NCPC
NATIONAL CLEANER PRODUCTION CENTRE
SOUTH AFRICA
Meiring Naude Road, Brummeria PO Box 395, Pretoria, 0001
Pretoria: +27 12 841 3772 Cape Town: +27 21 658 2776 Durban: +27 31 242 2365
Email: ncpc@csir.co.za www.ncpc.co.za/www.iee-sa.co.za @NCPC_SA

Resource Efficiency and Cleaner Production (RECP) Programme

Case Study

Company name	**ACA Group (Pty) Ltd.**		
Sector	**Thread Manufacturer**		
Company Contact	**Name: Chris Handt**		**Position: Operations Manager**
	Email: chandt@acagroup.co.za		**Telephone: +27 21 981 1133**
Year joined NCPC Project	**2013**		
Year of interventions	**2015/2016**	Duration (months)	**24**
Utility Intervention	**Steam, Electricity and Water**		
Case Study Author	**Gavin Graham**		
Project Manager	**Andre Page**		

SUMMARY OF SAVINGS	
Total No. of Projects	**5**
Gross Monetary Savings	**R 4,265,082**
Top Resource Savings (in units)	**494,411 kWh HFO + 329,136 kWh Electricity + 33,709 kl Water**
Total Investment	**R 4,499,500**
Overall Payback Period (in years)	**1.1**
GHG Emissions Reduction2	**494.41 tonnes**

1. BACKGROUND

1.1 Company profile

ACA, previously known as African Consolidated Agencies started with one single agency in 1953. Under the ownership of the Marshing family, ACA signed a partnership with the Amann Group, Europe's largest sewing thread manufacturer. ACA's core business has evolved into a manufacturing company as well as other diversified businesses. The move into manufacturing necessitated relocation to Brackenfell in 1971. ACA has vertical local production, stretching from raw materials to the finished articles, whilst still importing specialised products from global partners. The group takes pride in local investing in South Africa throughout its years of development, and in having been a pioneer in its field of manufacture.
Website: http://www.acathreads.co.za/

1.2 Plant profile

No. of employees: ~100
Trading Since: 1953
Departments: Receiving, Twisting, Dyeing, Final Winding/Lube, Despatch.

2. THE ISSUE AND MAIN FINDINGS

2.1 General

- Resource Efficient and Cleaner Production (RECP) methodologies were used in carrying out the assessment. General Project Management techniques were employed in implementing recommendations.
- The assessment was carried out in November 2014. The baseline period was September 2013 – August 2014.
- Systems descriptions – The significant energy uses, by electricity consumption (kWh), consisted of:
    - Motors 54.8%
    - Lighting 9.0%
    - Pumping 8.4%
    - Heating 7.9%
    - Production Equipment 7.7%
    - Compressed Air 7.3%
- Energy costs were of particular concern to the company and one of the main reasons the assessment was requested. Water consumption was also an area of unease.

2.2 Consumption patterns prior to assessment

Resource	Usage per annum (units)	Usage per annum (Rand)
Water and Effluent	**40,092 kl**	**~R 93,541**
Energy – electricity	**1,407,635 kWh**	**R 1,734,370**
Energy – HFO	**130,426 litres**	**R 1,001,142**

3. RECP IMPLEMENTATION

3.1 Details of assessment carried out

A Resource Efficiency and Cleaner Production assessment was conducted at ACA Group in Brakenfell from the 3rd – 5th of November 2014. The methodology included the compiling of detailed energy balance and noting areas for increased optimisation. Areas for saving included electrical, water and effluent.

3.2 Key findings of the assessment

Overall Areas identified for resource saving included:

- In excess of 20% of boiler fuel usage and costs
- In excess of 14% reduction in electrical cost and 3% of energy usage.
- Water savings of more than 19,000 kl.
- Savings identified amounting to in excess of R1,100,000 per annum

4. HIGHLIGHTS OF THE INTERVENTIONS

ACA Threads implemented eleven projects as part of their resource reduction initiatives, nine of which were identified in the assessment.

The opportunities identified in the RECP Assessment were incorporated into the plans of the Management team's planning and prioritised for implementation. Many of the projects were implemented based on existing maintenance and/or upgrading planned by the company. These interventions were carried out over twelve months from January 2015.

Detailed information was provided for the Dye-house (one of the largest significant resource users on site). Regression and Multi-Variant Regression was carried out using the data for the period Jan 2014 – Dec 2016. There was a good correlation of 0.806 using Monthly Production, Electricity, Water, Heavy Fuel Oil (HFO) consumption and Heating Degree Days (HDD) with a 25 degree base temperature.
Separate regressions on Electricity, Water and HFO were carried out for the three years, with positive improvement in the R^2 values for each of the resources vs Total Dyehouse Production relative to the base year of 2014.

- Electricity R^2 improved from 0.69 in 2014 to 0.8851 in 2016.

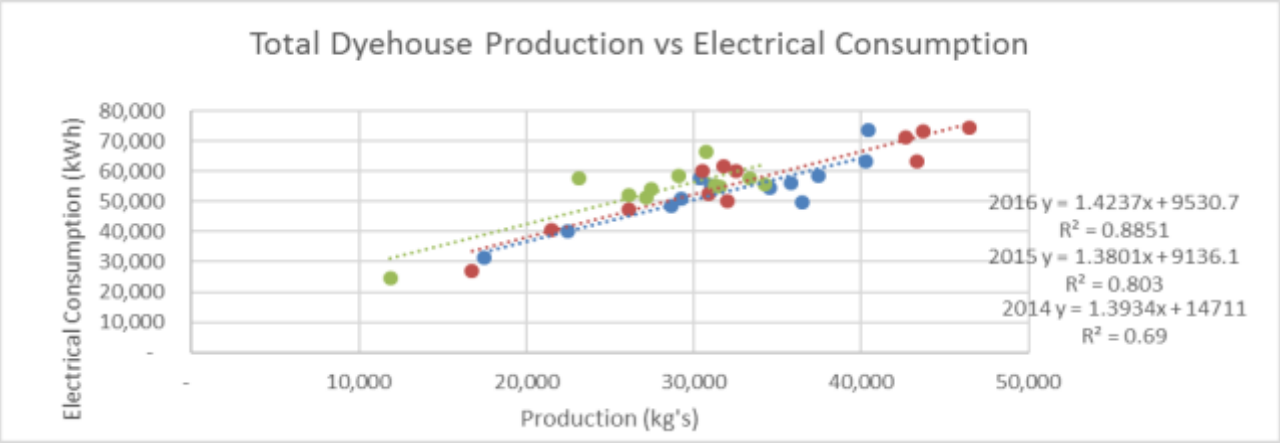

Figure 1. ACA Threads Monthly Electricity Consumption vs Dyehouse Production Regression Jan 2014-Dec 2016

- HFO Consumption R^2 improved from 0.45 in 2014 to 0.8409 in 2016.

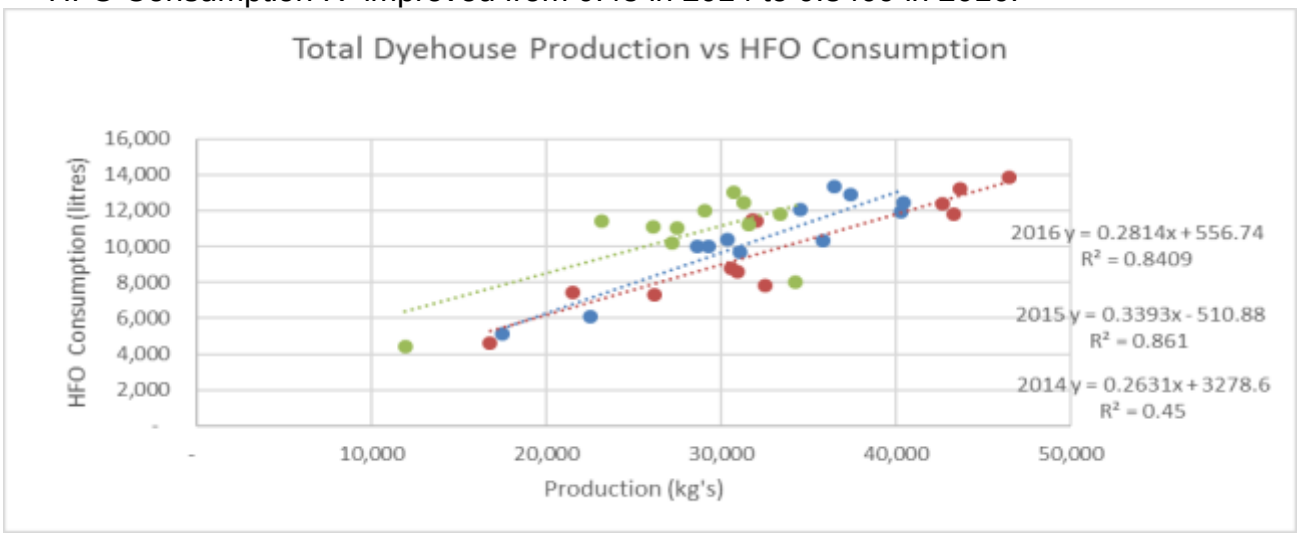

Figure 2. ACA Threads Monthly HFO Consumption vs Dyehouse Production Regression Jan 2014-Dec 2016

- Water Consumption R^2 improved from 0.5571 in 2014 to 0.5918 in 2016.

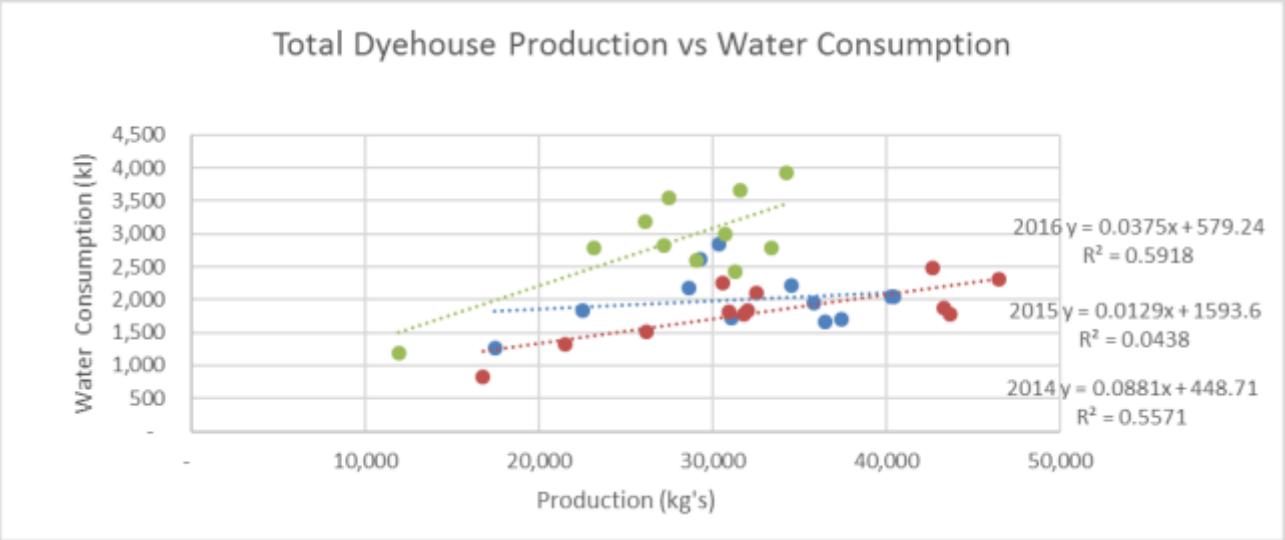

Figure 3. ACA Threads Monthly Water Consumption vs Dyehouse Production Regression Jan 2014-Dec 2016

The savings were a result of the combination of the projects implemented. The savings provided good payback and significant reduction in electricity costs.

The cumulative sum of the savings (CUSUM) graphs, for each of Electricity, HFO and Water showed savings, using the baseline year of 2014.

There were savings of 122,106 kWh of electricity which was calculated with the Regression formula: y = 1.3934 x Production +14711, using the monthly data supplied.

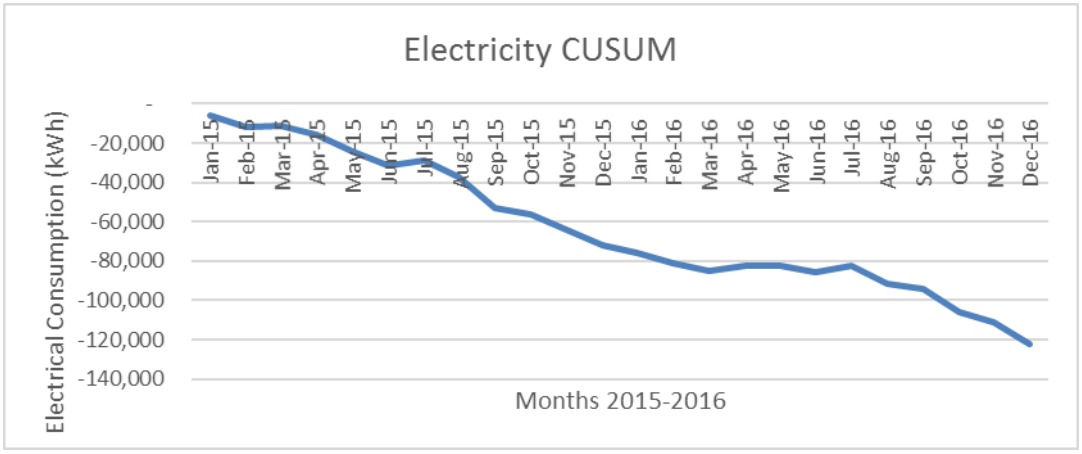

Figure 4. ACA Threads Electricity Savings CUSUM based on monthly data

There were savings of 41,586 litres (494,411 kWh) of HFO which was calculated with the Regression formula: y = 1.3934 x Production +14711, using the monthly data supplied.

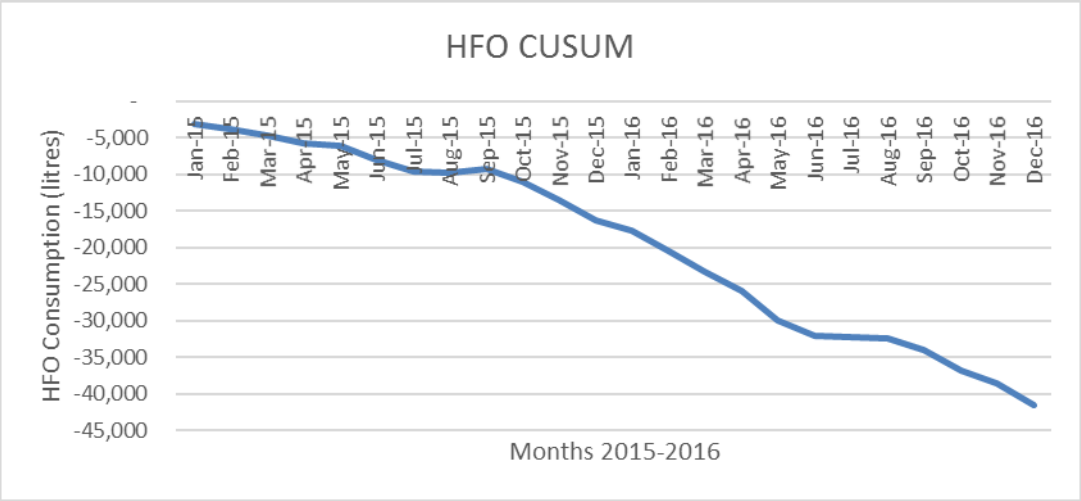

Figure 5. ACA Threads HFO Savings CUSUM based on monthly data

There were savings of 33,709 kl of water which was calculated with the Regression formula: y = 0.0881 x Production + 448.71 using the monthly data supplied.

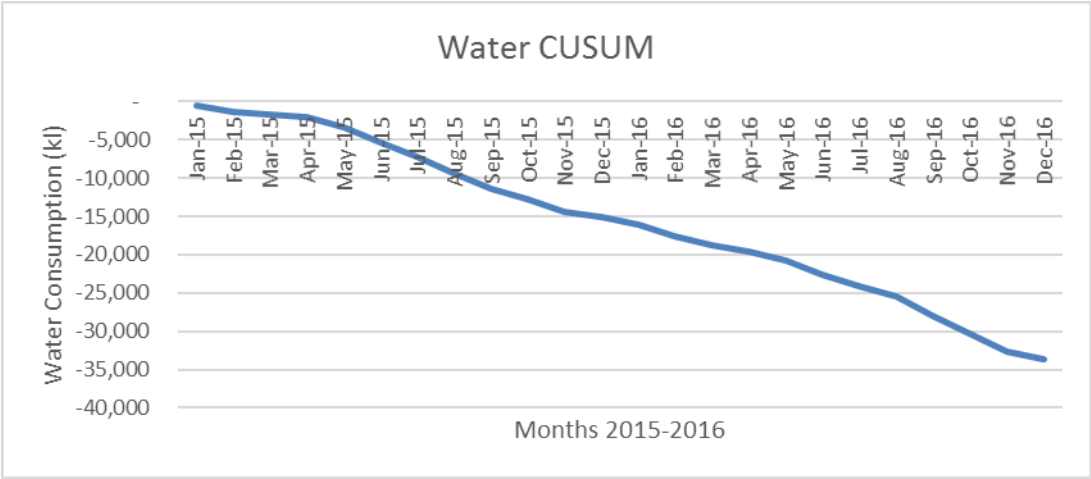

Figure 6. ACA Threads Water Savings CUSUM based on monthly data

4.1 Resource use implications

Resource	Intervention	Utility saving (Units)	Investment (ZAR)	Savings (ZAR)	Payback (years)	Period	GHG Emission Reduction (kg CO_{2e})[1]
Energy - Steam	Insulate valves and Flanges Reduce Boiler Blowdown Use Smaller Boiler Pre-Heat Boiler Water	494,411 kWh	R 63,000	R 311,895	0.2	Jan '15 – Dec '16	137,763

[1] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, chapter 2, Table 2.2 http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf and Grid Electricity Emissions (tCO2/MWh) Source: GEF EE Tool.

Energy - Electricity	Electricity Tariff Change (Reduce Peak Electrical Demand)	-	R 5,000	R 350,670	0.0	Jan '16 – Dec '16	-
Energy - Electricity	Process Rinse Optimisation, Replace Fluorescent T8 Lamps Replace 400W HID Bulbs with Lower Wattage Lamps	122,106 kWh	R 31,500	R 156,296	0.2	Jan '15 – Dec '16	127,296
Water + Process	Process Rinse Optimisation and Specific Water Usage Dyehouse cooling water heat recovery	33,709 kl	R 2,200,000	R 3,202,315	0.7	Jan '15 – Dec '16	-
Energy - Electricity	Renewable Energy - Solar Photovoltaics	207,030 kWh	R 2,200,000	R 243,907	9.0	Jan '16 – Dec '16	198,335

5. SELECTED SYSTEM OPTIMISATION INTERVENTIONS

INSULATE VALVES AND FLANGES

Uninsulated pipes, valves and flanges were recommended to be insulated. A project was carried out and half of the identified items were insulated. This project was completed in March 2015. Cost savings of R37,500 were achieved through this project.

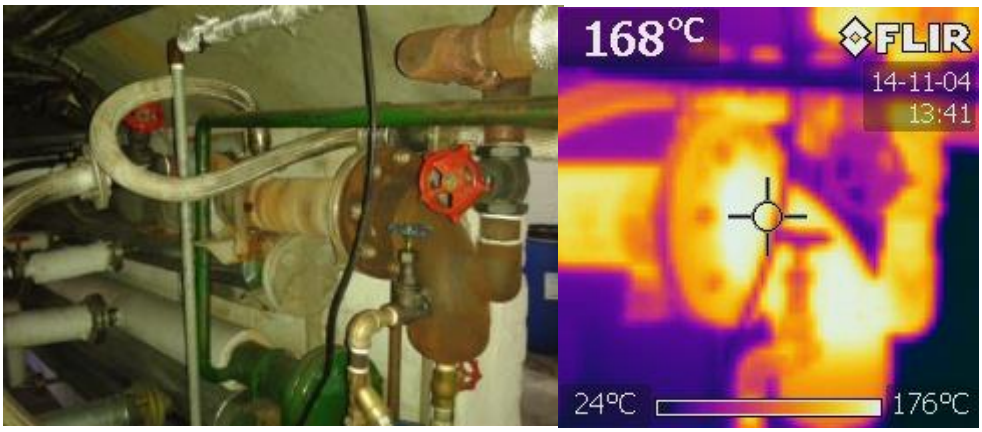

Figure 7. Original uninsulated flanges and piping and illustration of radiation losses.

Figure 8. Insulated flanges and piping

PRE-HEAT BOILER FEED WATER

The existing solar hot water system was used to pre-heat the boiler feed water. A new coil was added the 60ºC solar thermal tank and the water heated to 40-50ºC (improvement in ΔT of >20ºC). Cost savings of over R24,000 were achieved through this project. The project was completed in Nov 2015.

Figure 9. Insulated 60ºC tank situated behind the boiler

ELECTRICITY TARIFF CHANGE (REDUCE PEAK ELECTRICAL DEMAND)

ACA Threads were able to move from a Large Power Users (Low Voltage) tariff to a Small Power Users 1 (High consumption ->1000 kWh / Month. Maximum demand previously accounted for ~50% of their electricity bill. In order to qualify for the consumption only tariff, the Maximum Demand of the facility had to be reduced below 500kVA. The Bonding and Polishing Department which consumed large amounts of energy was closed down (and the material rather imported), as well as a number of smaller projects such as reducing oven operating times, swiching off geysers etc, to reduce demand. The tariff change (using 2016 total electrical consumption figures and indicative 2015 demand values), equates to an average monthly saving of around R29,000. Particular savings were noted during the annual shut-down period over Dec/Jan. The project was completed in September 2015.

RENEWABLE ENERGY - SOLAR PHOTOVOLTAICS (PV)

A new Solar Photo Voltaic system of 131.04 kWp was installed at ACA Threads by Soventix. The Modules are Canadian Solar 260W units and the Inverters are ABB TRIO-27.6-TL. Actual metered data was provided to confirm the saving. This equates to an average monthly saving of around 17,252 kWh. The project was completed in November 2015.

Figure 10. Rooftop Solar PV installation

PROCESS RINSE OPTIMISATION AND SPECIFIC WATER USE REDUCTION

ACA Threads have undertaken two projects in the Dyehouse to optimise water consumption. The first was to change from an overflow rinse to a programmable fill and flush system. The new system does not have an overflow to drain, but is rather any additional water goes to a bulk storage tank for re-use. Secondly, all the Dye vessels were automated. One new 300kg vessel was purchased and three automatic AREL controls fitted to the existing vessels. Based on the Dyehouse consumption information a 37% reduction in water consumption has been achieved, savings of 1,064kl per month, relative to 2014. With an estimated combined water and sewerage cost of R59.40/kl (R33.60 for water + R25.80 for sewerage) this would result in a cost saving of ~R 63,200 per month. There is however currently a billing discrepancy with the City of Cape Town, therefore the financial savings have not yet been realised. These projects were implemented between July 2016-Jan 2017.

Figure 12. New programmable fill and flush systems installed

Figure 11. New automated 300kg vessel

DYE HOUSE COOLING WATER HEAT RECOVERY

Previously the Dye house vessels flushed 130 º C water at 6 bar pressure to effluent. It was required to cool to 90 º C prior to discharge. This process took around 30 minutes to complete. A heat recovery project was carried out where a mixer unit was installed which uses grey water to cool the outgoing waste water. A submerged Heat Exchanger tank was built for 90 º C water to fill up, and provide supplemental heat to the existing insulated 60 º C tank in the boiler house. In addition to the heat recovery, the benefits of the project were that the flushing time was reduced to 5 minutes (a 25 minute saving per load) and as a result of the better controls in the process, the quality improved in the polyester (olygimus) and there was no need for an additional lubricant cycle. This resulted in a ~R100,000 saving a month. This project was completed in Jan 2016.

Figure 13. Grey water mixer unit at the dye vessel

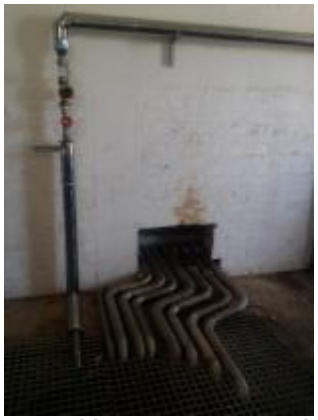

Figure 14. Piping to the submerged heat recovery tank

6. ADDITIONAL PROJECTS

- Reduction of boiler blowdown
- Replaced faulty steam trap and removed direct steam
- Discontinued use of larger boiler
- Installed electricity sub-meters to provide detailed readings geyser in the Winding department was switched off
- Implementation of a regular in-house compressed air leak detection and repair programme on Saturdays
- Replacement of fluorescent T8 lamps with T-5 lamps
- Replacement of 400W HID bulbs with 200W Metal Halide lamps
- Started to introduce LED Lights
- Switching off and disconnecting the geyser in the winding department
- Environmental information and training was provided for staff

7. BENEFITS & LESSONS LEARNED

7.1 Impacts

- The interventions were essential to assist the company reducing costs and improving profitability.
- The savings did not have an impact on direct and indirect job retention/creation or the company gender profile.
- With an increasing focus on resource efficiency, this has reduced wastage and improved quality.
- Positive improvement in awareness of resource use. This is now in the forefront as reported quarterly as part of Quality Management System (ISO 90001).

7.2 Challenges

- The water projects planned are fairly complex and may involve larger capex.
- Many of the projects to be carried out have longer paybacks and are more complex - since many of the ‘low hanging fruit’ in terms of optimisation projects has been realised.
- Currently there are tough trading conditions due to poor economic growth and pressures on the textile industry (illegal imports, tariff structure abuse etc.).

8. FUTURE INTERVENTION / PLANS

8.1 Any future plans

- Water recovery and rainwater recharge of borehole is to be investigated
- PV Plant extension planned
- LED Lighting retrofit
- Steam Pipe insulation to be completed.
- Boiler replacement project.
- Energy Management System (EnMS) Implementation being considered

8.2 Conclusion

ACA Group are an efficient facility, which has steadily improved over time. They have shown enthusiasm and eagerness to implement opportunities, despite a challenging operating environment.