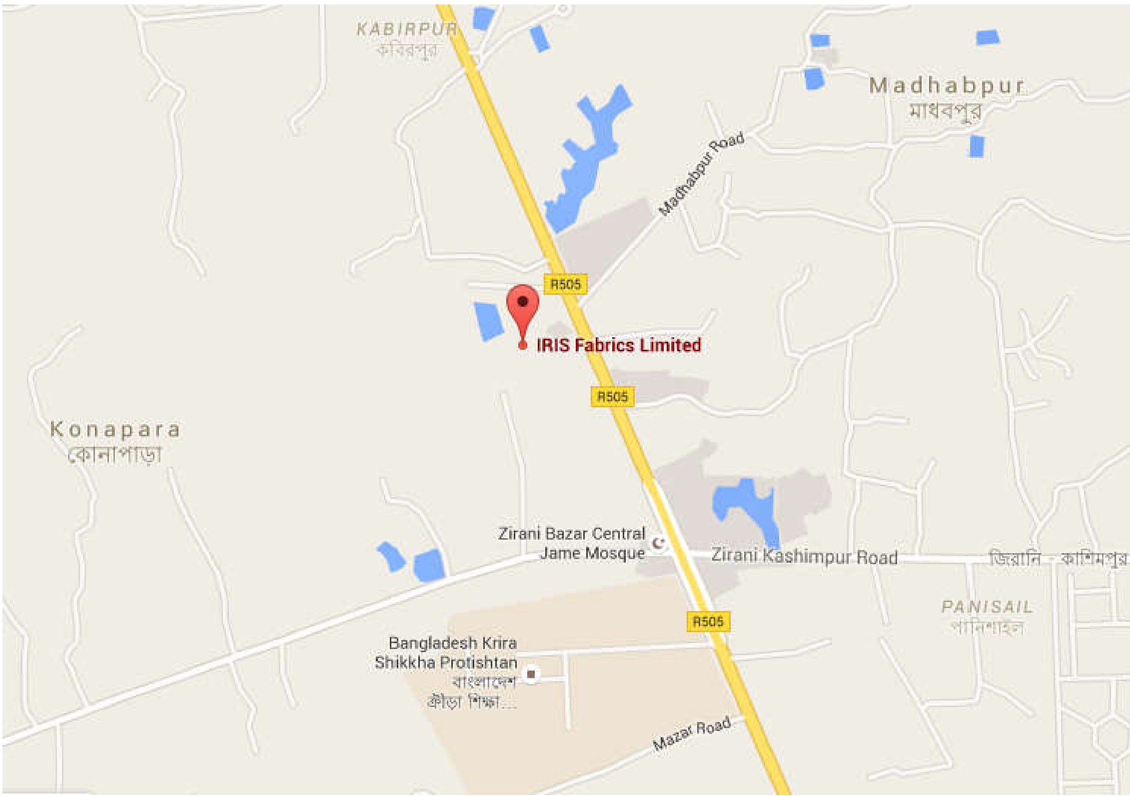
	Planned for 2016
Self-Assessment and Baseline Assessment	✓
On-site measuring and implementation support	✓
Workshops: three times a year	✓
Reporting three times in the year	✓
Awareness sessions	✓
Resource measurement and tracking	✓
Waste-water tests (where applicable)	✓
One Closing meeting with units and brands	✓
Setting up a team to look at resource management and reporting	✓

2 IFL Operations

2.1 General Information

Name of the factory: IRIS Fabrics Ltd.

GPS Location: 23°59'56.9"N 90°15'04.0"E



Company Profile:IFL is located in Zirani Bazar, BKSP, Kashimpur, Gazipur. It is involved in knit fabric dyeing & finishing with attached garments. The unit has an annual dyeing & finishing capacity of approximately 6,000 tons of knit fabric and knitting capacity of 4,000 tons garments. Dyeing & finishing unit is in production in 3 shifts, 24 hours and 300 days per year. The factory has attached garments which run 10-12 hours per day. The factory employs approximately 228 workers in dyeing & finishing section & 3,400 workers in garments section.

Nominating Brand: Ellos& KappAhl

Other Brands:H&M, Lindex

Certifications available:ISO 9001, ISO 14001, Oeko-Tex Standard 100, BSCI.

2.2 Production Process of Knit Dyeing and Finishing

2.2.1 Raw material and finished fabric

Raw material forIFL is knitted grey fabric (75% cotton, 15% PC & 10% CVC).Factory produces knit products of different varieties as per customer requirements and order preferences. The distribution of finished fabrics along with their average monthly production is given in Table 2.

Table 2: Average monthly production

Product type	Average monthly production (kg)
Knit dyeing & finishing	416,630
Total	416,630

Source: IFL management (Jan – Dec, 2015)

2.2.2 Production process

IFLproduces open width fabric using atmospheric and HTHP dyeing machines mostly with reactive dyes utilizing exhaust method as described below. Tubular fabrics are produced very often as per order. The average GSM varies from 120 to 180. Average width is 152-249 cm for open width fabric. For open width fabrics slitting and dewatering, stenter and open width compactor machines are used, while for the tubular fabrics squeezer, dryer and tube compactor machines are used. Flow diagram of different fabrics is shown in .

2.2.3 Exhaust dyeing process

Bulk production at IFL is being carried out in pressurized jets and atmospheric dyeing machines. A total of twenty-two machines are installed in the current set up out of which fourteen machines are utilized for bulk production while eight sample machines are used for sample processing and new chemical testing. In HTHP machines the factorymaintains M:L at 1:6 and for atmospheric machines at 1:8. Dyeing machines are manually operated. For manually operated machines workers follow the dyeing sequence. The selection of a particular machine depends upon the type of fabric and shade. Primarily, two generic types of reactive dyes namely mono and bi-functional dyes are being used for dyeing cotton fabric. About 85% dyes used are reactive dyes; the rest 15% are disperse dyes.

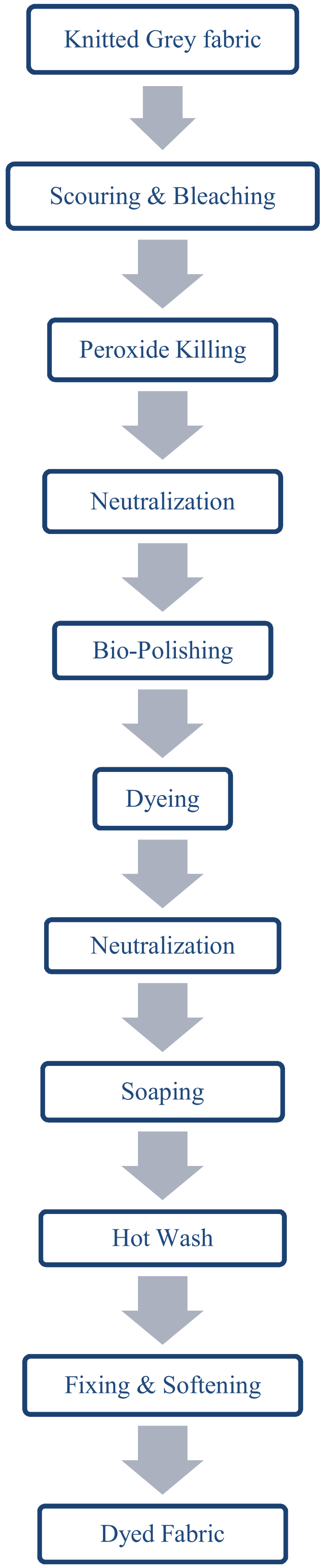


Figure 2: Block Diagram of Dyeing Process (100% cotton)

2.2.4 Finishing process

The finishing department of IFLcomprises of one opendryer, one stenter, two tumble dryers and four compactors. These processes are mainly aimed towards drying, width setting and GSM regulation of the running fabric and are physical in nature with standard chemical application of softeners. Finishing sequences generally follow different combination of above stated operations depending upon the required appearance of the finished fabrics. Finishing of tubular and open width fabrics takes place concurrently on separately designated machines.

Stenter:

Stenter is used for both chemical and mechanical finishing (width setting) purposes. One Stenter is installed for finishing operations which essentially involve incombined softener applications and width setting of incoming fabric. Stenter at IFL comprises of eight chambers, ***with two gas burners and two blowers per chamber for first Stenter (Bruckner-Germany).***

2.3 Equipment in the Plant

Following is the list of all major equipment:

Equipment type	Brand	Quantity
Dyeing machine	CANLAR	13
Dyeing machine	FONGS	3
Dyeing machine	TONG ZENG	1
Dyeing machine	Brazoli	3
Dyeing machine	STARTEX	2
Turning machine (color)	CANLAR	1
Turning machine (grey)	CANLAR	1
Slitting machine	ALKAN	1
Slitting machine	CORINO	1
Squeezing machine	CALATOR	1
Open compacting machine	HAS	1
Tubular compacting machine	TUBE TEX	1
Santex machine	ALKAN	1
Stenter machine	BRUCKNER	1
Open width compactor machine	LAFAR	1
Open width compactor machine	HAS	1
Tumble dryer	Gold Dragon	2
Soft setting machine	HSING CHENG	1
Sueding machine	LAFAR	1
Boiler	MECHMAR	1
Gas generator	CATERPILLAR	2
Diesel generator	VOLVO	1
Gas generator pump	SIGMA	2
Compressor	BOGE	3

Compressor	SANLION	2
Compressor	PARISE	1
Compressor	GARDNER DENVER	2
Submersible pump	SIGMA	2
Submersible pump	ZAEDA	2
Water treatment plant pump	SIGMA	2
Booster pump	SIGMA	6
Hot water pump	SIGMA	1
ETP blower	ROBUSHI	3
Open fabric inspection machine	OSHIMA	2
Tubular fabric inspection machine	OZBILIM	2

Metering status:

IFL has good metering system for water, gas & energy. But there is no steam flow meter. Metering status is listed below:

Type of meter	No. of meters
Water	13
Gas	2
Steam	-
Electricity	4

3 Water and wastewater management

3.1 Sources and consumption

Factory has a total of 13water flowmeters. From the existing water flowmeter readings water usage in thefollowing points can be tracked:

Area	Average consumption (m^3)/year	KPI (l/kg)
Ground water	691,545	142
Process water (soft water)	568,821	117
Wastewater	555,430	114

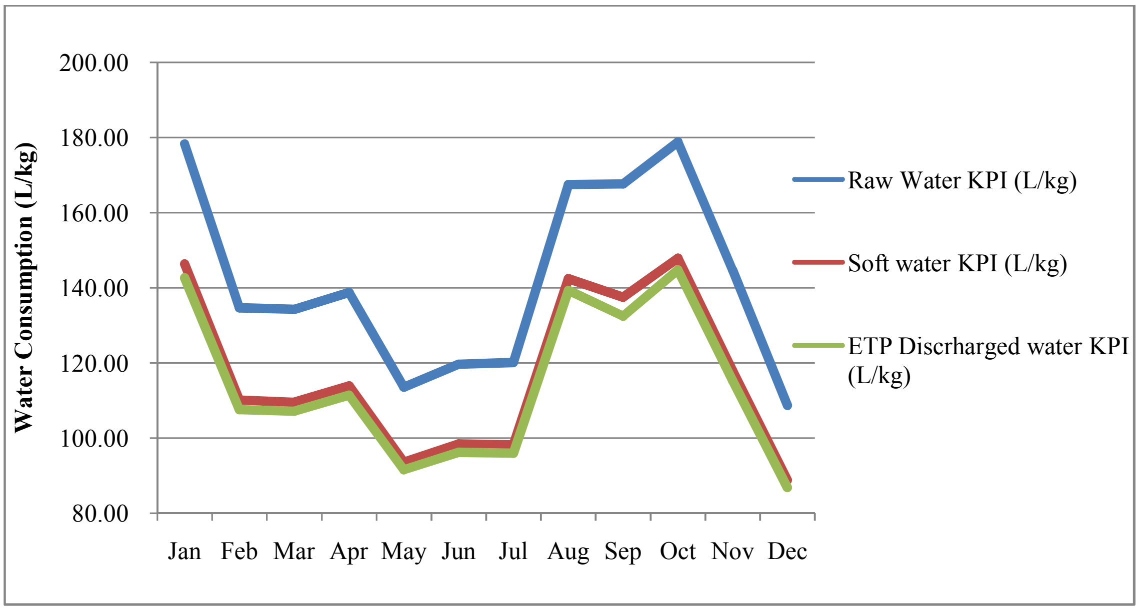


Figure 3: Water KPI for different areas in 2015

From Figure 3, it is clearly visible that water consumption varied throughout the whole year. At the beginning of the year, water consumption was decreasing gradually. But water consumption was found higher from Aug'15 to Oct'15. This could be because of the ongoing construction work in the factory premises.

4 Energy management:

4.1 Source

The main energy sources of IFL areNG, CNG and grid power. NG and CNG are used in gas generators. Steam is produced in steam boiler using NG.

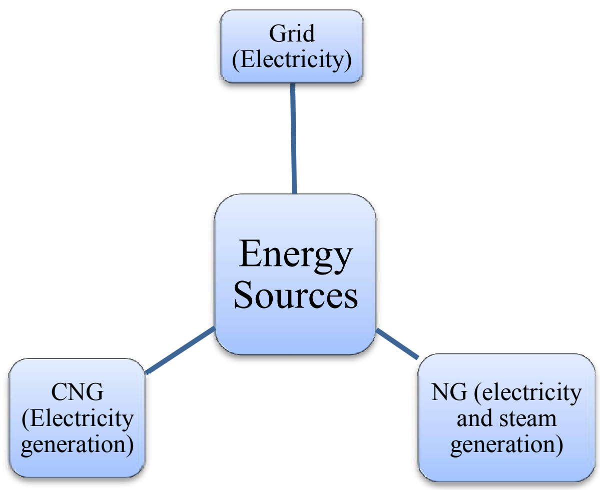


Figure 4: Energy source scenario in 2015

The major source of energy for IFL is natural gas (90.7%).

4.1.1 Grid electricity

IFL has power connection to the national grid. Sanction loads for the factory is1000 kVA. Factory installedPFI unit which maintains a good PFof0.96.

4.1.2 Diesel generators

IFL has three diesel generators which is operated as emergency backup and rarely required.

Table 3: Specifications of Diesel Generators

Manufacturer	VOLVO	MaxENERGY	KOHLER
Model	-	-	-
Rated power (kW)	220	200	160
Voltage	-	-	-
rpm	50	50	50
Running load	N/A	N/A	N/A

4.1.3 Gas generators

IFL has two gas generators which are the main machines for electrical power generation. One gas generator is run by NG while other generator is run by CNG.

Table 4: Specification of gas generators

Manufacturer	CATERPILLER	CATERPILLER
Model	3516	3516
Rated power (kW)	1,030	1,030
Voltage	-	-
rpm	50	50
Running load (kW)	800	-

4.1.4 Boiler

IFL has one gas-fired boiler for steam generation. Steam is used indyeing, finishing and steam irons.

Table 5: Specification of boiler

Manufacturer	MECH MAR
Model	AS2400/150 (24000 pph)
Fuel	NG
Capacity (ton/hr)	10
Rated Pressure (bar)	10
Operating Pressure (bar)	8
Feed water Temperature (˚C)	85

4.2 Energy consumption pattern

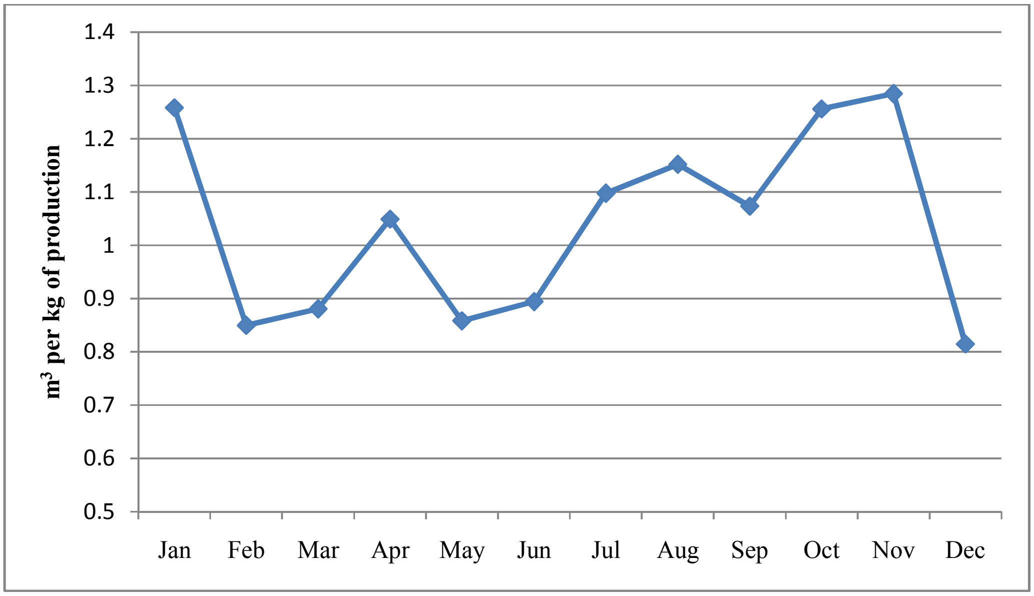


Figure 5: NG KPI for 2015

From Figure 5, it is clearly visible that natural gas consumption varied throughout the whole year between 0.8 and 1.30. There is a sharp reduction of NG at Dec'15

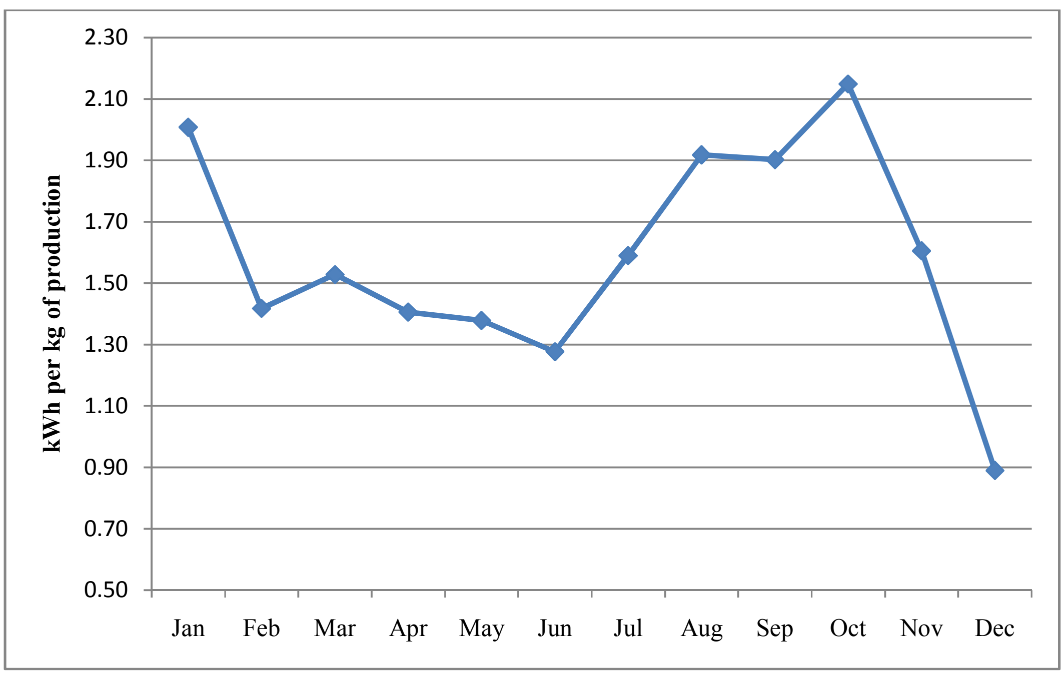


Figure 6: Power KPI for 2015

4.3 Electricity consumption

IFL has captive power generators. Two gas generators are main source of captive power generation. The diesel generators are used for emergency backup. The factory also uses grid electricity. All the power generation data is recorded and maintained properly. There are four energy meters at the factory.

Source	Average Consumption (MWh)/year	KPI (kWh/kg)
Electricity from REB	1,766	1.59
Electricity from gas generators	5,916	

**Based on factory provided 'Management Performance Report' (2015)*

4.4 Thermal utilities

The boiler meets the steam demand of the factory. No economizer and steam flow meter has been installed for waste heat recovery and steam consumption measurement on site.

4.5 Chemicals and dye consumptions

Chemical consumption for the year of 2015 was 718 ton. According to this data, chemical KPI was found to be 144 gram per kg of dyeing production which is unusual. Monthly chemical consumption for the year of 2015 is given below:

Month	Consumption (ton)
January	30.5
February	36.9
March	36.9
April	39.9
May	38.7
June	62.3
July	60.4
August	72.7
September	75.6
October	81.9
November	86.8
December	96.2
Total	718.8

5 Quantified indicators on resource consumptions

5.1 Overall resources consumptions and costs

The total resource consumption and cost have been presented here from January – December 2015. Factory consumes water, NG, CNG as the key resources. A significant amount of cost is involved with wastewater treatment; hence, it is also presented along with the water pumping and softening costs.

Resources	Consumption (Jan –Dec, 2014)	Cost (BDT)[4]
Soft water (m^3)	568,821	4,458,610
Wastewater (m^3)	555,430	8,331,450
Electricity(kWh) from grid	1,765,960	14,083,208
NG& CNG (m^3)	5,435,194	36,657,807

The total cost scenario can be seen here:

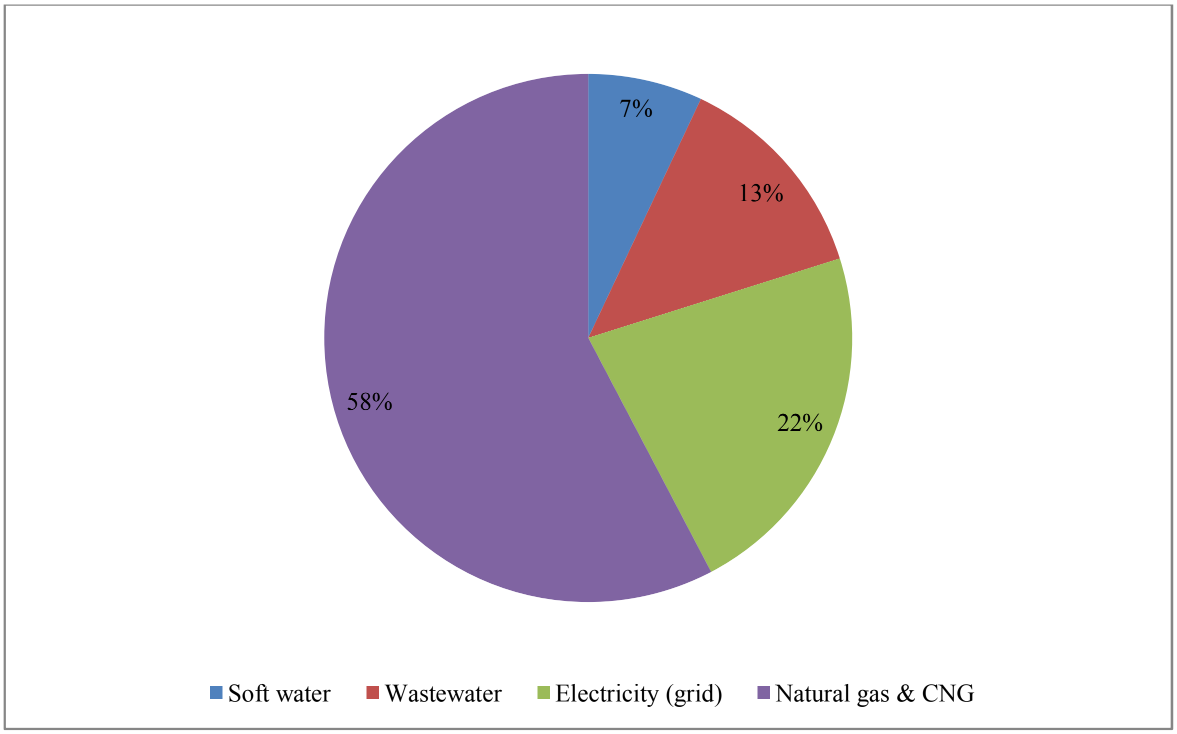


Figure 7: Resource cost distribution

[4] Unit cost of the resources have been provided in Appendix-3 'Calculation Basis and Assumption'

6 Assessment summary and suggested plans

6.1 Scenario

Following KPIs have been identified for IFL as part of STWI program. These will enable efficient monitoring of the effectiveness of projects implemented. A target is also established for the year 2016.

Parameters	Annual Consumption	Estimated Savings	Present KPI	Target KPI	Unit	Remarks
Raw Water (m3)	691,545	7,498	142	141	l/kg	Water flow-meter available
Soft Water (m^3)	568,821	7,498	117	116	l/kg	Soft water data available
Natural Gas (m^3)	5,435,194	987,324	1.04	0.85	m^3/kg	Gas flow meter available for natural gas; CNG consumption data available
Power (kWh)	7,682,101	831,249	1.59	1.42	kWh/kg	Energy meters available
Chemicals (kg)	718,800	35,940	0.144	0.137	kg/kg	Chemical consumption data available

KPIs have been estimated on the basis of annual production of 4,999,583 kg of knit dyeing fabric (Jan –Dec, 2015)

6.2 Resource Saving Opportunities and Prioritizing Quick Wins

The following resources saving opportunities have been identified:

Sl. No.	Projects	Investments (BDT)	Water savings (m^3/year)	Natural gas saving (m^3/year)	Power saving (kWh/year)	Chemical savings (kg/year)	Financial savings (BDT/year)
1.	Clutch motors replaced by servo motors	8,712,000	-	147,533	610,929	-	3,592,115
2.	Energy efficient lighting installation	1,147,500	-	53,205	220,320	-	1,295,429
3.	Exhaust heat recovery boiler installation	10,000,000	-	341,951	-	-	2,065,384
4.	Replacing normal water taps with stop taps	-	-	-	-	-	-
5.	Economizer installation to recover heat from boiler stack gas	2,500,000	-	175,371	-	-	1,059,240
6.	G-Traps installation in steam irons	96,000	-	76,575	-	-	462,516
7.	Conducting compressed air leak test regularly	-	-	-	-	-	-
8.	Burner tuning for improved combustion efficiency	15,000	-	189,460	-	-	1,234,332
9.	Dedicated washing facility for dyeing house	40,000	583	3,228	-	-	34,334
10.	Using air cooler pads in garments floor	-	-	-	-	-	-
11.	Moisture sensor installation for stenter machine	-	-	-	-	-	-
12.	Proper metering and monitoring system development	-	-	-	--	-	-

13.	Process chemical consumption reduction	-	6,915	-	-	7,188	161,094
14.	Adopt automatic dye and chemical dispensing system	-	-	-	-	28,752	8,626
Total		22,510,500	7,498	987,324	831,249	35,940	9,912,069

6.3 Key Visual Observations

Pictures from Initial Assessment	
	
Chemical storage & management	ETP discharge point
	
Secured rotating parts in ETP blower room	Installing push tap replacing ordinary tap
	
G-Trap should be installed in the every steam iron	

6.4 Project details

6.4.1 Clutch motors replaced by servo motors

Issues/observations:	• 726 pcs of clutch motors are running in the garments section
Solutions/recommendations:	• Replacing clutch motors with servo motors will save significant amount of electrical energy
Type of project:	• Mid-term win
Investment cost (BDT):	8,712,000
Savings:	
Power (kWh/year)	610,929
NG (m^3/year)	147,533
Annual cost savings (BDT)	3,592,115
Payback period (months):	29
Whether implementation can be done in-house or needs specialized external support?	• In-house team can handle the system after the completion of installation by manufacturer
Tracking process for the project:	• Power saving • NG saving

6.4.2 Energy efficient lighting installation

Issues/observations:	• There are about 1530 T8 lights running in the factory
Solutions/recommendations:	• T8 lights should be replaced with energy efficient LED lights
Type of project	• Near term win
Investment cost (BDT)	1,147,500
Savings:	
Power (kWh/year)	220,320
NG gas (m^3/year)	53,205
Annual cost savings (in BDT):	1,295,429

Payback period (in months):	11
Whether implementation can be done in-house or needs specialized external support?	• In house team can handle this
Tracking process for the project	• Power saving • NG saving

6.4.3 Exhaust heat recovery boiler installation

Issues/observations:	• Generator exhaust gas is currently released to environment which has a temperature of around 550-560^{0}C
Solutions/recommendations:	• Exhaust flue gases of the engines can be recovered more efficiently using a waste heat recovery boiler to generate steam
Type of project	• Long term win
Investment cost (in BDT):	10,000,000
Savings:	
NG (m^3/year)	341,951
Annual cost savings (BDT)	2,065,384
Payback period (months):	58
Whether implementation can be done in-house or needs specialized external support?	• Specialized external supplier needed
Tracking process for the project:	• Steam saving • NG saving

6.4.4 Economizer installation to recover heat from boiler stack gas

Issues/observations:	• Boiler exhaust temperature was found 210 ˚C during flue gas analysis
Solutions/recommendations:	• Boiler feed water can be passed through economizer to recover exhaust heat
Type of project:	• Mid-term win
Investment cost (BDT):	2,500,000

Savings:	
NG (m^3/ year)	175,371
Annual cost savings (BDT):	1,059,240
Payback period (months)	28
Whether implementation can be done in-house or needs specialized external support?	• Specialized external supplier needed
Tracking process for the project:	• NG saving

6.4.5 G-Traps installation in steam irons

Issues/observations:	• No G-traps installed in the steam irons. As a result steam is passing out with the condensate as flash steam
Solutions/recommendations:	• G-traps should be installed to save steam in steam irons
Type of project:	• Short term win
Investment cost (BDT):	96,000
Savings:	
NG (m^3/ year)	76,575
Annual cost savings (BDT):	462,516
Payback period (months)	3
Whether implementation can be done in-house or needs specialized external support?	• In house team can handle this with the support of vendor
Tracking process for the project:	• NG saving • Steam saving

6.4.6 Burner tuning for improved combustion efficiency

Issues/observations:	• Combustion efficiency was found 75.8% during flue gas analysis
Solutions/recommendations:	• Burner tuning should be conducted on regular basis to improve combustion efficiency
Type of project:	• Short term win

Investment cost (BDT):	15,000
Savings:	
NG (m^3/ year)	189,460
Annual cost savings (BDT):	1,234,332
Payback period (months)	1
Whether implementation can be done in-house or needs specialized external support?	• Specialized external support required
Tracking process for the project:	• NG saving

6.4.7 Dedicated washing facility for dyeing house

Issues/observations:	• Sample machines have separate washing tanks
Solutions/recommendations:	• Using one dedicated central washing facility will save significant amount of water and heat
Type of project:	• Mid-term win
Investment cost (BDT):	40,000
Savings:	
NG (m^3/ year)	3,228
Annual cost savings (BDT):	34,334
Payback period (months)	14
Whether implementation can be done in-house or needs specialized external support?	• In house team can do this with external support
Tracking process for the project:	• NG saving • Water saving

6.4.8 Process chemical consumption reduction

Issues/observations:	• At present, RFT is 80-85% which can be improved further
Solutions/recommendations:	• By conducting process optimization and rigorous trial, chemical consumption can be reduced

Type of project:	• Short term win
Investment cost (BDT):	Nil
Savings:	
Chemical (kg/year)	7,188
Water (l/year)	6,915
Annual cost savings (BDT):	160,094
Payback period (months)	Immediate
Whether implementation can be done in-house or needs specialized external support?	• Modification in process required extensive trial and error
Tracking process for the project:	• Chemical saving

6.4.9 Adopt automatic dye and chemical dispensing system

Issues/observations:	• Chemical weight measurement and dosing are done manually
Solutions/recommendations:	• Automatic dye and chemical dispensing system will reduce dye and chemical wastes significantly
Type of project:	• To be estimated
Investment cost (BDT):	-
Savings:	
Chemical (kg/ year)	28,752
Annual cost savings (BDT):	8,626
Payback period (months)	-
Whether implementation can be done in-house or needs specialized external support?	• Specialized external supplier needed
Tracking process for the project:	• Chemical saving

6.5 Additional observations

Some of the other projects which do not have a direct savings associated but are necessary for better and efficient operations:

6.5.1 Replacing normal water taps with stop taps

Issues/observations	Solutions/recommendations
• Ordinary taps are used in toilets and domestic area where water is wasted sometimes through open water taps	• Ordinary water taps should be replaced with push taps to reduce wastage of water

6.5.2 Conducting compressed air leak test regularly

Issues/observations	Solutions/recommendations
• Compressed air is one of the major consumers of electrical energy in garments factories. Compressed air leak test is not conducted regularly	• Compressed air leak test must be conducted regularly to identify leakages • Regular maintenance must be carried out

6.5.3 Using air cooler pads in garments floor

Issues/observations	Solutions/recommendations
• Demand for fan and pad cooling systems in workplace and factory environments is growing fast, particularly in industries such as garment factories, warehouses and product storage facilities	• Using air cooling pads by utilizing card board, paper pads • Installation of water line form water reservoir to cooling pads

6.5.4 Moisture sensor installation for stenter machine

Issues/observations	Solutions/recommendations
• There is no moisture sensor in stenter	• Moisture sensor must be installed in the stenter to control moisture content of fabric

6.5.5 Proper metering and monitoring system development

Issues/observations	Solutions/recommendations
• Currently, water consumption in the boiler cannot be measured. No steam flow meter is also available	• By measuring water flow to the boiler, steam production can be calculated indirectly

7 Appendices

7.1 Appendix 1 (STWI detailed score)

During the factory visits, assessment was done for this factory on a 120-point evaluation of its best practices performances. What follows is the score of the factory on the assessment: the gaps being areas that the factory has opportunities to improve. Some of the areas of improvement are related to projects recommended; others need incorporating maintenance best practices.

Sections	Score, %
Water and Wastewater management	70
Electrical utilities	85
Electrical consumption	77
Thermal elements	33
Chemical management	72
Solid waste management	50
Energy management & Process Best Practices	31

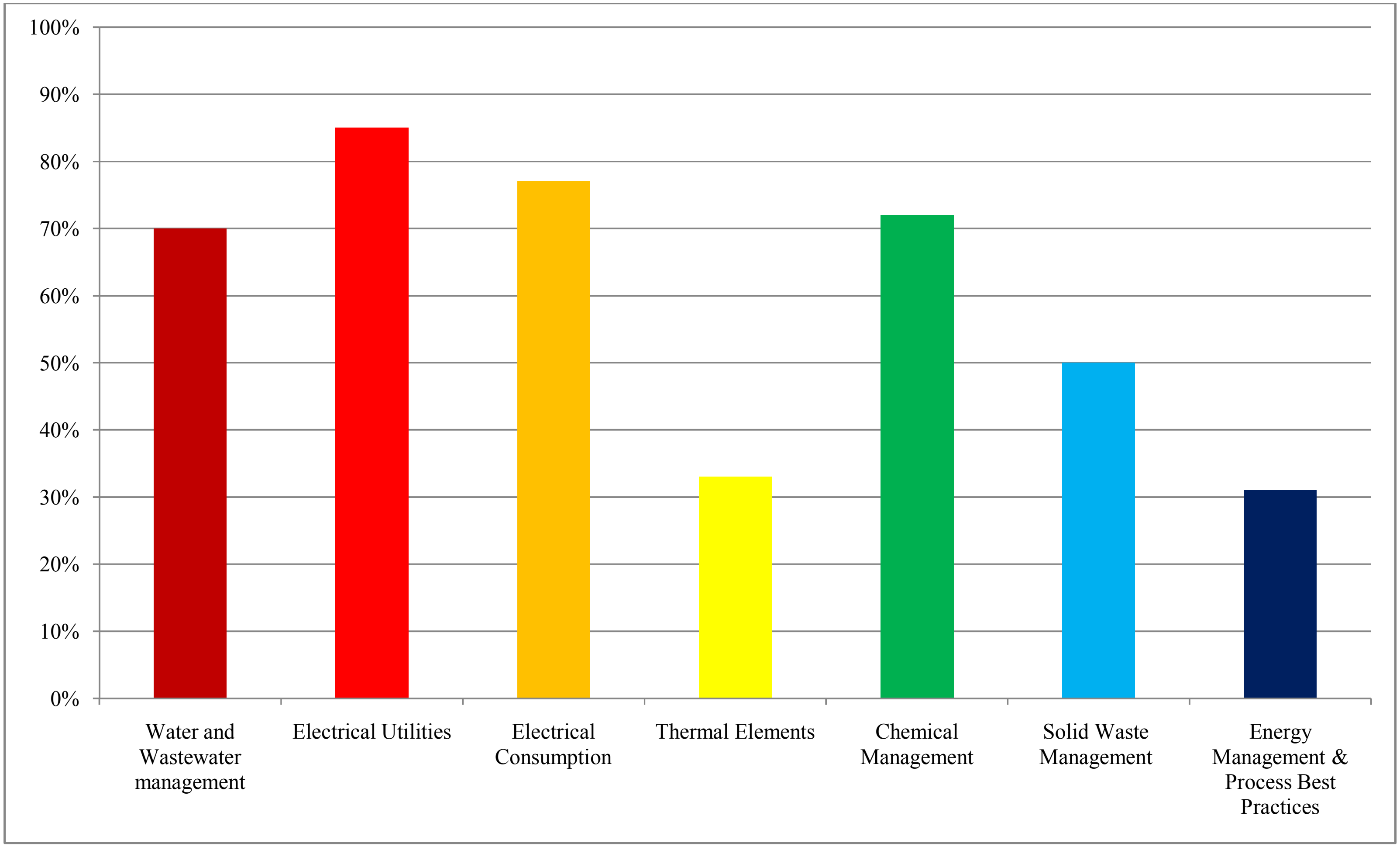


Figure 8: STWI detailed scoring on IFL

7.2 Appendix 2 (STWI Guideline Score and Questionnaire Response)

Sweden Textile Water Initiative is based on the idea that fashion brands must cooperate and follow common guidelines in order to achieve sustainable water use. The guideline covers three areas mainly- Water Efficiency, Water Pollution Prevention, Wastewater Treatment.

Following are the scores for the unit when assessed using the STWI guidelines questionnaire.

	Minimum	Improver	Achiever
Water Efficiency	90.9%	60.0%	100.0%
Water Pollution Prevention	94.1%	50.0%	50.0%
Wastewater	81.3%	42.9%	25.0%

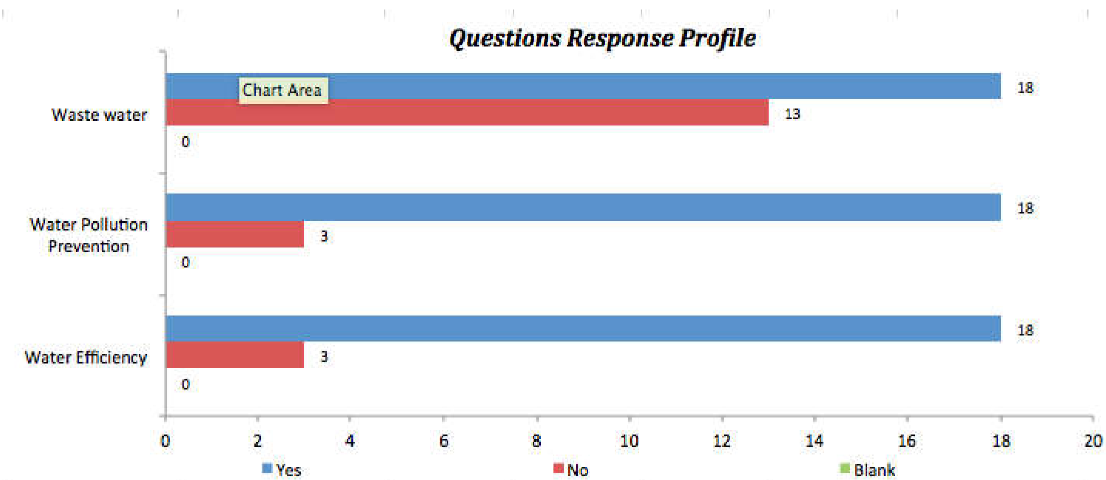


Figure 9: STWI Guideline Questionnaire Response Profile for IFL

7.3 Appendix 3 (Calculation basis and assumption)

For detail calculations the following assumptions & basis have been considered:

1. NG calorific value: 37,335 kJ/m^3
2. Flue gas density: 0.69 kg/m^3

The following costs have been considered:

1. Water cost: BDT 27.2/m^3
2. Steam cost: BDT 697/ton
3. Electricity cost: BDT 12.27/kWh
4. CNG cost: BDT 35/m^3
5. NG cost for power generation: BDT 846 / m^3
6. NG cost for heating: BDT 6.40/m^3

Sources of various data:

1. Water: 12 months data collected from the factory management. Water flowmeters are available in the factory.
2. Fuel consumption: NG bills are provided by the factory.
3. Steam consumption: No steam flow meter available in the factory.
4. Chemical consumption: Dyes and chemical consumption provided for the year of 2015
5. Flue gas analysis has been conducted on-site. See table 6
6. All investments costs are approximate- depends upon the suppliers, installation, material and time.

Table 6: Boiler flue gas analysis and other parameters

Parameter	Value	Unit
Boiler type	Steam boiler	-
Fuel type	NG	-
Flue gas temperature	210	^{0}C
Ambient temperature	36	^{0}C
Steam pressure	8	bar
Steam generation rate	10	TPH
GCV of fuel	37,335	kJ/m^3

Feed water temperature	85	^{0}C
% oxygen in flue gas	12.2	-
% CO_2 in flue gas	4.8	-
CO in flue gas	243	ppm