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CASE STUDY
Resource Efficient and Cleaner Production Indonesia

Textile Sector
PT Kahatex (Rancaekek Unit)
Sumedang, West Java, Indonesia

BACKGROUND

Industrialization is vital for economic development and has helped bring millions out of poverty in recent decades. But as more countries industrialize, growing consumption, rapid urbanization and unsustainable use of natural resources is exacerbating climate change and polluting the ecosystems on which we depend (UNIDO 2017) The pattern of current production and consumption, scale and speed of resource use has almost reached the limit of what planet can offer and sustain. While it is essential that industry continues to grow and prosper, it is also worth considering changing the mindset of the way industrial sector does business and becoming more efficient and responsive to resource consumption and waste generation.

INTRODUCTION

Established in 1979 as a knitting mill and dye-house, **PT Kahatex**, a large integrated textile company in Indonesia, is manufacturing polyester chips, polyester fibers, yarns, fabrics, garments, and socks, in a vertical inte grated set-up. The company produces textile products such as garments, blankets, gloves, rugs, carpets, socks, etc. from a variety of yarns and fabrics. Its garments, socks, and gloves divisions are 100% export oriented. The company has grown in size and stature into one of the largest integrated textile complexes in the country, in more than 155 hectares at Cijerah-Bandung, Rancaekek-Sumedang and Solokan Jeruk-Majalaya, employing more than 48,000 workers.

PT Kahatex is driven by internal and buyer's environmental sustainability programmes and constantly identifying and implementing resource efficiency measures guided by experts and professionals in this area. With this vision, PT Kahatex joined the Resource Efficient and Cleaner Production (RECP) Indonesia programme for demonstration of RECP in the textile sector with the chief objective of improving sustainability by optimizing resource efficiency, reducing the company's environmental foot print, and improving Occupational Health and Safety and the wider workplace environment.

With the introduction of RECP programme, RECP options were identified and implemented, focusing especially on the wet processing section. Unlike other processes, wet processing used steam, water, energy, water and chemicals and generating waste streams, making it a key focus for RECP. The key steps are outlined below.

PROCESS DESCRIPTION

In this case study, the focus is on the wet processing. The major unit operations in wet processing are shown in the flow diagram process in **Figure 1** below (rinsing in between steps is not mentioned here).

During the entire process, large quantities of materials like yarn, water, chemicals and energy (electrical and thermal) are being used, which and they generate significant emissions and thereby raising the operation and waste management costs.

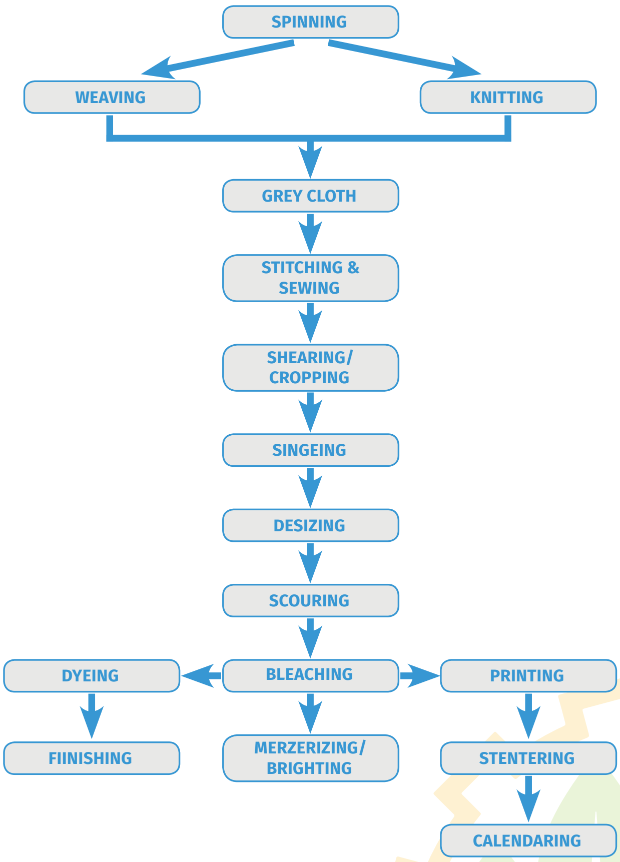

Figure 1: *Flow chart of wet processing (for cotton fabric)*

RECP POTENTIAL

In accordance with the company's corporate philosophy, PT Kahatex, has initiated several resource conservation options in order to move towards environmental and financial sustainability. Afterwards, the company internal RECP team with the support of external RECP experts determined the resource efficiency baseline (specifically liquid pollution volume and load from wastewater, as well as greenhouse gas emissions from energy use).

The specific resource consumption presented in **Table 1** indicates that specific energy, water and chemical consumption in the company is higher compared to the industrial benchmarks. As reported by management and experts, higher consumption of resources is caused by several factors, for example old piping for water and steam distribution and high energy consumption due to high liquor to cloth ratio.

Table 1: *Baseline Data and Potential of RECP in The Unit*

Components	Unit	Baseline before RECP	RECP potential	Saving potential USD/year	Remarks
Production*	T/year	382,667	421,000	-	production data based on 400,000 T/year
Total electrical energy	MWh/ year	622,217	560,000 (10%)	-------	
Sp. electricity cons (SEC)	kWh/ kg	1.63	1.47	7,040,000	400,000 T & 0.11 USD/kWh
Total coal	MT/ year	407,349	366,600 (10%)		Need quality of coal
Specific Coal Consumption (SCC)	kg/kg	4.55	4.09	13,800,000	400,000 T & 0.075 USD/Kg
Total Diesel	Liter/ Year	746,458	671,800 (10%)	----------	
Sp. Diesel Cons (SDC)	Liter/ kg	0.0020	0.0018	48,000	400,000 T & 0.6 USD/Liter
GHG emissions*	T/year	4,878,305	4,390,474 (10%)		GHG reduction 487,831 T/year
Sp. Water Cons (SWC)	M^3/T	25.5	23	200,000	Water cost USD 0.2 /m^3
Sp. WW Gen (SWWG)	M^3/T	11,.7	9.3	384,000	Water cost USD 0.4 /m^3
Recycle Water	M^3/ year	891,048	2,148,000	251,390	Water saving 1,256,952 M^3/year
TOTAL				**21,723,390**	Saving USD 0.0543/ kg

- Based on 400,000 T production per year and specific consumption/ton
- Water cost including treatment is taken as US$0.2 /m3 and water treatment cost including chemicals and energy estimated as US$0.4/$m^3$

POTENTIAL OF RESOURCE EFFICIENT AND CLEANER PRODUCTION

Table 1 presents the existing consumption and the potential for savings that can be obtained by implementing RECP measures. For ease of comparison and in accordance with benchmarking studies, resource consumption is calculated per ton of product output. Since the production data is recorded in kgs and yards of product produced, therefore, yards are converted into kg to evaluate results.

A total of 22 RECP options were identified during the study and after pre-screening 14 were selected for detailed feasibility analysis and subsequent implementation of techno-economically viable and environmentally desirable RECP solutions.

During the initial stage of implementation, particular attention was paid to those measures which could be carried out at low and medium cost to the unit. Thus far, the unit has implemented 9 RECP options as part of RECP implementation and others options are into consideration. The RECP team and project team estimated the potential for RECP savings USD 21,723,390 per year, which are presented in **Table 1**.

The results achieved from implementation of 9 techno-economic viable options with an investment of USD 4,403,843, are compiled in **Table 2**. The management also decided to continue RECP activities in the company even after the completion of the project activities in order to identify and implement additional techno-economically viable RECP options for wet processing, reduce water consumption, reduce the volume and load of wastewater, chemical consumption, as well as to optimize the thermal & electrical energy consumption.

THE IMPLEMENTATION OF RECP OPTIONS AT PT KAHATEX

One of the most effective ways of creating more efficient resource usage is to ensure the optimized management of resource use through a dedicated, structured framework that improves performance and maximizes resource consumption and reduce waste generation over time. Number of RECP options were identified during the RECP assessment in PT Kahatex and feasibility analysis was conducted by RECP team of PT Kahatex. Some of the selected and implemented options are listed below in

Table 2.

Table 2: *RECP Options Implemented by PT Kahatex*

No	RECP options already implemented	Investments
1	Install variable speed driver (VSD) for motor	USD 55,000
2	Recycle water up to 55%	No Cost
3	Install and replace LED lamp	USD 60,000
4	Building Capacity for Boiler operator	USD 7,300
5	Auditing and maintain steam piping system	No cost
6	Technology Change in dyeing processing	USD 4,274,133
7	Installation of skylight/daylight using transparent roofing sheets to use natural daylight in several sheds/ production areas	USD 6,800
8	Optimization of compressed air as per usage 6.5 to 5.7 bar	No cost
9	Reducing Ground Water usage	USD 610
	Total investment	**USD 4,403,843**

It was reported that the company has made investments of approximately USD 4,403,843 to implement the above RECP options, resulting in reduction in energy consumption as well as a reduction of over 225,460 tons of GHG emissions per year. The poor coal quality (with high water content and low Kcal/kg) resulted in increased coal consumption per ton stem generation and thereby impacted on actual GHG emission reduction from the implemented options. Savings on water consumption and wastewater generation are moderate and pollution load reduction was achieved by 8.5 per cent as presented in **Table 3**.

Table 3: *Results of RECP Options Implemented (as on July 2019)*

No	Compo-nents	Unit	Before RECP	After RECP	Savings (USD/ year)	Remarks
1	***Production***	T/ year	382,667	391,423	NA	Demand-based
2	***Specific Electricity Consumption***	kWh/ kg	1.63	1.58 (3.1%)	2,152,827	Electricity cost= 0.11 USD/kwh
3	***Specific coal consumption***	kg/kg	4.55	4.33 (4,8%)	6,458,480	Coal cost = 0,075 USD/ Kg
4	***Specific water consumption***	m^3/T	25.5	23.6 (7.5%)	148,741	Water cost = USD 0.2/M3
5	***Specific WW generation***	m^3/T	11.7	10.6 (9.4%)	172,226	Waste Water cost = USD 0.4/M3
6	***Sp. Diesel cons.***	Liter/ kg	0.0020	0.0019 (5%)	23,485	Diesel cost USD 0.6/ Liter
7	***Recycle Water***	M3/ year	891,048	2,014,965	224,783	Water saving 1,123,917 M3/ year
8	***GHG emissions****	T/ year	4,878,305	4,652,845 (4.6%)		Computed from energy use. GHG reduction 225,460 T/ year
TOTAL					**9,180,541**	Saving USD 0.0235/kg

- *GHG reduction from stenter (coal-based thermal fluid to direct gas fired is still not accounted)

The reduction achieved so far implementing RECP options are approximately 42.3 per cent of estimated savings potential and 46.2 per cent GHG emissions reduction.

RECP is sustainable when it becomes internalized, which has been the case at PT Kahatex due to management support and proactive RECP team. During the current RECP assessment, several additional measures were recommended by an international RECP expert, which will be assessed and implemented in accordance with a company review in the future. In the next phase, it is important to continue to collect information on future improvements.

RECOMMENDED ADDITIONAL RECP OPTIONS BY PROJECT

1. Install coal mill to reduce the size of coal to reduce energy loss in bottom ash.
2. Install an economizer to preheat feed water and an air pre-heater to preheat combustion air with the two coal fired steam boilers with an estimated savings of approximately 5 to 6 per cent of coal.
3. Install a thermocouple to measure the stack gas temperature at the stack gas outlet after the air pre-heater to determine maintenance interval.
4. Install a humidity measuring system after each stenter and control the exhaust fans accordingly.
5. Retrofit all the stenters with a heat recovery system with estimated recovery of 70 per cent of heat losses.

CONCLUSION

Highlights of RECP implementation

1. **Reduced specific water consumption 7.5%**
2. **Reduced specific wastewater generation 9.4%**
3. **Reduced specific electricity consumption 3.1%**
4. **Reduced GHG emissions 4.6%**
5. **Improved working environment and Occupational Health and Safety**

The implementation of RECP options has contributed significantly to enhance the profit margins, reduce GHG emissions and improve the workplace environment, for example in reduced air emissions discharge, better working conditions and improved quantity and quality of products. As part of the project implementation, a monitoring programme was established for the feasibility analysis of identified options and improvements. Following on from this success, the company is now aiming for market expansion by diversifying its product range.

RESOURCE EFFICIENT AND CLEANER PRODUCTION

Resource Efficient Cleaner Production (RECP) is a new and creative way of thinking towards products and the production processes. It is achieved by the continuous application of preventive strategies to minimize the generation of wastes and emissions. RECP strategy comprises the following eight practices, which are also applied in the demonstration of RECP at PT Kahatex:

1. **Good Housekeeping (GHK):** appropriate provisions to prevent leaks and spills (such as preventative maintenance schedules and frequent equipment inspections) and to enforce existing working instructions through proper supervision, training etc.
2. **Input Material Change (IMC):** replacement of non-renewable inputs by low carbon, renewable feedstock.
3. **Better Process Control (BPC):** modification of working procedures, machine instructions and process record-keeping to operate processes at higher efficiency and lower rates of waste and emission generation.
4. **Equipment Modification (EM):** modification of production equipment and utilities (for instance through the addition of measuring and controlling devices) in order to run processes at higher efficiency and lower rates of waste and emission generation.
5. **Technology Change (TC):** replacement of technology, processing sequence and/or synthesis pathway in order to minimize rates of waste and emission generation during production.
6. **On-site Recovery/Reuse (RR):** rreuse and recycling of wasted materials and energy (thermal energy) in the same process or for another useful application within the company.
7. **Production of Useful By-Product (BP):** transformation of wasted material into a material that can be reused or recycled for another application outside the company.
8. **Product Modification (PM):** modification of product characteristics in order to minimize resource usage and associated environmental impacts of the product during or after its use (disposal) or to minimize the environmental impacts of its production.

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