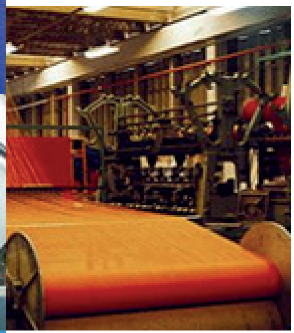
CASE STUDY
Resource Efficient Cleaner Production
Indonesia

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation



Textile Sector
PT Argo Pantes Tbk.
Cikokol, Tangerang, Indonesia

BACKGROUND

Last three to four decades has shown the most rapid growth in consumption of natural resources, unprecedented economic development and industrial growth globally. The economic growth, however, has come at a cost resulting significant pressure on environment: larger global warming green house gas (GHG) emission, lower resource efficiency wasteful industrial culture which creates more demand on natural resources and increasing pollution. 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 to change of mind set the way industrial sector (both manufacturing and service) does business and become more efficient and responsive to resource consumption and waste generation.

INTRODUCTION

Established in 1977, **PT Argo Pantes Tbk.** produces various textile products in Indonesia to sell around the world. The company produces textiles made of cotton and cotton blend raw materials from a fully integrated mill comprised of spinning, weaving, dyeing, finishing, and yarn dyeing units. In 1991, the company became a public company and it currently has over 2,000 employees. PT Argo Pantes Tbk. has production facilities in Tangerang and Bekasi.

PT Argo Pantes Tbk. joined the RECP Indonesia demo programme 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. The company also participated in the Industrial Energy Efficiency (IEE) programme of the United Nations Industrial Development Organization (UNIDO) and the Global Environment Facility (GEF). With the introduction of the RECP programme, new energy-efficient options were identified and implemented, focusing on the wet processing section. Unlike other processes, wet processing uses steam, wastewater and chemicals, making it a key focus for RECP. The key steps are outlined below.

PROCESS DESCRIPTION

In this case study, the focus is only on wet processing. The major unit operation in wet processing is shown in the process flow diagram 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 used and they generate significant emissions, raising both operation and waste management costs.

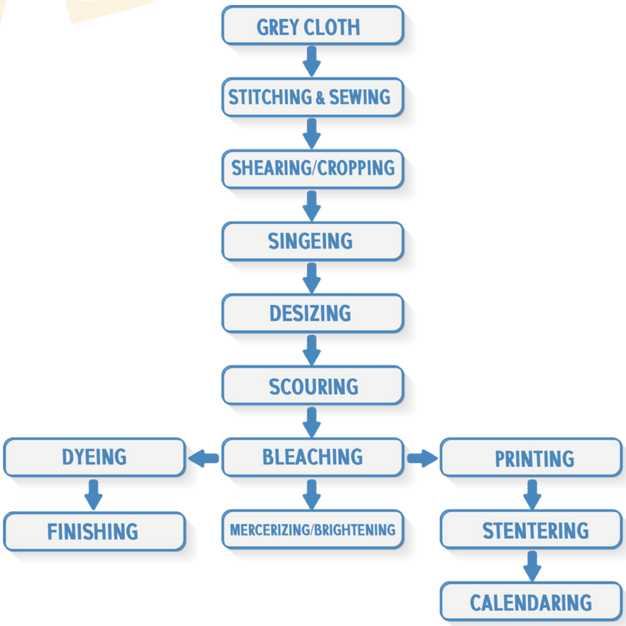


Figure 1: *Flow chart of wet processing (for cotton fabric)*

RECP POTENTIAL

In accordance with the company's corporate philosophy, PT Argo Pantes Tbk. has initiated several resource conservation options, to move towards environmental and financial sustainability. The company joined the RECP project to build on the action taken in-house for resource conservation. An RECP company team and RECP experts determined the resource efficiency baseline (specifically liquid pollution volume and load from wastewater, as well as GHG 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 industrial benchmarks. As reported by management and experts, higher consumption of resources is due to 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 US$/year	Remarks
Production	T/year yards	4,500 25 M	NR	NR	Assumed production in 2018
Total electrical energy	MWh/year	7,750*	4,500 (31%)	-------	Savings in next row
Specific electricity consumption (SEC)	kWh/yard	0.31	0.18	357,500	25 M yard & 11 cent/kW
Total coal	MT/year	16,791	12,500	300,370	Need quality of coal
Stenter energy cost	US$/year	1,569,000	40% reduction	627,600	Better temperature required
Caustic recovery	T/year	200	800	90,000	24Be caustic is recovered
GHG emissions	T/year	42,158	30,254	11,904	>28% reduction
Water consumption	m^3/T L/yard	256 50	200 40 (20%)	47,700	Need to focus on RECP
Specific WW generation	m^3/T kg COD/T	90 60	60 36	54,000	0.4$/$m^3$
Chemical consumption	T/year	230	150	80,000	Average 1,000 US$/T
TOTAL				**1,557,170**	**623 IDR/yard**

- Based on 4,500 T and 25 million yard production per year and specific consumption / yard
- Coal use for direct fired stenter is not calculated in this table for comparison, but stenter cost month before and after is calculated
- Water cost including treatment is taken as US$0.2 /$m^3$ and water treatment cost including chemicals and energy estimated as US$0.4/$m^3$
- Potential calculation without co-generation (separate DPR done and decided to implement after relocation)

RESOURCE EFFICIENCY & EMISSION REDUCTION POTENTIAL

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

A total of 40 RECP measures were identified during the study and after pre-screening 23 were selected for detailed feasibility analysis and subsequent implementation of techno-economically viable and environmentally desirable RECP solutions.

Table 2: *Resource efficiency measures implemented by the unit.*

No	RECP options already implemented	Investments
1	Direct fired (natural gas) stenters: reliable, more efficient with accurate temperature control and adjustable production speed according to requirements	US$1.6 million
2	In yarn dyeing process, cooling cycle avoided and rinsing performed in hot condition, reducing process time by 30 minutes per batch and reducing water and energy consumption	BPC measure no investment
3	Optimize cloth/ liquor ratio to reduce water, wastewater, steam, chemicals and energy consumption	No cost option
4	For exhaust fan, innovative silencer designed in company and installed to reduce noise pollution and provide a comfortable working environment	Low cost in-house fabrication
5	Production planning devised to match resource requirements, such as steam to regulate boiler operation	No cost
6	Part replacement of fluorescent lamps (36 watt) with LED lamps	US$80,000
7	Replacement of identified old, inefficient motors with energy-efficient motors	US$120,000
8	Recovery of caustic soda almost >90% by modifying idle recovery system	US$15,000
9	Replaced magnetic ballast with electronic ballast	Low cost
10	Improved steam distribution insulation using high quality rock wool material	US$15,000
11	Wherever feasible, heating is switched from direct steaming to indirect heating and collecting condensates	Low cost
12	Installed invertors on all major drives/motors	US$85,000
13	Replaced steam traps to improve steam quality (wet steam)	Low cost
14	Recover and reuse condensate as process water (so far not as boiler feed water due to distance)	Low cost
15	Optimize/improve power factor by installing capacitor bank to major motors and main distribution	US$69,000
16	Auditing of compressed air supply and reduced leakages	Ongoing
17	Optimization of compressed air as per usage requirement from 7 bar to 6 bar	No cost
19	Continuous capacity building of employees and involvement of shop floor staff in RECP	No direct cost
20	Installation of variable speed drives (VSD) for motors with fluctuating load	US$24,000
21	Installation of skylight/daylight using transparent roofing sheets to use natural daylight in several sheds/production areas	US$7,000
22	Segregation of lean wastewater and concentrated wastewater before pre-treatment	No cost

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. So far, the unit has implemented over 22 RECP options as part of their sustainability programme. The RECP team and project team estimated the potential for RECP savings, which are presented in **Table 1**. The results achieved from implementation of over 22 techno-economic viable options with an investment of US$ 2.015 million, are compiled in **Table 2**. In 2017, a management review proposed to extend the RECP programme for one more year to identify and implement additional techno-economically viable RECP options for wet processing, to reduce water consumption, wastewater volume and load reduction, chemical consumption, as well as to optimize both thermal and electrical energy consumption. Attention will also be paid to reduced reprocessing or rejection of product and date collection and compilation on this aspect is ongoing.

RECP OPTIONS IMPLEMENTED BY 2017

The company has implemented a large number of technically feasible RECP options on their own and also with assistance from other projects such as those energy efficiency options identified during the UNIDO IEE project. Some of the reported RECP measures implemented before this case study are presented in **Table 2.**

It was reported that the company has invested approximately US$ 2 million to implement the measures above, resulting in an average 30 % reduction in energy consumption as well as a reduction of over 3,800 tons of GHG emissions per year. Due to the coal quality (reported low in 2017 with high water content and low K cal/kg), coal consumption increased per ton stem generation, meaning that the GHG emission reduction was not as much as estimated. Savings in water consumption and wastewater generation was moderate and pollution load reduction was achieved by 18 % as presented in **Table 3**.

Table 3: *Results of RECP measures implemented reported to date*

No.	Compo-nents	Unit	Before RECP	After RECP	Savings (US$/year)	Remarks
1	***Production***	M yard/ year	25	25	NA	Demand-based
2	***SEC***	kWh/ yard	0.31	0.18 (42%)	357,500	Collected during follow-up visit
3	***Specific steam consumption***	kg/ yard	4.03 16,791	3.76(7%) 15,615x	78,750	Steam generation/T coal decreased
4	***Caustic recovery***	T/ year	200	730 (24Be)	79,450	
5	***Energy saving from (DGF) stenter***	cost/ year	1,569,000	1,004,160	564,840*	Stenters were replaced before RECP project
6	***Specific water consumption***	m^3/T	256	240	14,400	Need to look into
7	***Specific WW generation Pollution load***	m^3 kg/T	90	60 80.4	50.5 29,160	18% pollution load
8	***Chemical consumption***	T/ year	230	177	53,000	
9	***GHG emissions****	T/ year	42,158	38,340	3,818	Computed from energy use
	TOTAL				**1,083,750**	**563 IDR/yard**

- *GHG reduction from stenter (coal-based thermal fluid to direct gas fired is still not accounted)
- Based on 2017 production and consumption data; will be reassessed after complete year (next year)
- For material, major chemicals consumption/loss will be assessed during next visit

Results achieved and reported so far are approximately 65 % of estimated RECP financial potential, and less than 40 % of GHG reductions from the target potential (worked out by comparing the benchmark with similar units in other countries). In addition to water/wastewater and pollution load reduction, RECP will also focus on material savings, percentage reject/second quality and auxiliary chemical consumption optimization. RECP is most successful when it becomes internalized, which has been the case at PT Argo Pantes, through both IEE and RECP. During the current RECP assessment, five additional measures were recommended by an international RECP expert which will be assessed and implemented in accordance with the company review in the future. In the next phase, it is important to continue to collect information on future improvements.

RECOMMENDED ADDITIONAL RECP MEASURES BY PROJECT

1. Install coal mill to reduce the size of coal pieces to an appropriate minimum, reducing 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; estimated savings approximately 5 - 6 % 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 % of heat losses.

CONCLUSION

Highlights of RECP implementation

1. Reduced pollution load 18%
2. Reduced sludge generation
3. Reduced GHG emissions 10%
4. Reduced energy consumption
5. Improved working environment and Occupational Health and Safety

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

RESOURCE EFFICIENT AND CLEANER PRODUCTION

Resource Efficient Cleaner Production (RECP) is a new and creative way of thinking about products and the processes that make them. It is achieved by the continuous application of strategies to minimize the generation of wastes and emissions. RECP strategy comprises the following eight techniques, many of which were applied in this case study:

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):** reuse 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.

For more information, please contact:

Permod Kumar Gupta
Chief Technical Advisor, UNIDO
P.Gupta@unido.org
www.recpindonesia.com

Resource Efficient and Cleaner Production INDONESIA

Mr. Yohanes Susanto
Director, PT ARGO PANTESTbk
Y.susanto@argopantes.com
Jl. Mh. Thamrin Kav No. 4, Cikokol, Tangerang, Banten

ARGO PANTES