FINAL REPORT

NATIONAL RESOURCE EFFICIENT AND CLEANER PRODUCTION (RECP) PROGRAMME INDONESIA

PT. WISKA

NATIONAL EXPERT

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SUMMARY

National Resource Efficient and Cleaner Production (RECP) Programme Indonesia was organized by UNIDO and BBT (Center of Textile). Its purpose is to raise the industry's concerns and understanding specifically the textile industry in managing and minimizing consumption source and pollution.

The chosen industry would be willing to apply RECP program is PT. Wiska. This industry main core is Dyeing-Finishing with polyester and cotton as their product.

With several consideration in accordance with the RECP' attainment, an agreement has been mFinishing department producing.

The initial assessment was conducted using the RECP method. The results of the discussion between the project team show that based on the RECP indicators and observations, the solution given for an immediate RECP implementation are as follow :

- Good Housekeeping, covering:
    - Steam leakage repair to increase energy usage efficiency
    - Developing SOP in production area
    - Using sunlight to make better lighting in production room

- the area of priority chosen for detailed assessment are:
    - Modification of R/C in dyeing process for polyester
    - Good house keeping
    - The use of condensate water for dyeing or boiler

Recomendation according to initial assessment result, the Project Team agreed that improvement recommendation in RECP at PT WISKA and Based on the fact sheets, the area of priority chosen for further detailed assessment and feasibility study are Modification of R/C in dyeing process for polyester and the use of condensate water for dyeing or boiler

As follow is implementation of RECP in PT Wiska :

- Steam leakage repair to increase energy usage efficiency
- Agreed to develop SOP in production area
- Agreed make better lighting system by using sunlight to make workspace comfort and to save energy.

- Agreed to implementation modification of R/C in dyeing process for polyester
- Agreed to implementation for using of condensate water

INTRODUCTION

PT Wiska, located in *Jalan Raya Bandung – Garut Km 20,9 Rancaekek, Desa Sayang, Kecamatan Cikeruh*, *Kabupaten Sumedang,* is a company that specializes in textile dyeing and finishing. The company produces knitted fabric, up to 6 tons per day in total, in form of cotton-polyester (80% - 20%) towels, nylon-polyester (60% - 40%)brocades, and other polyester based fabric such as table cover, vitrage, tille, paragon, and blanket. This production level is supported by sufficient non continual textile chemistry process machines such as Haspel (2 units), jet flow (1 unit), jet dyeing (12 units), stenter (4 units), raising (5 units), brushing (4 units), polyshering (4 units), Schutcer (2 units), and centrifuge (3 units).

Pt Wiska markets the products for export and domestic trade with percentage of 70%:30%. Therefore, to meet the requirements from foreign buyers, PT Wiska pays a great deal of attention to environmental issues.

This company processes *grey* fabric into ready-to-use or colored fabric by using non continual production system which generally uses a great amount of water which lead to the potential of waste water. The waste water requires a further treatment in a IPAL (*Instalasi Pengolahan Air Limbah*), waste water processing installation, to reduce the value COD, BOD, TSS, and other criteria in order to meet the standard quality of textile waste water. Treating waste water with IPAL is a high cost process, so the less waste water to process means lower cost. Moreover, the environmental concern developed recently sees waste processing as irrelevant.

This concern develops a concept of preventing waste production as a more beneficial process and emphasizes on more effective and efficient production process, especially in the use and the maintenance of available resources (raw material, energy, water, etc.) Therefore, the concept of Resource Efficient and Cleaner Production (RECP), a continual environment management strategy in process, product, and service in order to improve efficiency and to reduce the potential risk of harm to human and the environment, is relevant to be implemented in PT Wiska.

The initial goal of RECP in PT Wiska is to analyze the available resource (chemicals, energy, water, etc.) in process production or the products based on assessment in order to improve efficiency and to reduce the amount of waste produced and reduce the potential risk of harm to human and the environment. The steps in RECP include preparation, initial assessment, detailed assessment, feasibility analysis and implementation. In this ad interim report, the steps

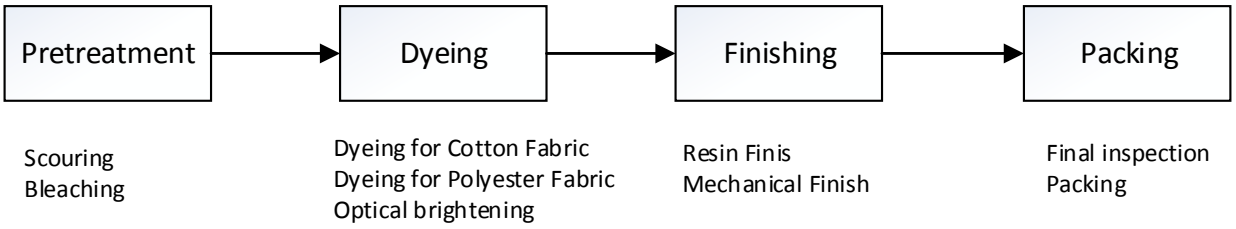
done are preparation and initial assessment. The following are the steps and objectives of the assessment:

Assessment Phase	Key Tasks	Objective
Preparation	1. Secure management commitment 2. Organize project team 3. Establish baseline RECP profile	1. Management commitment in implementing RECP is secured 2. Establishment of RECP project team **3.** Preliminary data consisting of water, energy, and waste as the baseline for initial assessment are gathered
Initial Assessment	1. Develop flow diagram and eco-map 2. Do plant walk-through 3. Establish actions and priorities	1. Develop flow diagram and ecomap as tools in identifying process and the potential leaks/inefficiency. 2. Do plant walk-through to get a direct picture of the real situation and the spots of potential inefficiency. 3. Establish actions and priorities based on the previously gathered data to improve efficiency

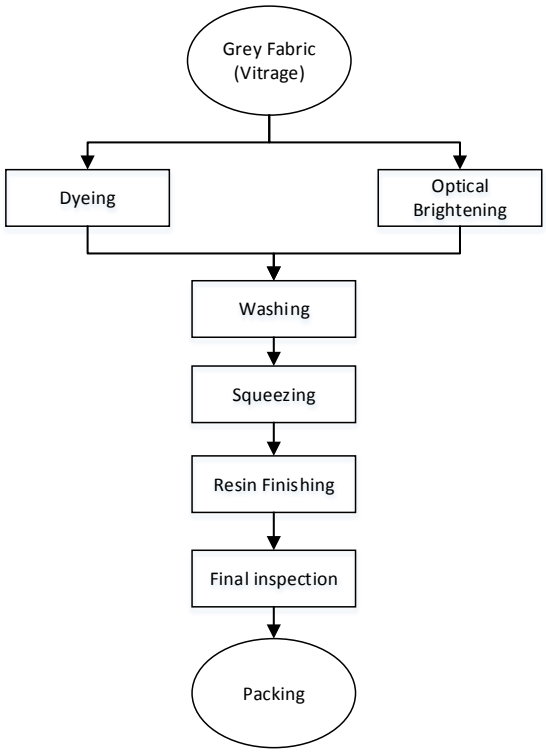
BASELINE SITUATION

Total daily production of PT Wiska is 8 tons of fabric/day with 2 – 3 tons of towels and 3 – 4 tons of vitrage, and monthly production is 200 tons of fabric with total material use up to 202 tons/month. Water for production is gained from ground and rain water with the amount of 750 m^3 / day, and the waste water produced is 650 m^3 / day. The waste water is then processes with biological system to meet the waste standard quality. Total energy used is 400 tons of coal/month or 6000 Kkal/kg and 170.000 Kwh/month of electricity supplied from external source since PT Wiska does not own a power plant.

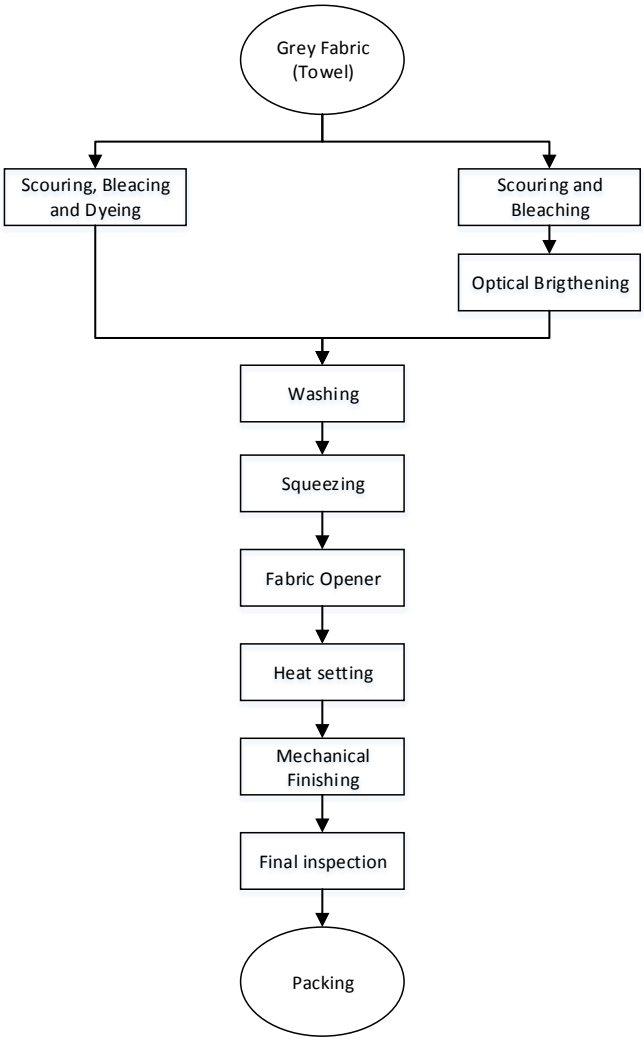
The production process in PT Wiska includes pretreatment, dyeing, finishing, and packing. The whole process uses non continual or batch system, separating each process from the other. The production process overview is as follows:



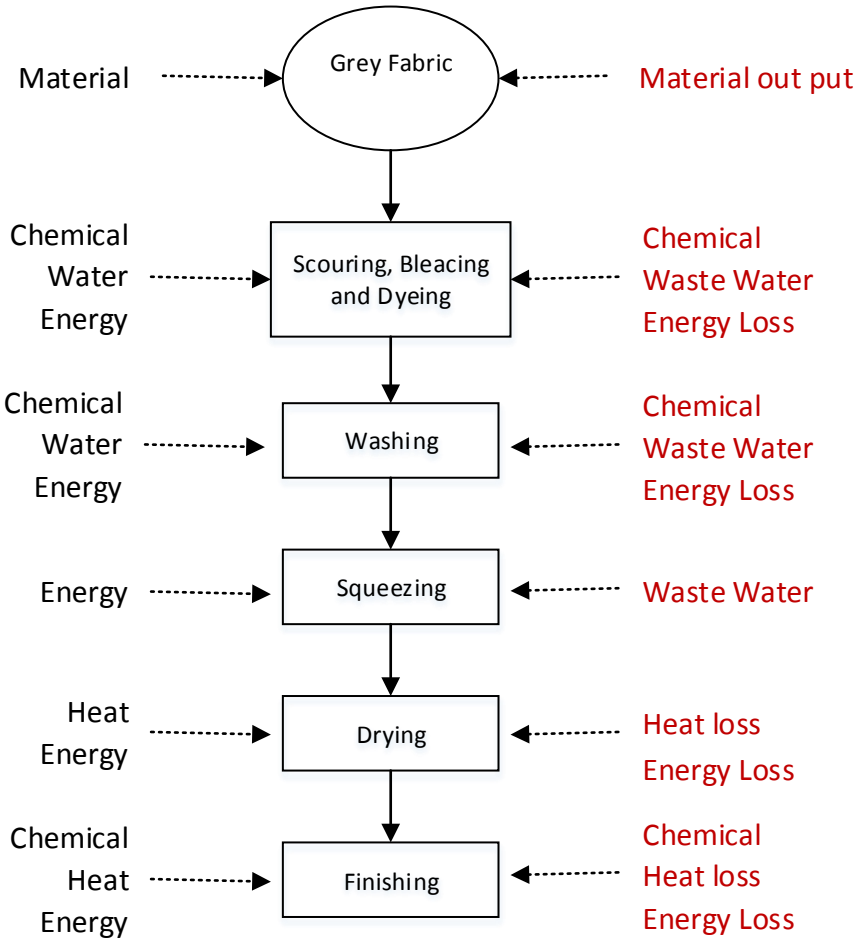
Overall, pretreatment process is done simultaneously to save water, energy, and time. In addition, there are several dyeing processes that are done simultaneously with the pretreatment processes, or also known as *grey dyeing*. This process saves a great amount of water, energy, and time, but requires extra chemicals. Optical brightening is also done with chemical substances in production process. The following is the flow diagram of production process in PT Wiska based on the type of fabric.



Flow process diagram for
Polyester vitrage fabric



Flow process diagram for Cotton
Polyester Towel fabric



In the first assessment, after an eco-map was made, a walkthrough was done in production area of PT Wiska to directly observe the environmental condition and production management. Some notes to consider from the observation are as follows:

Observations 1: General workplace appearance, housekeeping and standard operating practices	1. There is no SOP in every machine, so operators work based on routine 2. Process cards do not give sufficient information on the process being carried on 3. Poor lighting in the production room 4. Poor drainage system in production room has caused puddle in some spots, especially in the dyeing area 5. Poor lighting in inspection room 6. Several dyeing machines seem dirty
Observations 2: Leaks, spills or other losses observed	1. There are steam leaks in the dyeing machine 2. There are water puddles the work area

Observations 3: Level of technology, its maintenance and control status	1. The jet dyeing machines are old, in average, with high water usage technology (Vlot 1:15) 2. The newest jet flow dyeing machines have good water usage capability (vlot 1:5), but require very high energy
Observations 4: Materials and waste – main users and sources, current controls and handling and disposal practices	1. There is no SOP for material handling, such as dyed fabric or chemicals treatment. Operators work based on routine 2. There is no MSDS in chemicals storage
Observations 5: Water and waste water – main users and sources, current control and discharge practices	1. There is only one dyeing process waste line, no segregation. 2. There is no effort to apply on-site reuse of the waste water
Observations 6: Energy – main users, losses, waste energy discharges	1. Steam input in one of the jet dyeing machines leaks 2. Steam condensate water has not been utilized yet, and is directly disposed to the process water reservoir to be processed with resin. 3. Cooling water remain has not been utilized yet, and is directly disposed to the process water reservoir to be processed with resin. 4. Waste water heat recovery has not been utilized yet
Observations 7: Chemicals and emissions – main users, losses, hazards	1. The use of chelating agent 2. The use of dispersing agent
Observations 8: Occupational health and safety issues identified	1. There is no SOP for health and safety yet 2. Employees in chemicals division are not wearing masker 3. Employees in chemicals division are not wearing gloves 4. Employees hang clothes and towels near production machines

Assessment result shows that maintenance level and good housekeeping in production room, especially in the dyeing finishing area, are insufficient. Therefore, the focus area for the implementation of RECP is in the dyeing finishing area.

AREAS OF IMPROVEMENT

The first stages to implement RECP in the dyeing finishing area include improvements in good housekeeping, input change, better process control, equipment modification, technology change and on Site Reuse or Recycling. The following is specific RECP option for consideration, delivered by the RECP team.

RECP Practices	Specific RECP options for consideration
1. Good Housekeeping	1. Steam leaks repairs 2. Water puddle handling in production room, especially in the dyeing area 3. Better lighting system in production and inspection rooms
2. Input Change	1. Stop the use of *chelating agent* 2. Optimum use of dispersing agent
3. Better Process Control	1. The development of production process card 2. SOP making for every process 3. SOP making for material handling
4. Equipment Modification	1. Drain pipe to reuse water in the dyeing machine (on site) 2. Water reservoir for condensate and cooling water
5. Technology Change	1. Optimization of hot washing process 2. Modification of R/C process in polyester dyeing
6. On Site Reuse or Recycling	1. The use of condensate and cooling water 2. The use of waste water from light color dyeing and washing process. 3. The use of waste water heat recovery

The following are the implementation steps of RECP recommended to be done in the dyeing finishing areas, and the economic and environmental benefit.

Description	Expected economic benefit	Expected resource use and/or environment benefit
1. Good Housekeeping		
1.1. Development of more informative process card	1. Avoid process error 2. Avoid excessive cost from repeat process because of process error	1. Production process efficiency 2. Reducing production process error 3. Avoid waste water formation

1.2. Repair of the steam leaks	1. Energy usage efficiency	1. Work comfort 2. Reduce heat in the room
2. Input change		
2.1. Stop the use of chelating agent	1. Reduce chemicals costs	1. Reduce waste load 2. Reduce operators' workload
2.2. Optimum use of dispersing agent	1. Reduce chemicals costs	1. Chemical usage efficiency 2. Reduce waste load 3. Reduce operators' workload
3. Technology change		
3.1. Modification of R/C process in polyester dyeing	1. Reduce water supply 2. Energy saving 3. Time usage efficiency	1. Reduce waste load 2. Reduce energy supply 3. Reduce operators' Workload
4. On Site Reuse or Recycling		
4.1. The use of condensate water for dyeing or boiler	1. Reduce water supply 2. Energy usage efficiency	1. Reduce waste load 2. Reduce energy supply 3. Reduce operators' Workload

RECOMMENDATIONS

Explaining the recommended options for implementation with investment forecasting, cost saving and environmental benefit, with recommendation for implementation and continual management of RECP in the company.

"Traffic light" system process was done to determine the RECP options to be implemented.

Based on the aforementioned facts, the area of priority chosen for detailed assessment are:

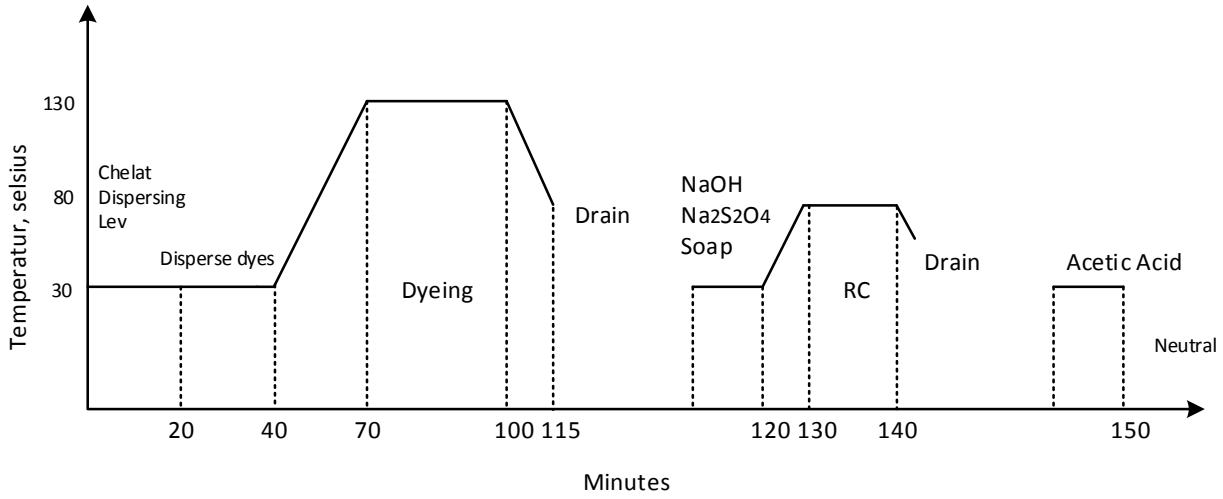
1. Modification of R/C in dyeing process for polyester
2. Good house keeping
3. The use of condensate water for dyeing or boiler

ACTION

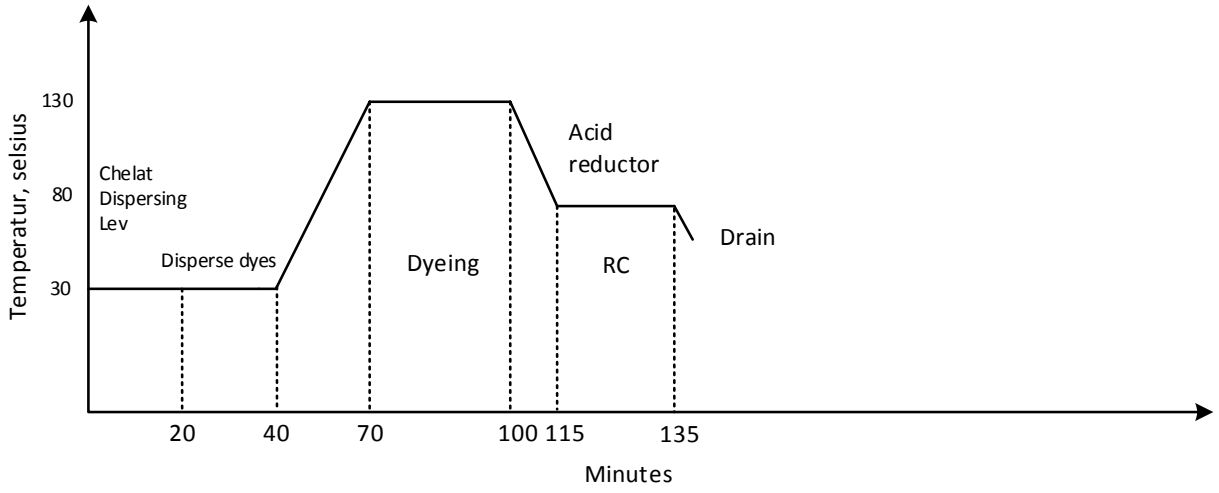
1. Modification of R/C process in polyester dyeing

R/C process aims to release unfixing dyestuff in the process of polyester dyeing using disperse.

In general it's carried out to get a dark colour dyeing result. PT Wiska is having R/C process in alkali condition therefore during the process needs more water supply. The development of auxiliaries make R/C process possible in acid condition. This process could save water, energy and time usage. Follows are the comparison of process scheme in both conditions.



R/C process scheme in alkali condition



R/C process scheme in acid condition

From the scheme above, it can be seen that advantage got using R/C process in acid condition are :

1. Water saving
   - Do not need water supply to R/C and neutralized process
2. Time efficiency
   - Reduce time usage for neutralizing process
3. Energy saving
   - Do not need heating R/C process from 30 – 80 ^{0}C

Feasibility study for Modification of R/C in dyeing process

Material	Amount	
	R/C Alkali condition	**R/C Acid condition**
Fabric	25 ton/month	25 ton/month
Water supply (LR 1:15)	375 m^3/month	375 m^3/month
$Na_2S_2O_4$ (2 g/l)	0.6 ton/month	
NaOH (4 g/l)	1.2 ton/month	
Surfactant (0.5 g/l)	150 kg/month	
Acid reduction (1 g/l)		300 kg/month
Neutralized process		
Water supply (LR 1:15)	300 m^3/month	
Acetic Acid (0.5 g/l)	150 kg/month	150 kg/month
Steam (Raise up temp 30^{0}C to 80^{0}C)		
Electricity (Running machines for R/C & neutralized)		

Cost (prices)

1. Water	Rp.	600 /m^3
2. $Na_2S_2O_4$	Rp.	14.630 /kg
3. NaOH	Rp.	3.192 /kg
4. Surfactant	Rp.	19.950 /kg
5. Acid Reduction	Rp.	39.900 /kg
6. Acetic Acid	Rp.	9.709 /kg
7. Steam	Rp.	125 /kg
8. Electricity	Rp.	1.070 /KWh

Note. Material Price (assumed $ 1 = Rp. 13.300)

Assumed :

Number of Jet Dyeing Machine : 2 machines/day

Jet Dyeing Capacity : 250 kg/machine

Number of R/C process : 2 times/day

Komponen/Material	R/C Alkali condition	R/C Acid Condition	Saving Cost
Water	Rp. 360.000,-	Rp. 180.000,-	Rp. 180.000,-
Material (auxiliaries)	Rp. 17.057.250,-	Rp. 13.426.350,-	Rp 3.630.900
Steam	Rp. 1.858.125	Rp. 1.375	Rp. 1.856.750
Electricity	Rp. 1.138.366	Rp. 849.527	Rp. 288.839
Total Cost Saving			Rp. 5.686.494
Time process	250 hours/month	225 hours/month	25 hours/month

2. Good housekeeping

Good housekeeping in industry can eliminate some workplace hazards and help get a job done safely and properly. Poor housekeeping can frequently contribute to accidents by hiding hazards that cause injuries. If the sight of paper, debris, clutter and spills is accepted as normal, then other more serious health and safety hazards may be taken for granted.

Housekeeping is not just cleanliness. It includes keeping work areas neat and orderly; maintaining halls and floors free of slip and trip hazards; and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of accident and fire preventive

Effective Good housekeeping in textile industry results in:

- reduced handling to ease the flow of materials
- fewer tripping and slipping accidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous substances (e.g. dusts, vapours)
- better control of tools and materials, including inventory and supplies
- more efficient equipment cleanup and maintenance
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
- less janitorial work
- improved morale
- improved productivity (tools and materials will be easy to find)

Description	Expected economic benefit	Expected resource use and/or environment benefit	Implemented by company
Good Housekeeping			
Development of more informative process card	1. Avoid process error 2. Avoid excessive cost from repeat process because of process error	1. Production process efficiency 2. Reducing production process error 3. Avoid waste water formation	• Process card revised (improve) • Process card agreed to be implemented
Repair of the steam leaks	Energy usage efficiency	1. Work comfort 2. Reduce heat in the room	• Steam leaks has been repaired
Using sunlight to make better lighting in production room	Energy usage efficiency	Work comfort	• Changing part or the roof using fiberglass

3. The use of condensate water for dyeing or boiler

Steam is supplied to equipment for a heating process, then the same amount of condensate needs to be discharged from the equipment. Condensate recovery is a process to reuse the water and sensible heat contained in the discharged condensate. Recovering condensate instead of throwing it away can lead to significant savings of energy, chemical treatment and make-up water and also reducing wastewater load.

Condensate can be reused in many different ways, for example:

- As heated feedwater, by sending hot condensate back to the boiler's deaerator
- As pre-heat, for any applicable heating system
- As steam, by reusing flash steam
- As hot water, for cleaning equipment or other cleaning applications

Reusing hot condensate can lead to considerable savings in terms of energy and water resources, as well as improve working conditions and reduce your plant's carbon footprint. Benefits using Steam Recovery in Textile are:

1. Reduced Fuel Costs

   Condensate contains a significant amount of sensible heat that can account for about 10% to 30% of the initial heat energy contained in the steam. Feeding the boiler with high-temperature condensate can maximize boiler output because less heat energy is required to turn water into steam. When efficiently recovered and reused, it can even be possible to reduce boiler fuel needs by up to 10 to 20%.

2. Lower Water-related Expenses

   As long as any impurities picked up during condensate transport are removed, condensate can be reused as boiler feedwater, reducing water supply and treatment costs, as well as costs associated with cold water used to lower condensate temperatures before sewering, where applicable.

3. Positive Impact on Safety and the Environment

   Reducing boiler fuel needs through condensate recovery leads to less air pollution by lowering CO_2, NO_x and SO_x emissions. Additionally, condensate recovery lines can also limit vapor clouds to reduce noise generated from atmospheric condensate discharge and help prevent build-up of water on the ground, considerably improving a plant’s work environment. Depending on the amount of condensate being recovered and reused, other benefits may include a reduced need for boiler blowdown through better feedwater quality, and less corrosion in the system as water quality becomes more consistent throughout the grid.

3. Feasibility Study Condensate Recovery

Water Production	750	m3/day
Steam Flowrate	8	Ton/h
Steam Pressure	11	Bar
Coal Consumption	14	Ton/day
Coal Heating Value	6000	Kal/Kg
Coal Price	900	Rp/Kg
Energy Cost	12,600,000	Rp/day
Water & Water treatment Cost	600	Rp/m3
Wastewater Treatment Cost	900	Rp/L
CP Water	4.2	KJ/Kg
Steam Heating Value @ 11 Bar	2779.66	KJ/Kg
Boiling Point	184	C
Energy Calculations	27,411,680	KJ/h
	657,880,320	KJ/day
Conversion Factor	0.238846	Calori
	157,132,082.9	KCal
	26,188.7	Kg Coal
Steam Price /Kg	65.63	Rp/Kg
Assumption	50%	
Condensate	4000	L/h
	96,000	L/day
Coal Saving	1,344,000	KJ/h
	32,256,000	KJ/day
	7,704,217	Kcal
	1,284	Kg/day

Savings

Coal Saving	1,155,632	Rp/day
Water Saving	57,600	Rp/day
Wastewater treatment saving	86,400	Rp/day
Savings	**1,299,632**	Rp/day
	32,490,812	Rp/month
	389,889,746	Rp/Year
Investment (Piping &Equipment)	**100,000,000**	Rp
Pay Back Period	**3,5**	**Month**

Steam input in one of the jet dyeing machines leaks production machines

Employees hang clothes and towels near

Employees hang clothes and towels near production machines

Employees hang clothes and towels near production machines

Puddle in some spots, especially in the dyeing area

Some working area look dirty

There is no SOP in every machine, so operators work based on routine

There is no MSDS in chemicals storage

Standard Operation Procedure of health and safety is not existing on the chemical warehouse and processing area