

Climate Action Training for textile suppliers in Vietnam

ENERGY SAVING IN THE TEXTILE INDUSTRY

HCM City, October 30, 2018

Presented by: Mr. Ma Khai Hien

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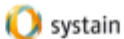
Content

1. About the textile industry
2. Energy saving solutions for the textile industry
3. Potentials for renewable energy applications

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About us



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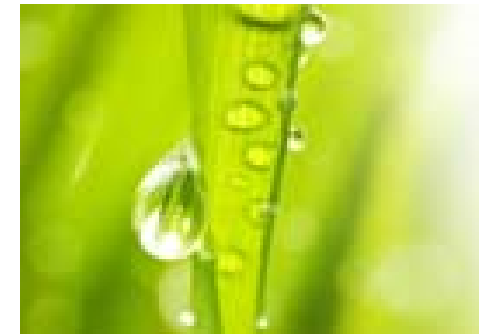
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- **The areas of expertise**

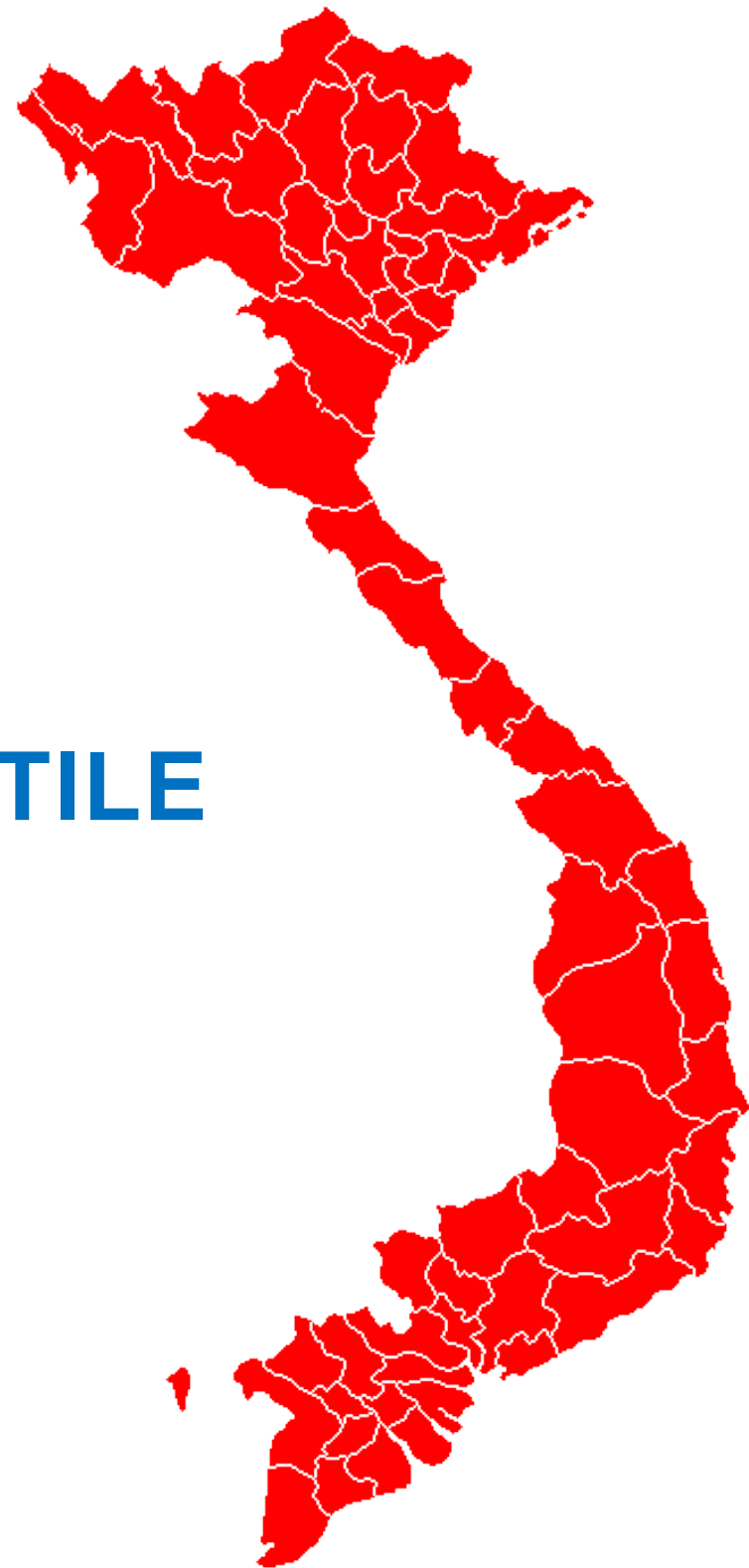
- ✓ Energy and water saving and efficiency
- ✓ Cleaner production
- ✓ Renewable and clean energy
- ✓ Resource management

- **Service**

- ✓ Research and Development (R&D)
- ✓ Project identification and implementation
- ✓ Feasibility study
- ✓ Technical expert review/appraisal
- ✓ Training



OVERVIEW OF THE TEXTILE INDUSTRY



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Overview of Vietnam's textile industry

6,000 Textile factories

84% – Privately owned

15% – FIEs

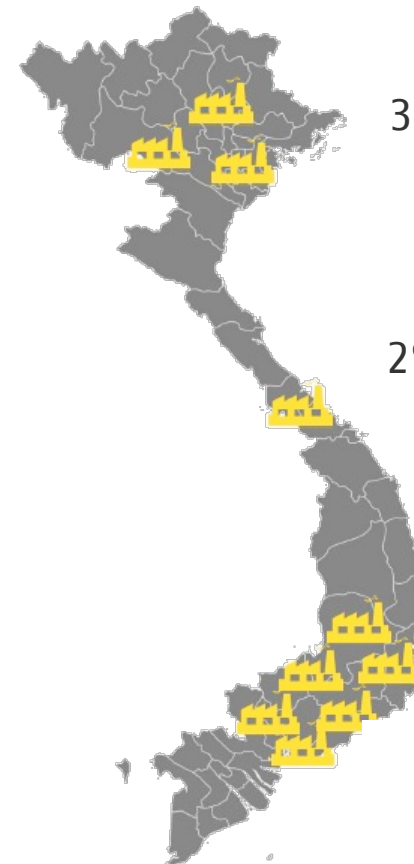
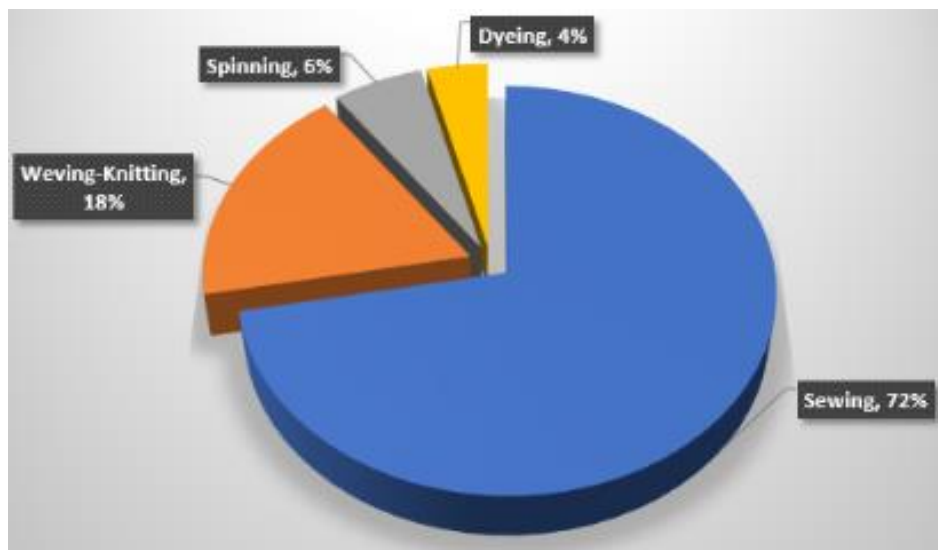
1% – State-owned.

Generating around **2.5 million** jobs nationwide

85% Processing factories for export

15% Textile exporters

BUSINESS MODELS



32% of the factories are in the North

2% in the Central region

62% in the South

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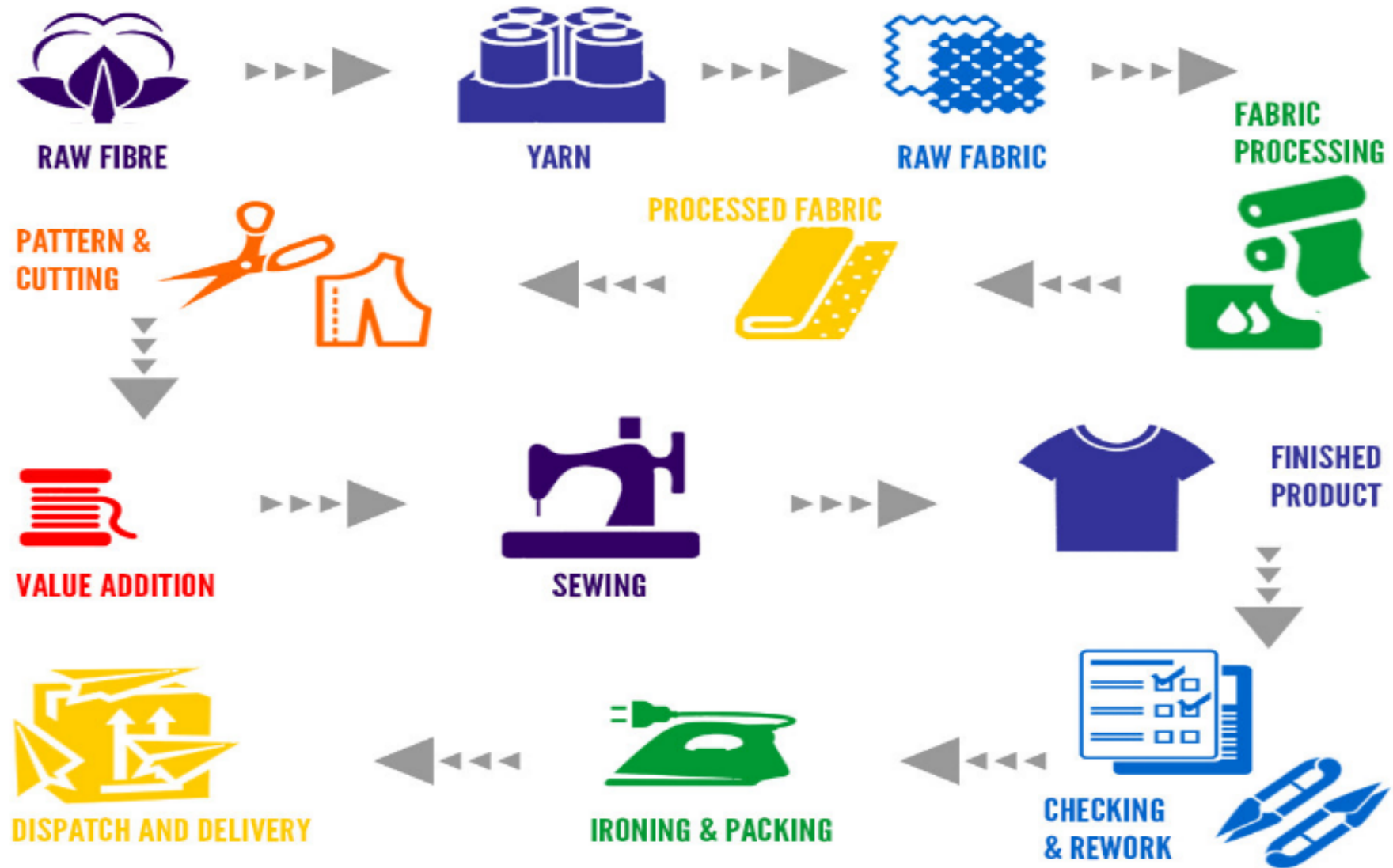


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<http://stitchdiary.com/vietnam-garment-industry/>



Fibre-to-Finished Product Process

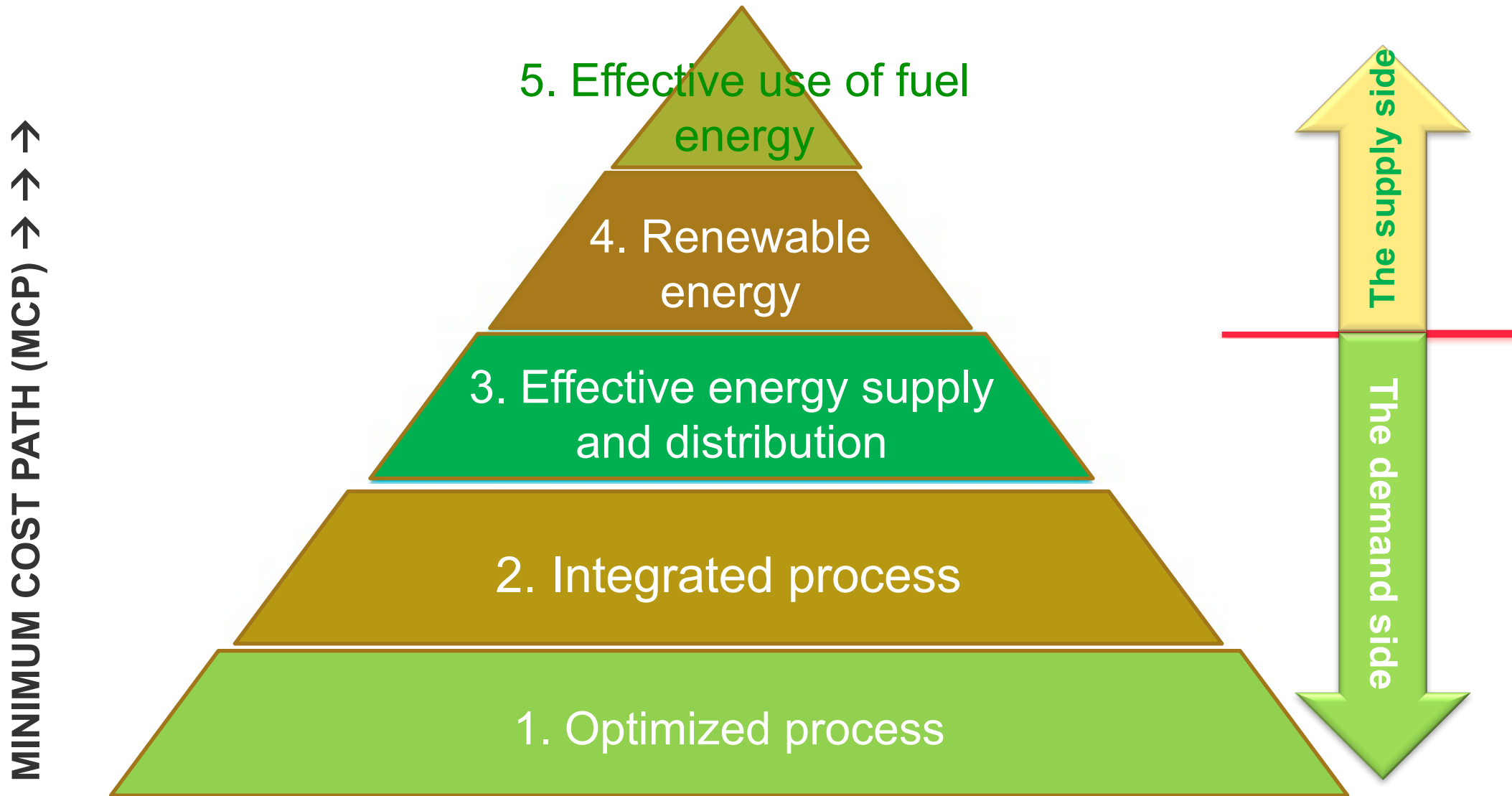


Productivity enhancement - resource saving

- Energy saving
- Water saving
- Material saving
- Labor saving



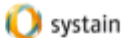
EXPERIENCE IN ACCESSING ENERGY SAVING AND EFFICIENCY



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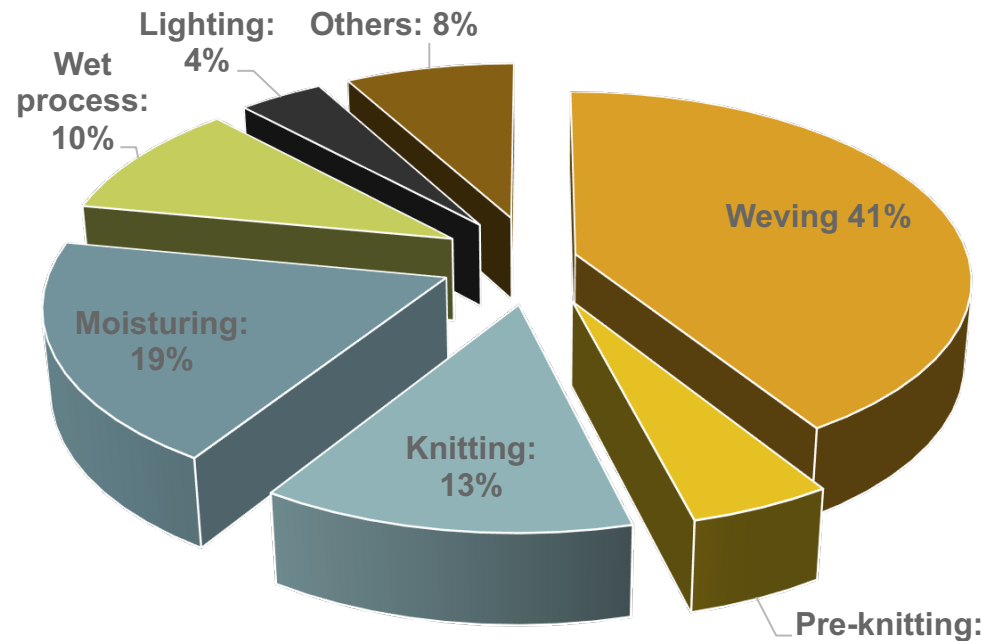
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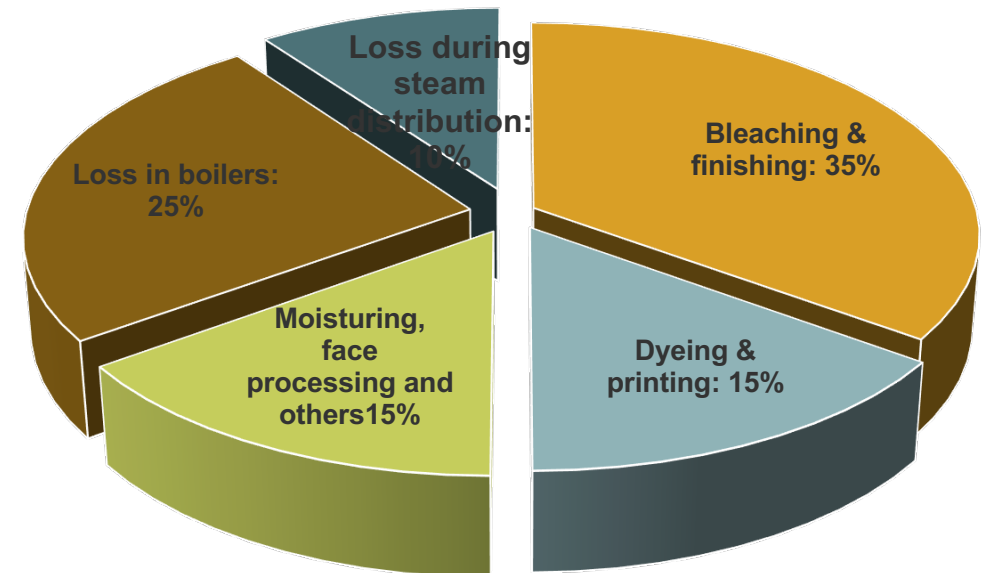
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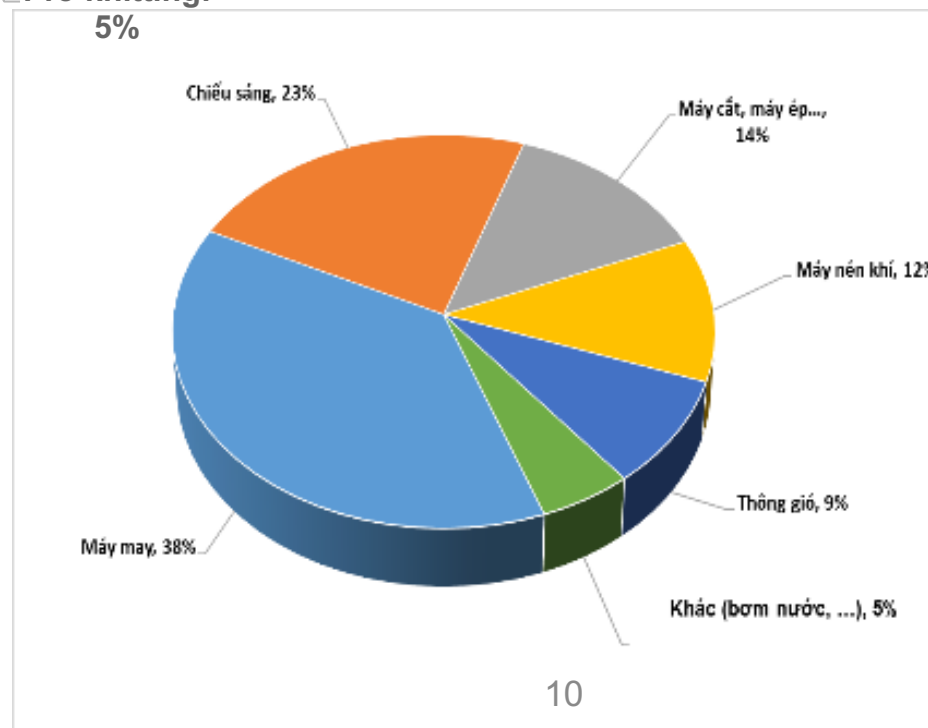
Power consumption in textile factories



Power consumption in a typical knitting, dyeing factory



Heat consumption in a typical knitting, dyeing factory



Energy consumption in a typical sewing factory

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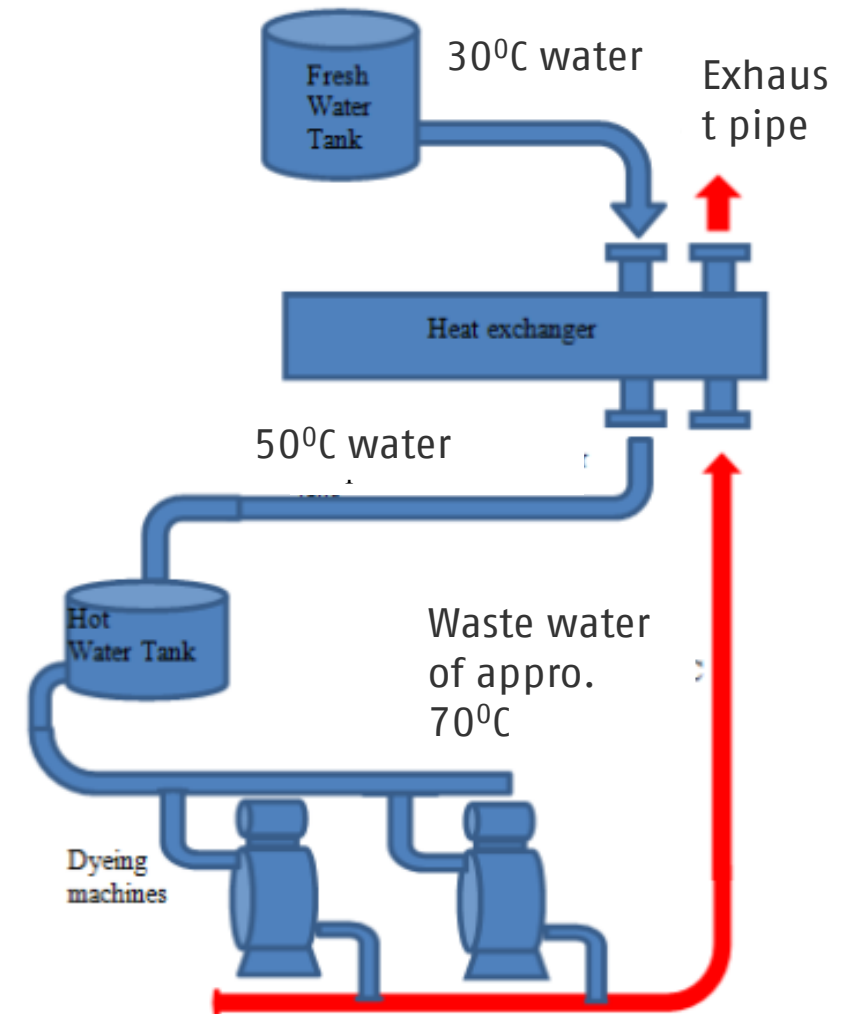


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Heat recovery in the dyeing process - A typical example

The system recovers heat from hot (of over 80 deg C) water exhaust pipes in all dyeing machines to produce 50 deg C water at a dyeing factory

Investment (VND)	1,188,000,000
Energy saving for the boiler system	4,721,000 kg/year
Fuel cost saving/year	VND5,340,000,000/year
Payback	~ 3 months



Simple schematic showing use of hot waste water to pre-heat

Low liquor ratio (LLR) dyeing technique - A typical example

- 8 LLR dyeing machines with the capacity of 800kg are installed in the factory

The current high
liquor ratio dyeing
machine



MAKE: JUNGIL MODEL: JIDC-2300
MLR: 1:8

The new LLR dyeing
machine



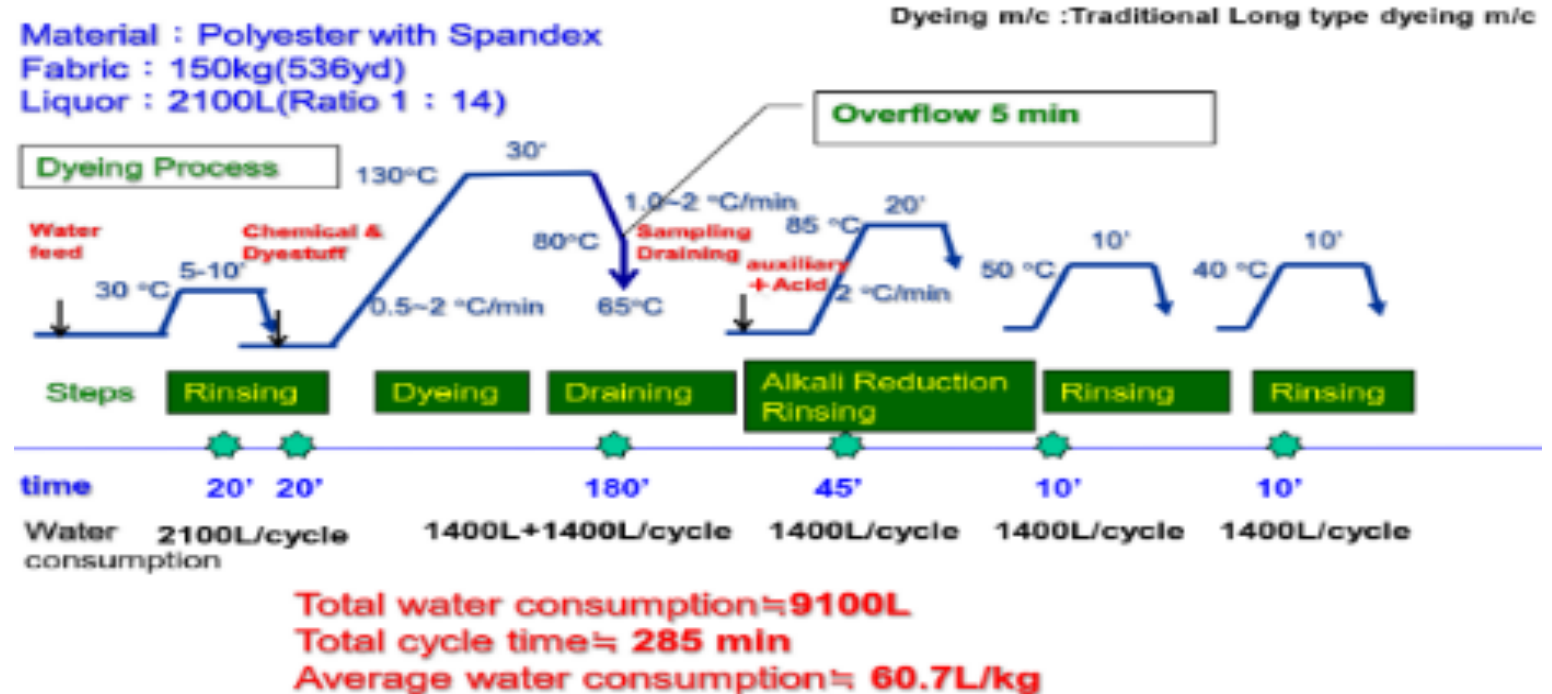
MAKE: ACME - MODEL : AM-ICD
MLR: 1:1.2 ~ 3.5

Dyeing with low Material to Liquor Ratio (MLR)

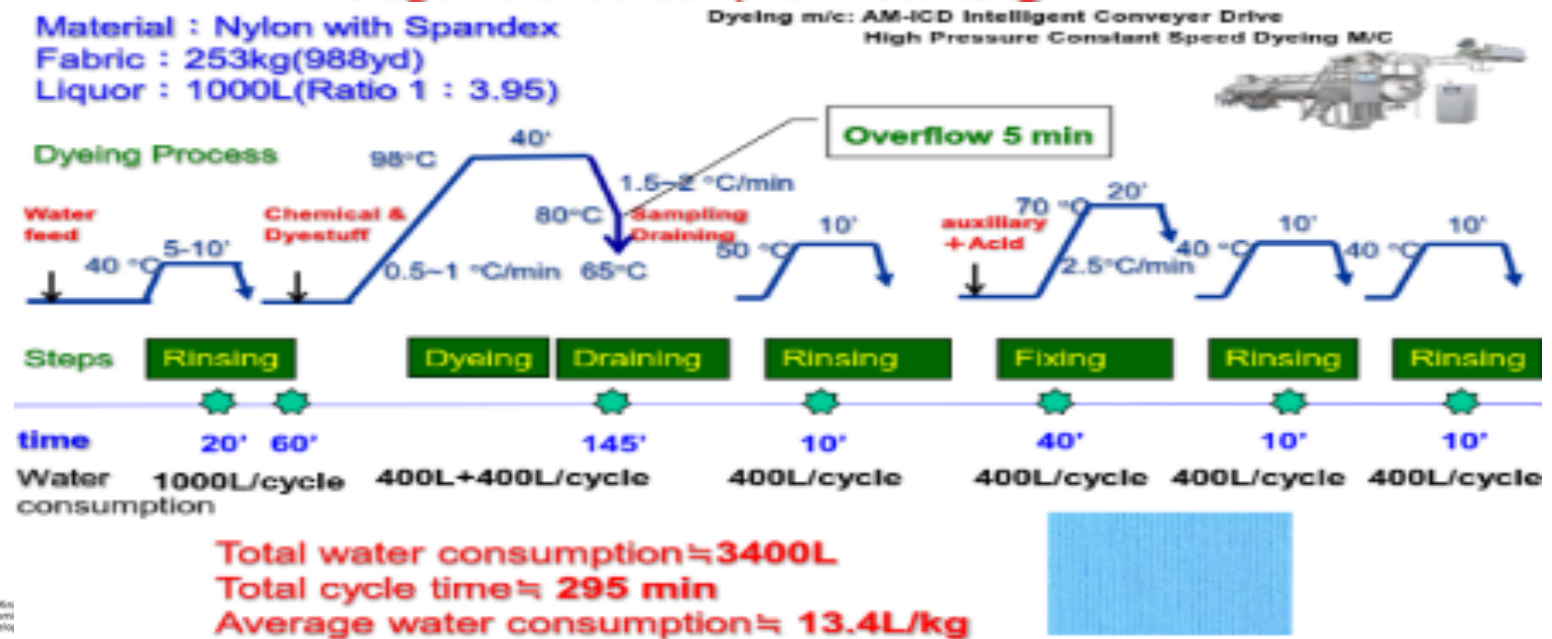
- The old-fashioned overflow dyeing machine causes excessive water consumption in a dyeing batch.
- Water is replaced with compressed air in LLR (air) dyeing machines.
- Reduce consumption of water and chemicals
- M:L = 1: 3 or 1: 4 Vs. the MLR of conventional dyeing machines of 1:8 or even 1:12.
- Air, even-flow and other LLR dyeing machines can save
 - Appr. 50% of water
 - Appr. 15% of steam, and
 - 15-50% of admixtures used in dyeing,
 - Save 2-3 hours of manufacturing time for a dyeing batch

Low liquor ratio (LLR) dyeing technique - A typical example

CURRENT DYEING MACHINE



LLR DYEING MACHINE



End-product fabric

Low liquor ratio (LLR) dyeing technique - A typical example

IMPACTS ON RESOURCE CONSUMPTION (8 machines x 800 kg)

Resources	Annual consumption by the high liquor ratio dyeing machine	Annual consumption by the LLR dyeing machine	Resource consumption reduction
Water consumption (m ³)	148,055	65,802	82,253
Waste water(m ³)	125,847	55,932	69,915
Chemical consumption (kg)	1,406,523	625,121	781,042
Steam consumption (kg)	5,552,064	2,467,584	3,084,480
Coal (kg)	922,941	410,196	512,745

COST EFFECTS (8 machines x 800 kg)

	High MLR machine	Low MLR machine	Saving
The cost of clean water (USD)	79,456	35,314	44,142
The cost of waste water (USD)	72,823	32,366	40,457
The cost of chemicals (USD)	2,169,724	964,932	1,204,792
The cost of steam consumption (USD)	87,890	39,062	48,828
Total Operation Costs (USD)	2,409,893	1,071,674	1,338,219

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Low liquor ratio (LLR) dyeing technique - A typical example

As part of its expansion plan, this factory ordered 8 AM-ICD LLR dyeing machines with the total capacity of 6.4 tons. (8 machines x 800kg/machine)

* Results:

- ✓30% of water consumption
- ✓50% of chemical consumption

Water saving	5.87%
Chemical saving	12.36%
Fuel saving	0.13%
Greenhouse gas reduction	2.150,9 tCO2e
Investment cost	US\$3,748,330
Payback	33.6 months

Recovering heat in the cooling process by reducing the temperature to 70 deg C in dyeing

Current state: In polyester dyeing heat loss can reach 80 deg C.

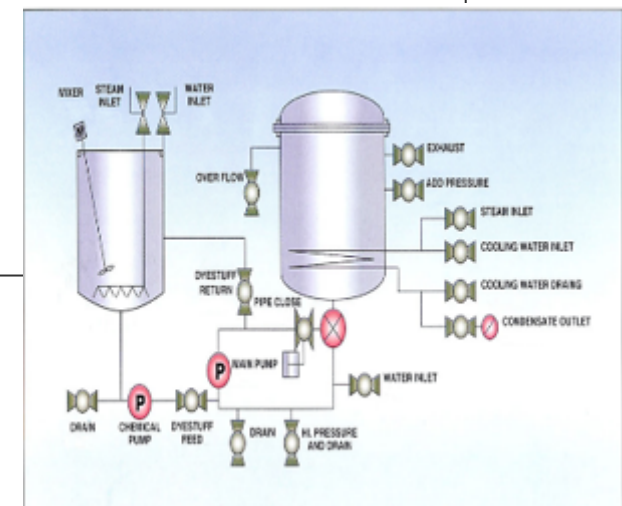
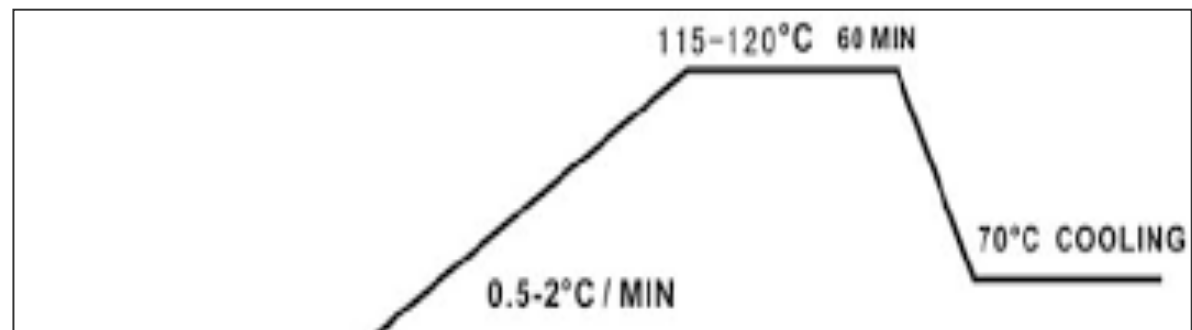
The process consumes more water; and fabric wrinkles may occur.

Solution: It is recommended the dyeing water temperature be reduced to 70 deg C and overflow be avoided, which enables water and energy saving (with 15 deg C of heat recovered).

Saving potentials:

- Water saving: - 15%
- Energy (steam) saving: - 5-7%

Investment: No investment



6. Insulation of dyeing machines to prevent Heat loss from dyeing machines

- **Current state:**

Facility has 15 dyeing machines with 70 tubes which are being used for polyester dyeing. In polyester dyeing heat loss from surface is too much. It is a direct thermal energy loss and so the heat loss to environment.

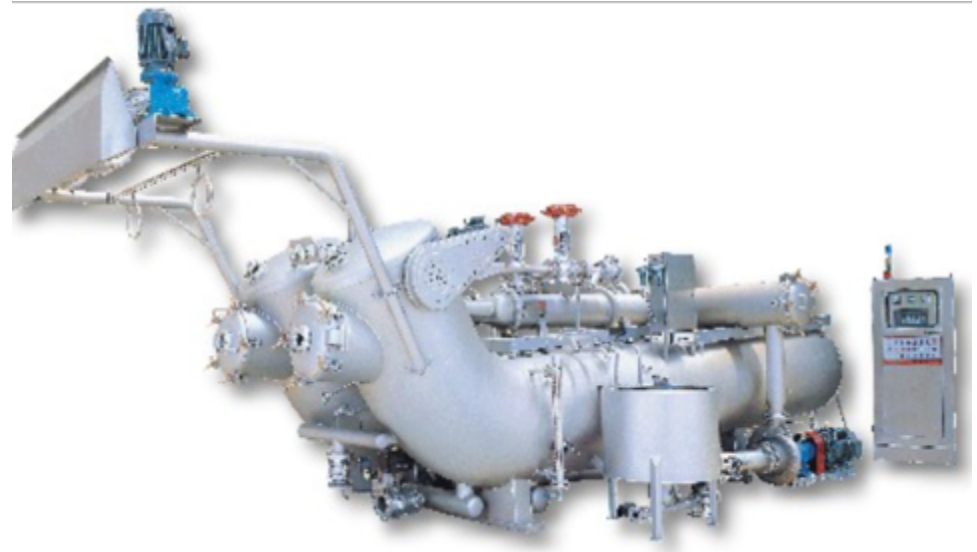
It increases the temperature of production floor as well as responsible for high consumption of steam. We have measured surface temperature 115 deg C when inside the machine was 130 deg C.

- **Solution:**

Insulate all the machines with Heat Shield paint to avoid any heat loss.

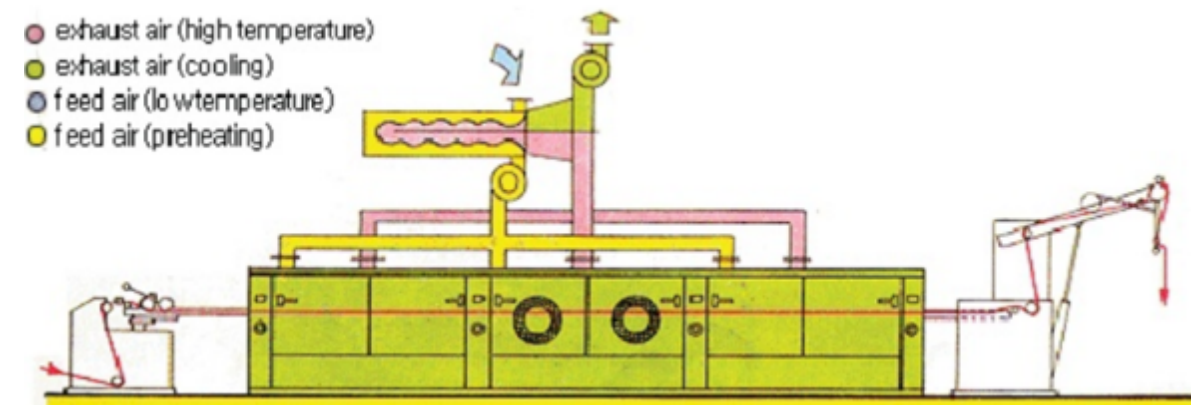
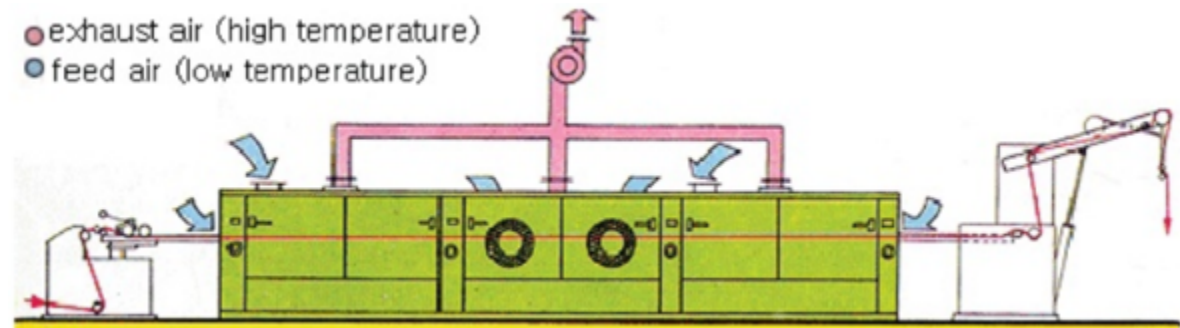
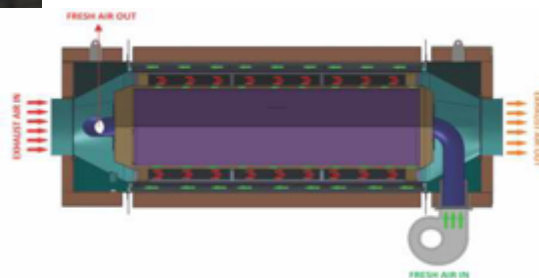
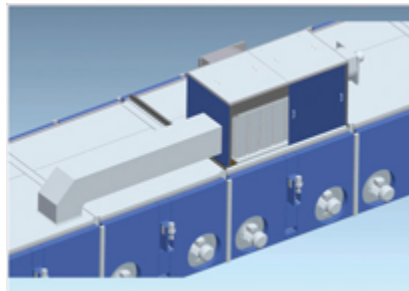
- **Benefit:**

It will save 15-20% thermal energy.

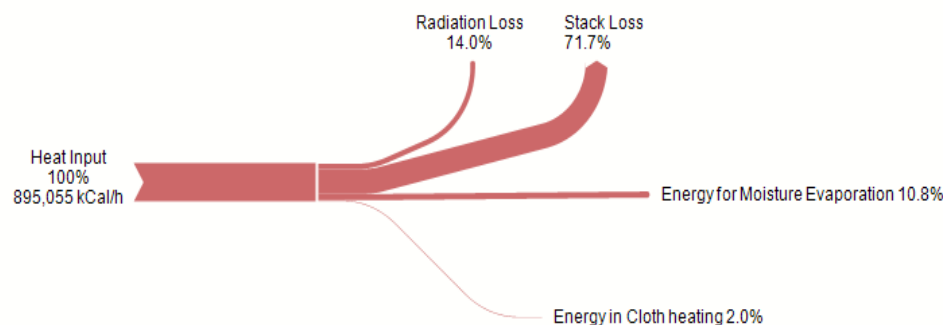


Refer: <https://www.coatingsworld.com/contents/view.../nansulate-coating...coatings/78>

Heat recovery from stenters



Heat Distribution of Stenter



Heat loss for fabric tumble drying

1,400 kCal/kg

Required temperatures

170 – 2,000 °C

Heat saving

20%

Investment in the waste heat recovery unit (WHRU)

US\$85,000

Payback

14 months

Greenhouse gas reduction

3,912 tCO₂e

Energy efficiency for washing machine in the textile industry

Comparison of water and energy consumption of 2 different washing machines in 2 factories:



Industrial horizontal washing machine
In Factory A (Thai Binh Province)



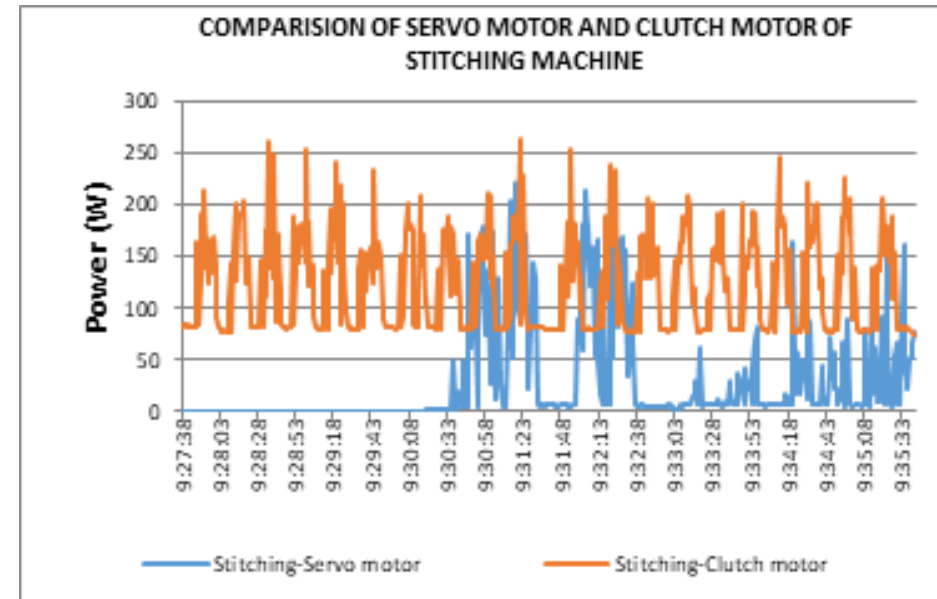
High-efficiency washing machine
Factory B

Water saving: 50 - 60%

Steam saving: ~30%

Electronic sewing machines with servo motors- A typical example

Case study: High-cost solution: Replace 280 common sewing machines with electronic servo machines at a plant in Ho Chi Minh City



- ❑ Cost saving: US\$113.953/year
- ✓ Power saving: 57,000 kWh/year
US\$4.331/year
- ✓ Labor saving: US\$96.854/year
- ✓ Annual maintenance saving: US\$12,768/year
- ✓ GHG reduction: 46 tons of CO₂/year
- ❑ Investment cost: US\$430.379
- ❑ Payback: 3.78 years

General benefits:

- Energy: 60%

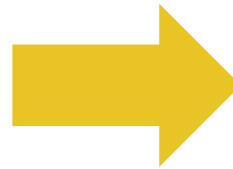


- Output: 15%



Energy saving measures for the lighting system

1. Make use of natural light



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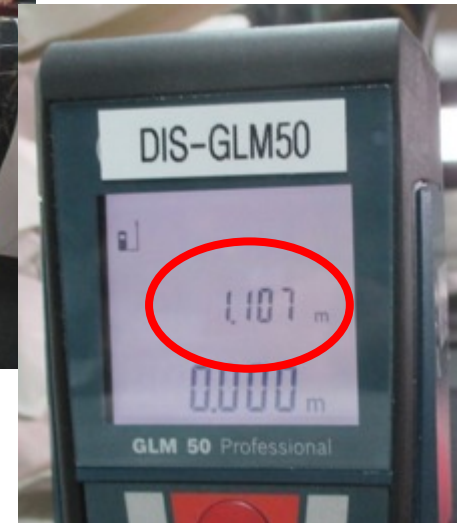
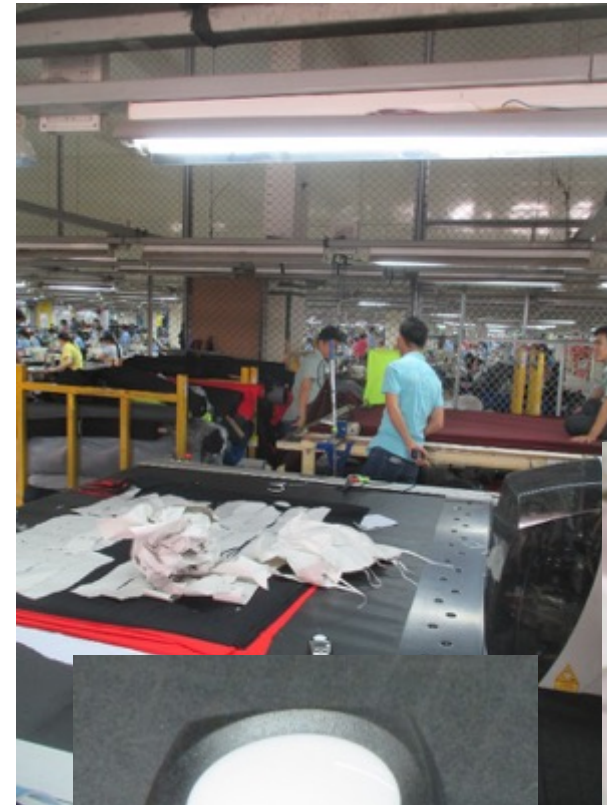
Energy saving measures for the lighting system

2. Turn off lights when not in use



Energy saving measures for the lighting system

3. Lower the heights of lights, increase their brightness, and reduce the number of lights



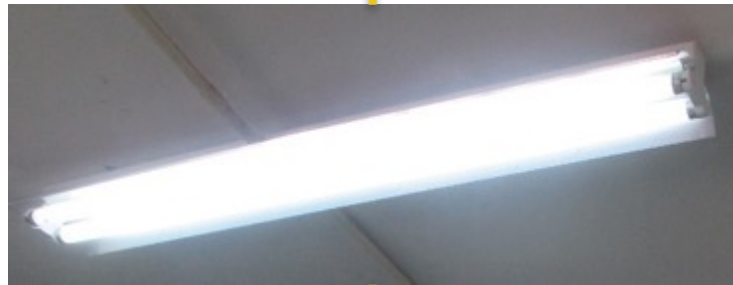
Energy saving measures for the lighting system

4. Use LED for sewing machine needles, reduce lighting in common areas (the number of ceiling lamps)



Energy saving measures for the lighting system

5. Replace existing fluorescent light bulbs with LED



Solution	saving percentage
Replace (magnetic) 46W T8 fluorescent ballasts with (18W) LED	~61%
Replace (electronic) 36W T8 fluorescent ballasts with (18W) LED	~50%
Replace 28W T5 fluorescent ballasts with (18W) LEDs	~36%

Investment: medium level

Payback: ~ 1–3 years



Energy saving measures for the COMPRESSED AIR SYSTEM

1. Fix all compressed air leakages



Code:

LEAKAGE TAG

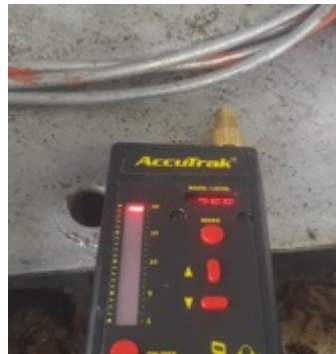
NAME:

DATE:

TYPE OF LEAKAGE (LOW, MEDIUM, HIGH):

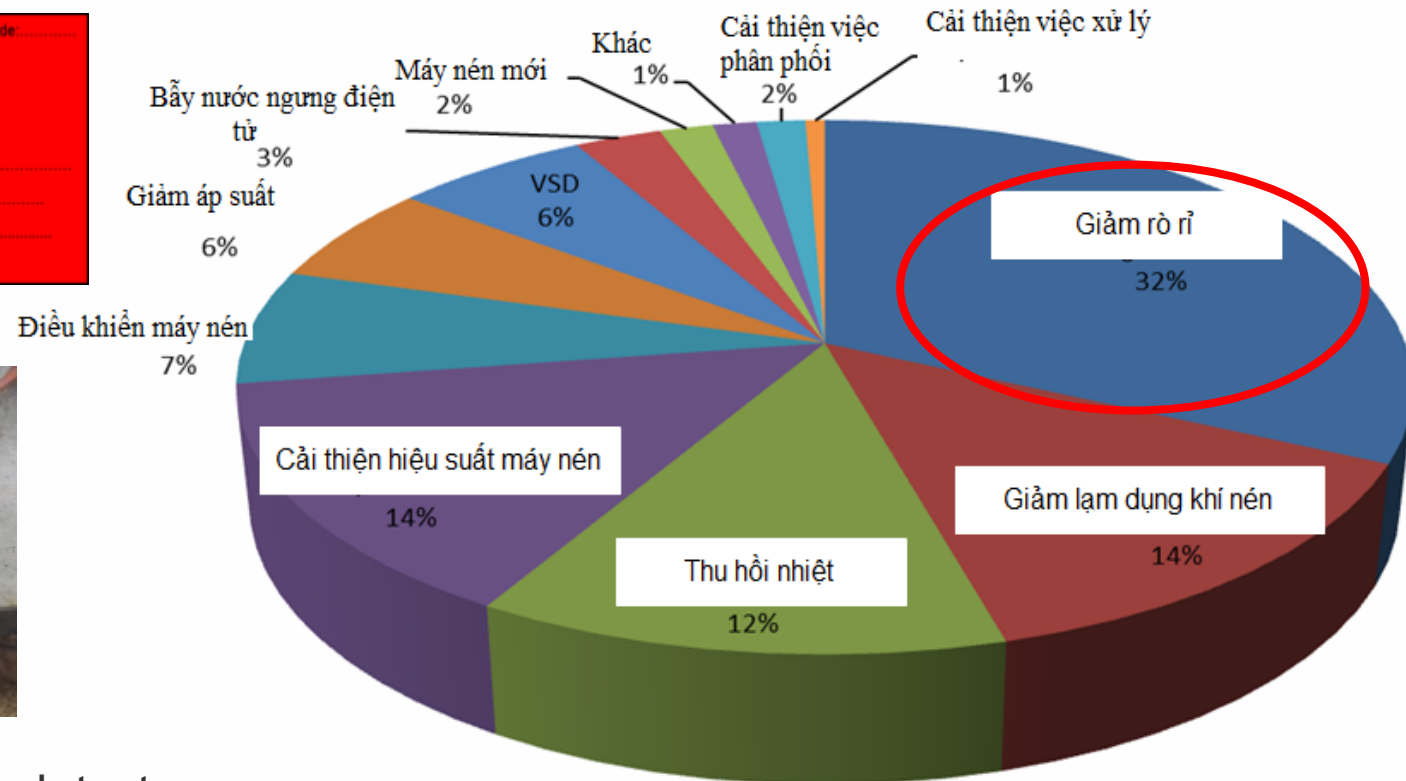
POSITION:

DESCRIPTION:



Ultrasonic leak detectors

Potentials for energy saving in the compressed air system



Source: Unido

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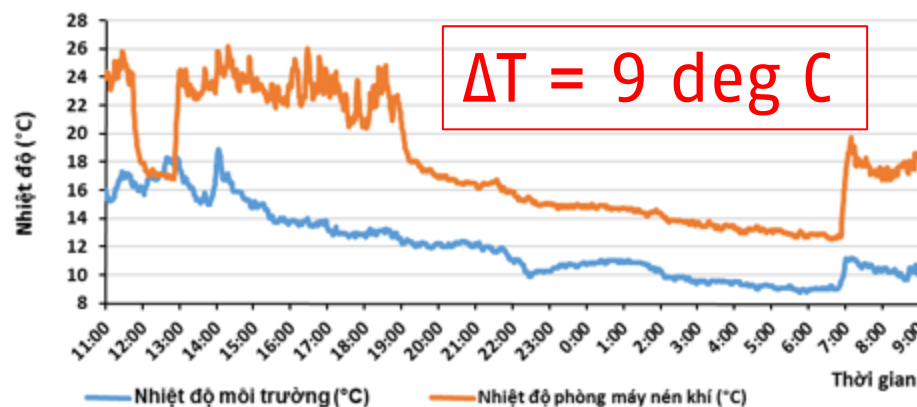


Energy saving measures for the COMPRESSED AIR SYSTEM

2. Reduce the temperature of the feed air for air compressors



Nhiệt độ môi trường (25-26/01/2016)



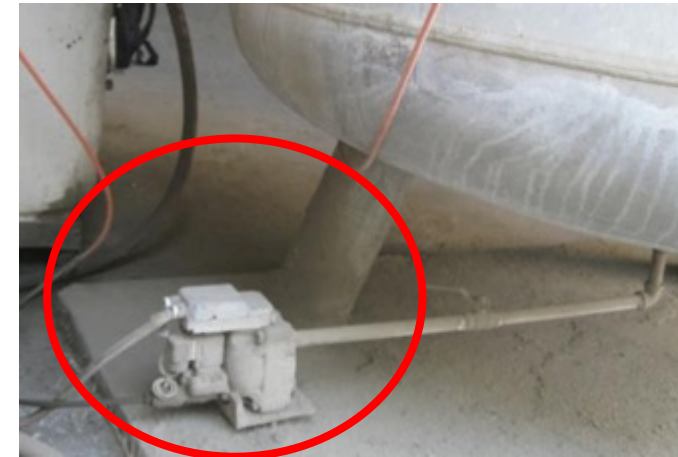
Reduce 4 deg C → Reduce power consumption by 1% (kWh)

Energy saving measures for the COMPRESSED AIR SYSTEM

3. Use automated condensate pump according to the water level

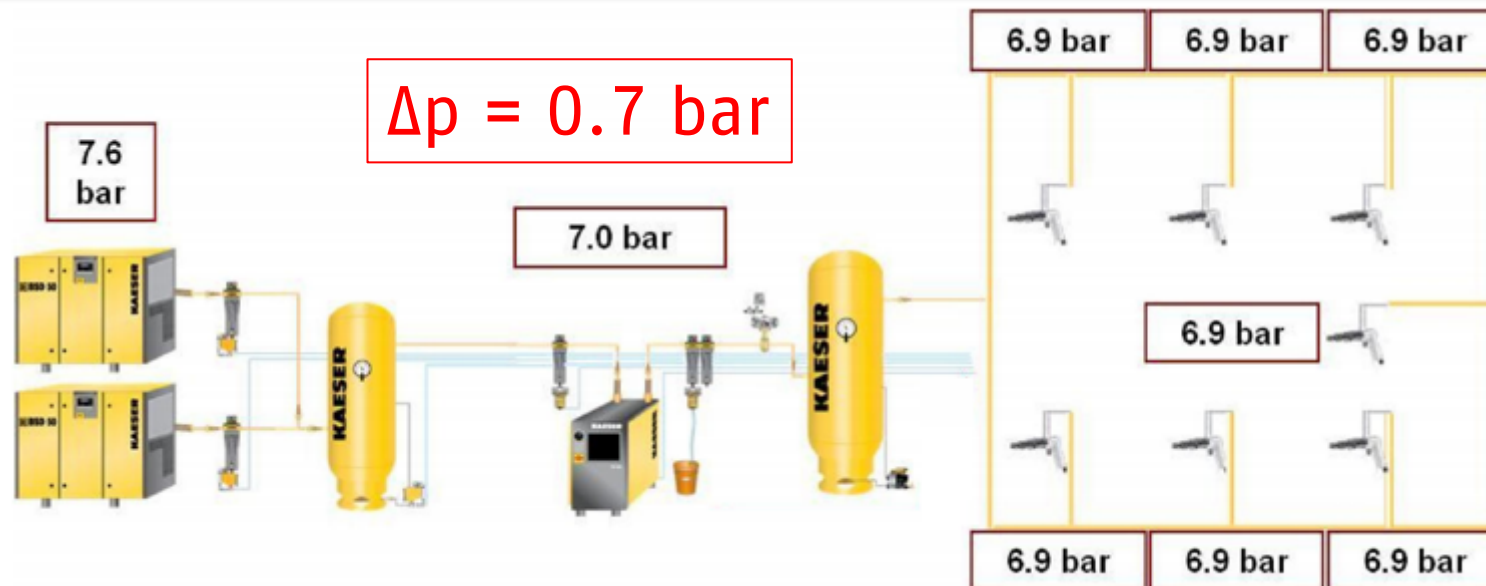
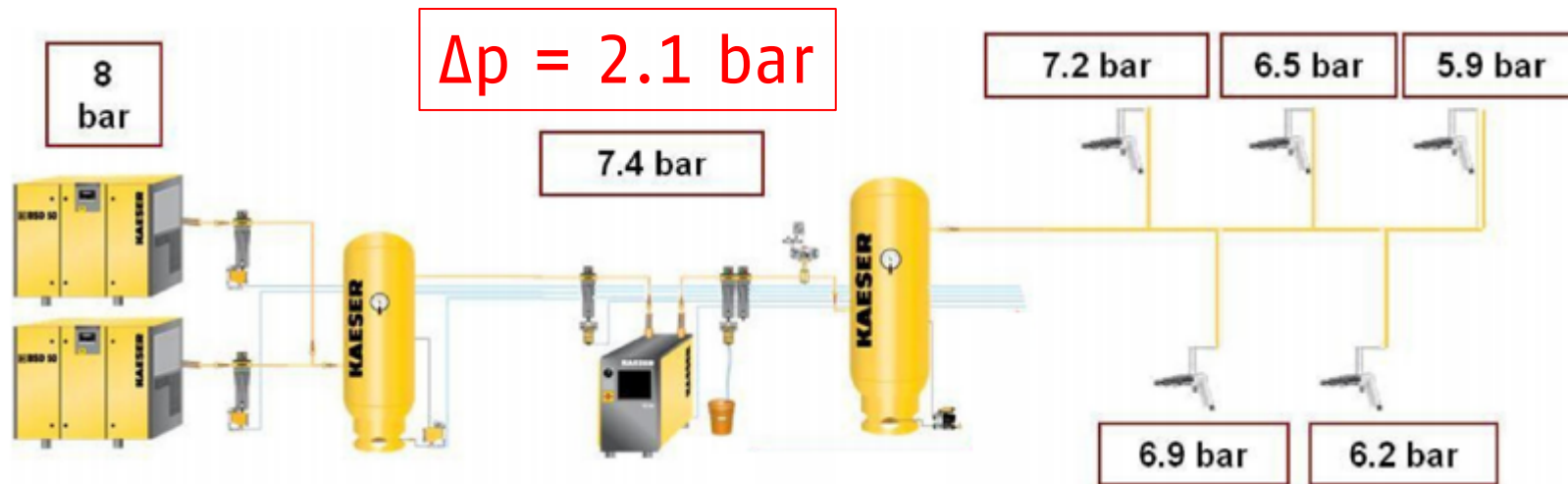


 Giá: Liên hệ XEM CHI TIẾT →	 Giá: 2.200.000 VNĐ Giá KM: 1.500.000 VNĐ XEM CHI TIẾT →	 Giá: 5.000.000 VNĐ Giá KM: 3.800.000 VNĐ XEM CHI TIẾT →	 Giá: 300.000 VNĐ XEM CHI TIẾT →
 Giá: 3.500.000 VNĐ Giá KM: 2.800.000 VNĐ XEM CHI TIẾT →	 Giá: 1.000.000 VNĐ Giá KM: 800.000 VNĐ XEM CHI TIẾT →	 Giá: 1.700.000 VNĐ Giá KM: 1.400.000 VNĐ XEM CHI TIẾT →	 Giá: Liên hệ XEM CHI TIẾT →



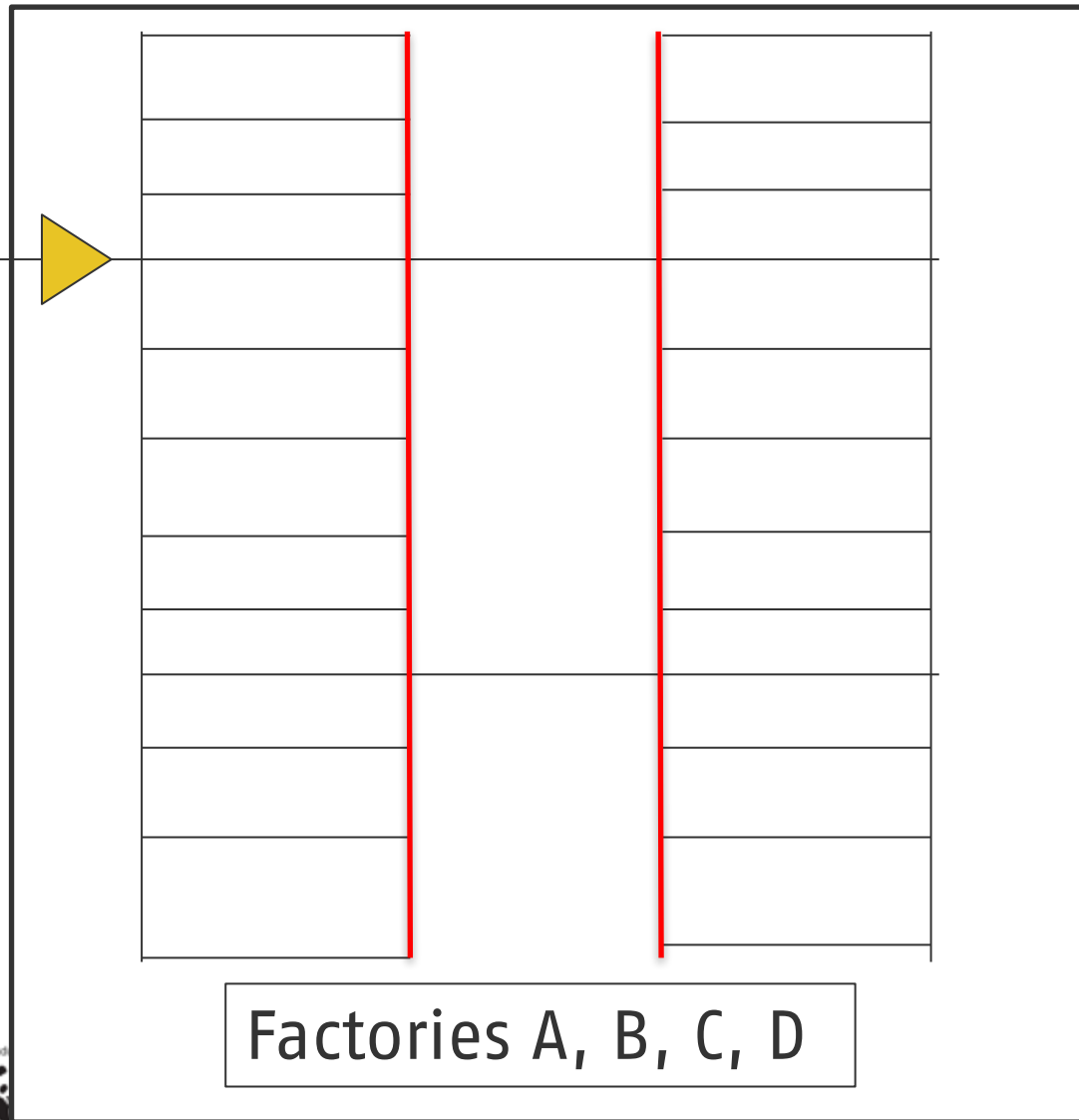
Energy saving measures for the COMPRESSED AIR SYSTEM

4. Build a ring line to reduce air pressure setting for air compressors



Energy saving measures for the COMPRESSED AIR SYSTEM

4. Build a ring line to reduce air pressure setting for air compressors



Unload: 8,0 bar
Load: 6.0 bar

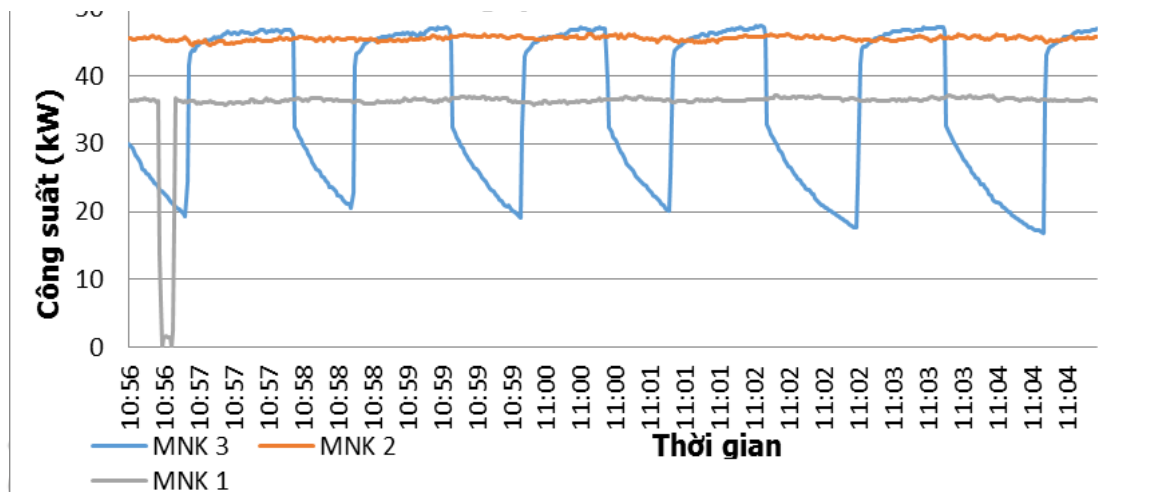
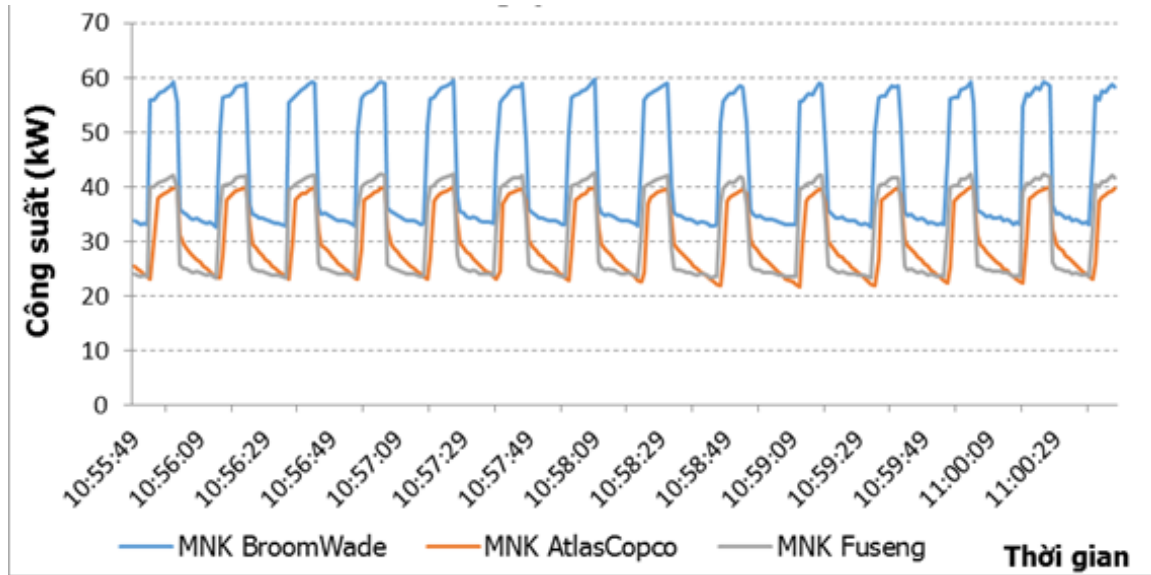


COMPRESSOR SET
STOP-P 8.0 bar
UNLOAD-P 6.0 bar
LOAD-P 6.0 bar

1 bar less → 6 - 10% (kWh) less of power consumption

Energy saving measures for the COMPRESSED AIR SYSTEM

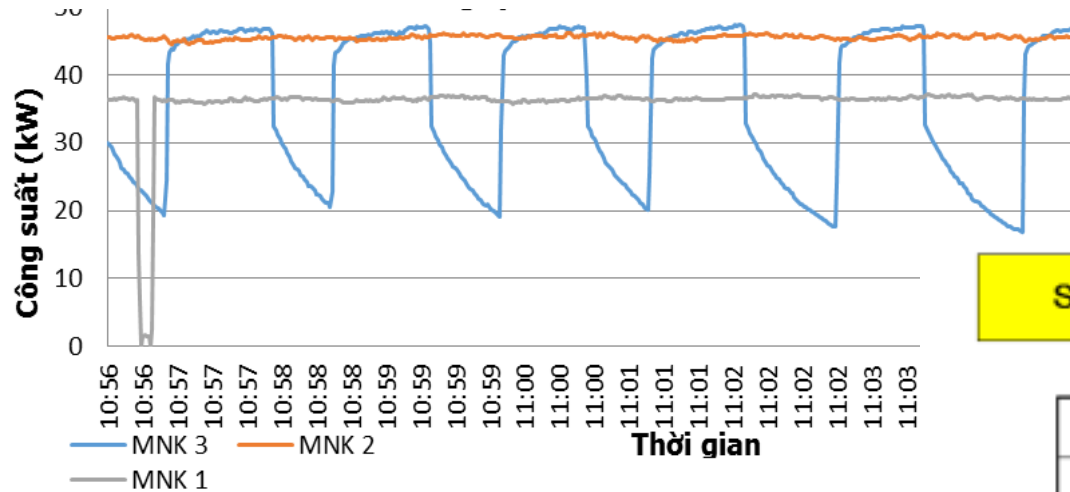
5. Stratify compressed air pressure & Install the central control unit



4 - 6% (kWh) less of power consumption

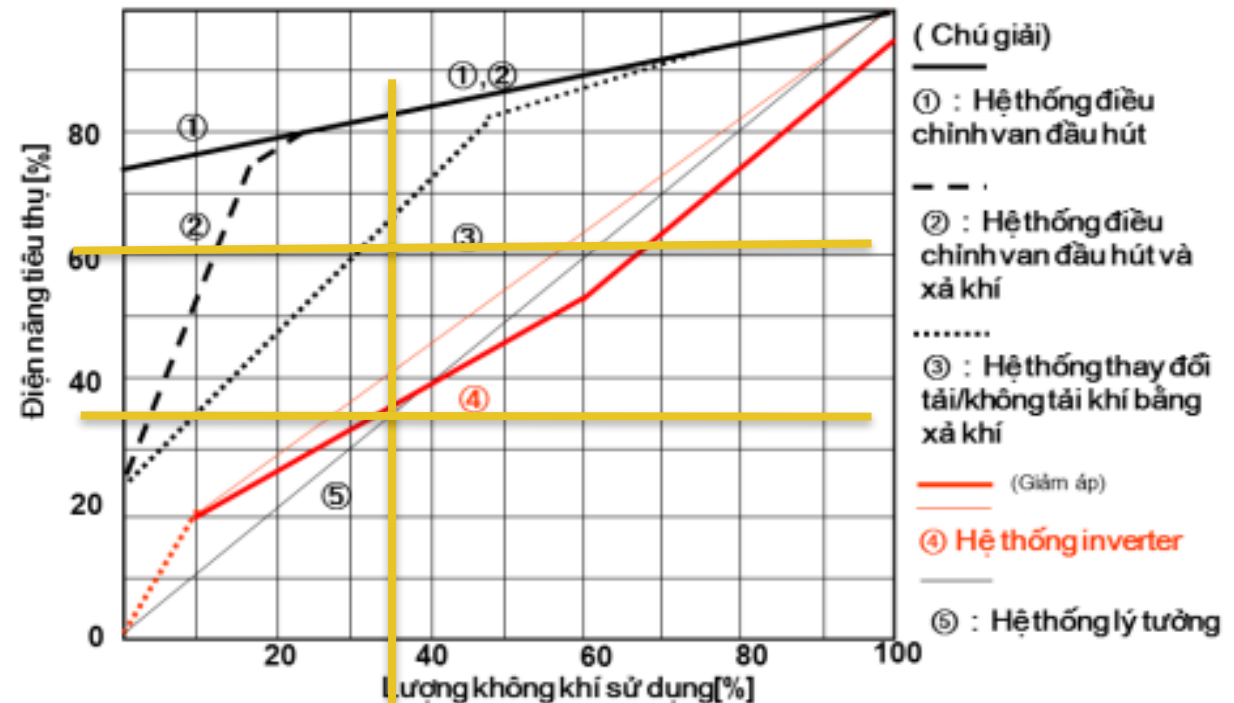
Energy saving measures for the COMPRESSED AIR SYSTEM

6. Install Variable Speed Drive (VSD)/inverters for air compressors



10 - 30% (kWh) less of power consumption

So sánh điện năng tiêu thụ của máy nén khí của từng hệ thống



Reference : " Air Compressor " by Mr. Matsukuma 2005 ECCJ

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SOLUTIONS FOR THE BOILER & STEAM FEED SYSTEMS

1. Equip a steam trap for each steam iron



30% less of steam consumption



SOLUTIONS FOR THE BOILER & STEAM FEED SYSTEMS

1. Equip a steam trap for each steam iron



Steam is exhausted through the condensate line



Steam traps are equipped for irons at the factory

Estimated percentage of steam saving	%	20%
Annual steam saving	tons/year	272.4
Annual wood saving	Kg/year	58,829
Annual fuel cost saving	Mil. VND/year	145.6
investment cost for 36 steam traps	Mil. VND	14.4
Payback	Year(s)	0.1

SOLUTIONS FOR THE BOILER & BOIL FEED SYSTEMS

2. Replace the central steam system with a local electrical steam system

7 kW/iron



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3kW/iron



Specification

Model	860F	860B
Table Size	1520 x 820	350 x 1000
Power Supply	220V/380V	220V/380V
Motor Power	750W	750W
Boiler Power	3KW	3KW
Table Heat Pipe Power	750W	1000W
Arm Heat Pipe Power	350W	350W



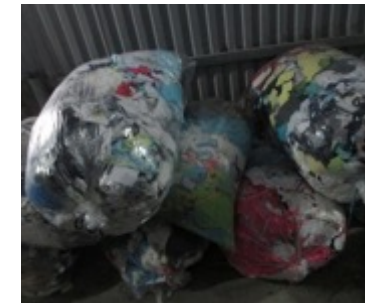
SOLUTIONS FOR THE BOILER & BOIL FEED SYSTEMS

3. Use biomass- and rag-fed boilers



Coal → Sawdust: 30%

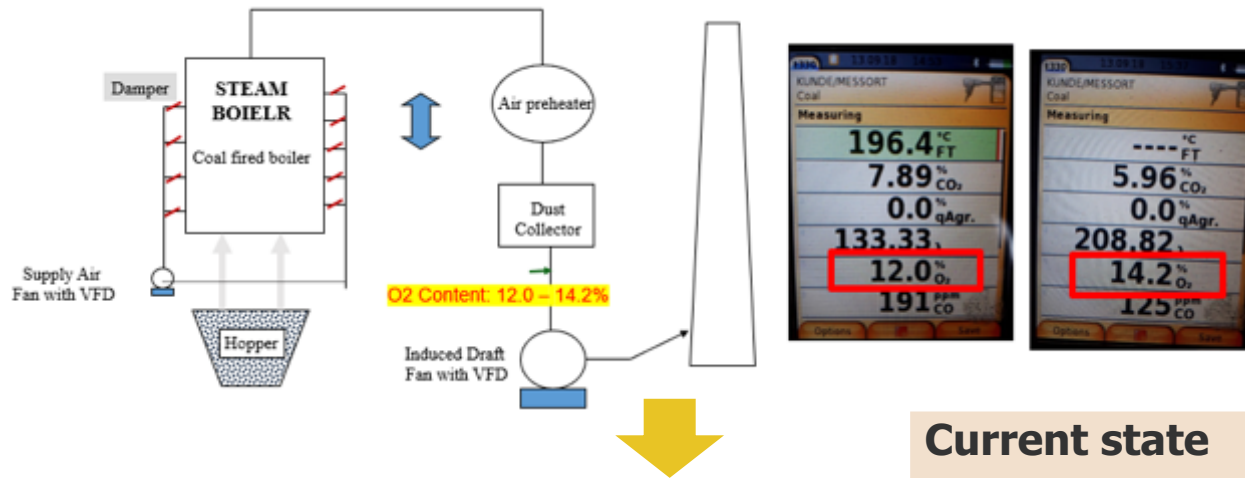
Sawdust → Rags: 70%



SOLUTIONS FOR THE BOILER & STEAM FEED SYSTEMS

4. Optimize combustion process and improve boiler capacity

CASE STUDY: Use an online oxygen sensor and a Variable Speed Drives (VSD) to control the air suction and blow fans for optimized thermal oil furnaces



Current state

The thermal oil furnace of a factory in Tien Giang province has 14% of oxygen which is higher than the expected level of 10%.

Recommendations:

Equip air suction and blow fans of the thermal oil furnace with VSDs and install an oxygen emission analyzer. Based on the measurements of the analyzer, VSD shall adjust the fans' speed for optimal air combustion, Enabling the combustion of appropriate materials and the fuel consumption of the thermal oil furnace.

SOLUTIONS FOR THE BOILER & STEAM FEED SYSTEMS

4. Optimize combustion process and improve boiler capacity



Annual fuel saving:

256 tons of rice husk wood

Greenhouse gas reduction

448 tons CO₂-e/year

Finance:

Cost saving: VND414 mil./year

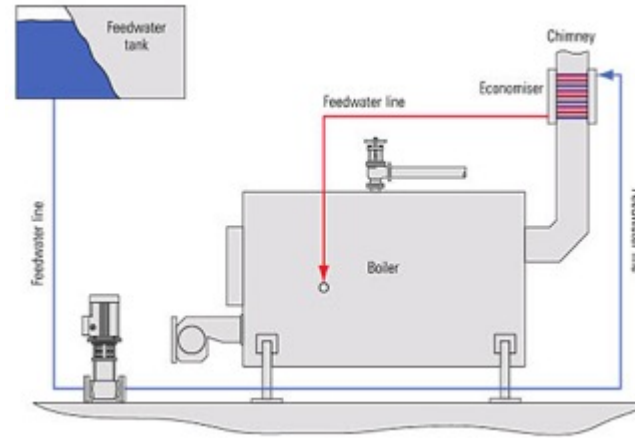
Investment: VND373 mil.

Payback: 1.1 years

SOLUTIONS FOR THE BOILER & STEAM FEED SYSTEMS

5. Install a WHRU to use the waste heat in warming boilers' feed-water

CASE STUDY: Install a WHRU



Annual fuel saving:

423 tons of coal

Greenhouse gas reduction

1,265 tons CO2-e/year

Finance:

Cost saving: US\$49,097/year

Investment: VND25 mil.

Payback: 0.5 year

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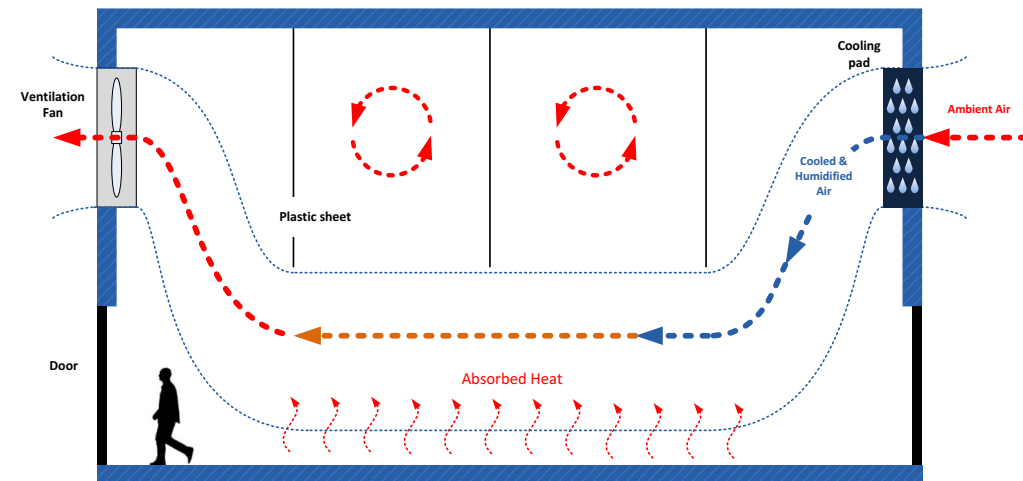
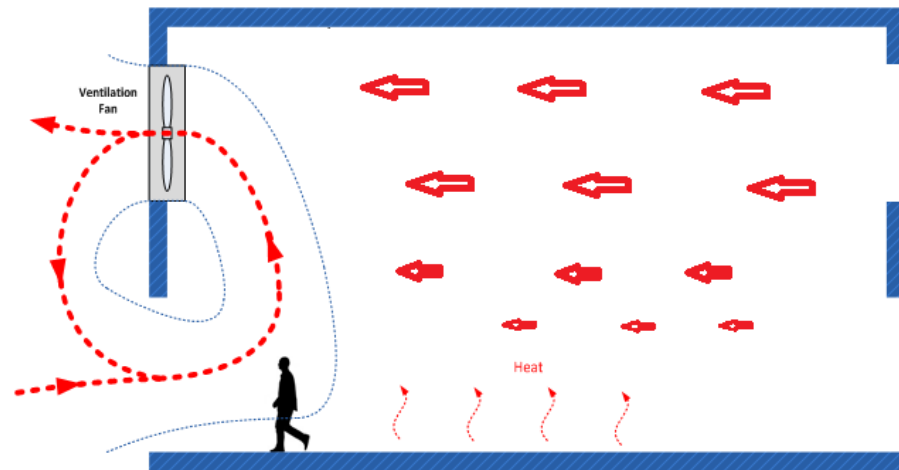


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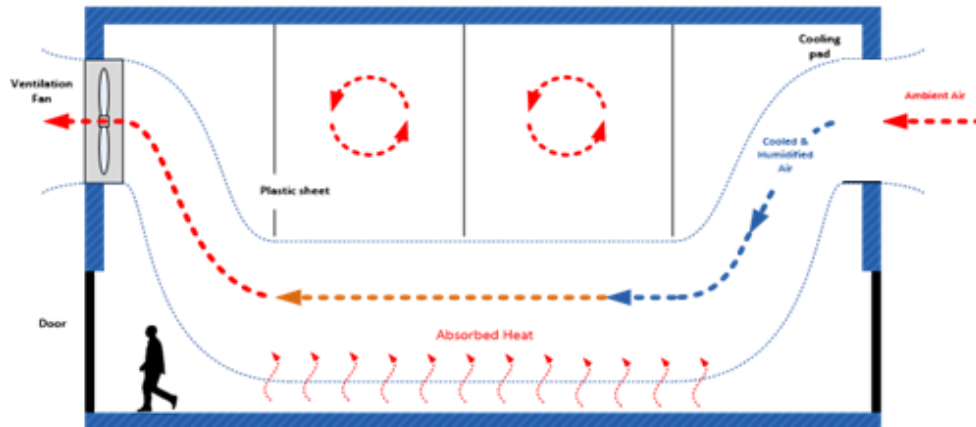
OTHER ENERGY SAVING MEASURES

1. Enhance the effectiveness of water screens and ventilation fans



OTHER ENERGY SAVING MEASURES

- Reduced air conditioned area in the factory: Use suspended ceiling or plastic sheets to lower the heights of the plants



- A plant measuring 40 x 100 x 6m uses 32 ventilation fans of 1.5 hp.
- Plastic sheets were installed to bring the plant's height down to 3 m
- 15% of water and 5% of power is saved for the water screens.

Benefits of solar PV power in the textile industry

1. High solar power output is recorded during peak hours of textile factories

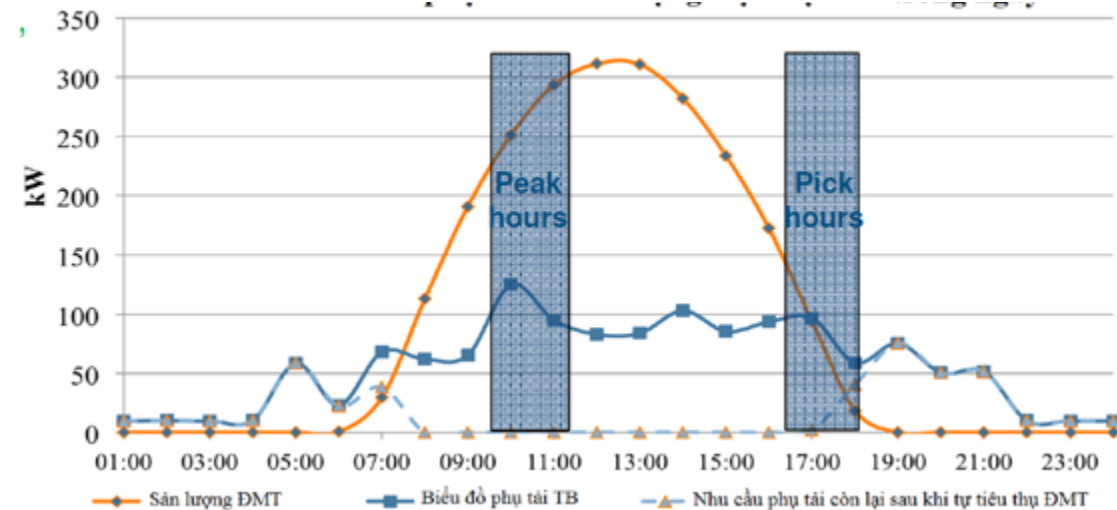
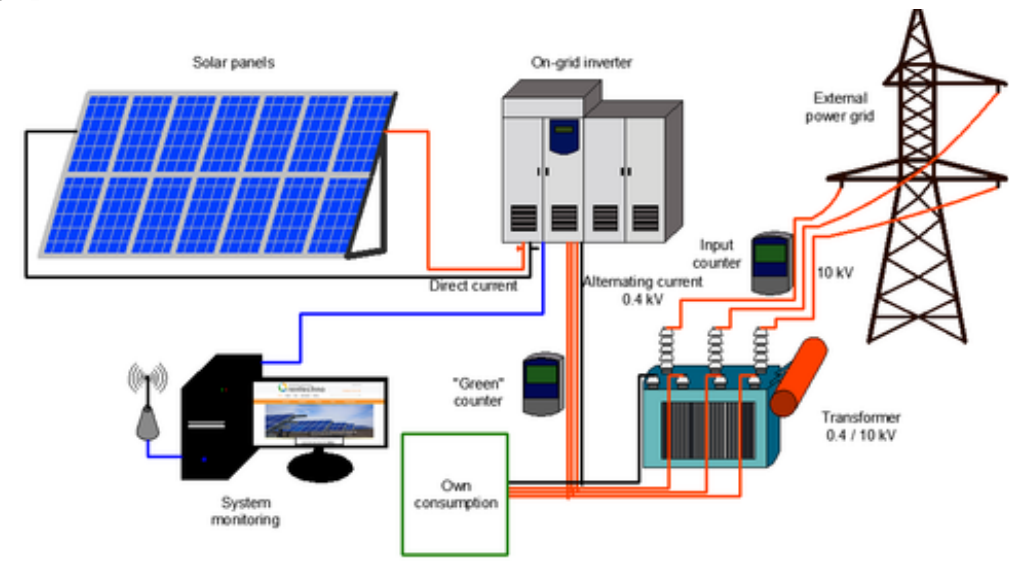
- Reduce peak electricity cost
- Reduce power consumption of “key users”
- Stable commercial power prices in 2020-2025

2. Meeting targets

- Sustainable development and corporate social responsibility (CSR)
- CO2 emission mitigation
- Meeting clients' requirements

3. A brand promotion tool

- Competitiveness
- Added value for products and supply chain

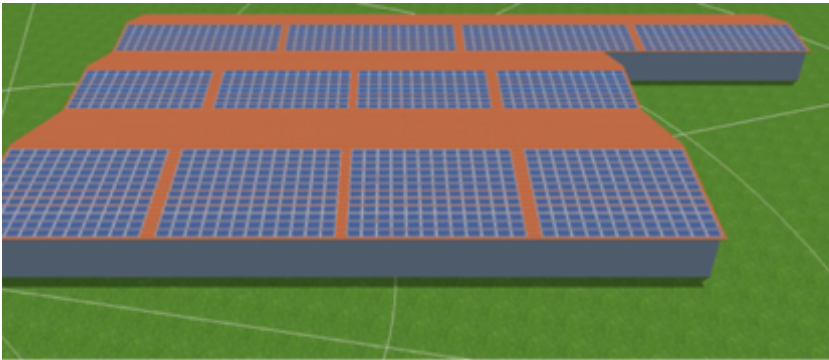


Source: MOIT/GIZ Energy Support Program

Examples: A solar power project of a factory in Binh Duong Province

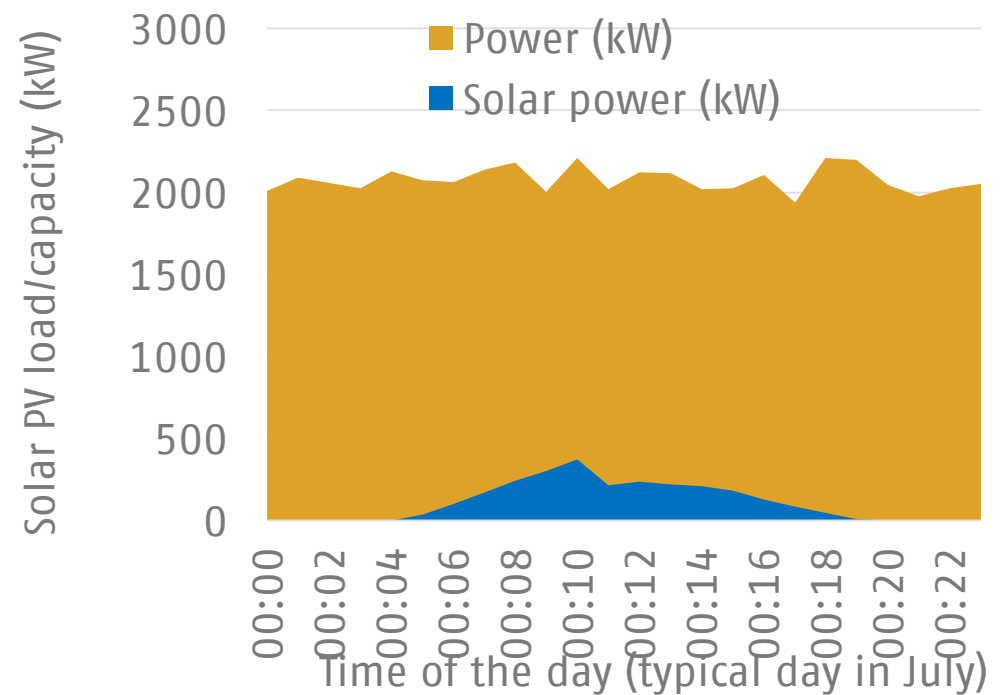
Details of the solar power project

- Roof area: 2,359 sqm
- Installed capacity: 391.5 kWp
- Output: 602,667 kWh/year
- Conductivity: 1,540 kWh/kWp
- Payback: 9 years
- CO₂ emission reduction: 361 tons/year



Source: EEN – MOIT/GIZ

Project solar PV load and output



THANK YOU!



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