

# ASEM SMEs Eco-Innovation Consulting Project :

*- Eco-Innovation Guideline for CNC International -*

2011. 12





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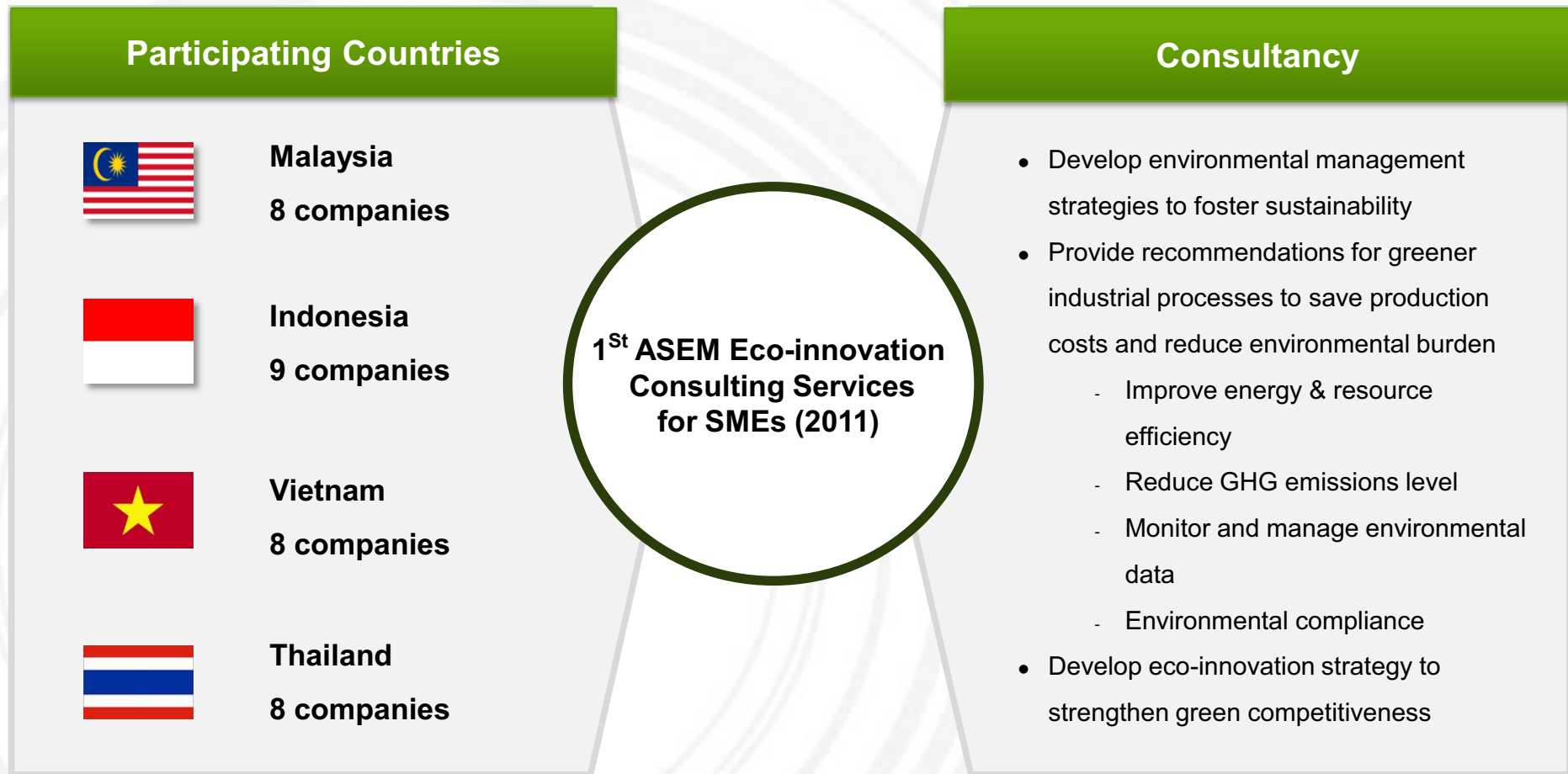
# Introduction to ASEM Eco-innovation Project

- The green marketplace is worth trillions of dollars and against this backdrop, Asian and European countries under ASEM established ASEIC as a cooperative mechanism with the principal mandate of enhancing eco-innovation of SMEs in both regions.
- The Project aims to facilitate innovation in the corporate strategy of SMEs at any stage of the product or service lifecycle, while developing global green growth opportunities.
- The consulting services provide SMEs with the implementation of a holistic and multifaceted approach to strengthening eco-innovation, from sharing core environmental regulations, innovative techniques and practices, to providing related educational program.
- The main goal of Eco-innovation consulting is to strengthen the “green competitiveness” of SMEs by disseminating and utilizing green management and technology in their various businesses.



# Introduction to ASEM Eco-innovation Project

1<sup>st</sup> ASEM Eco-innovation Project was launched September 2011 and finalized in December 2011. Four countries and a total of 33 companies participated in this Project.





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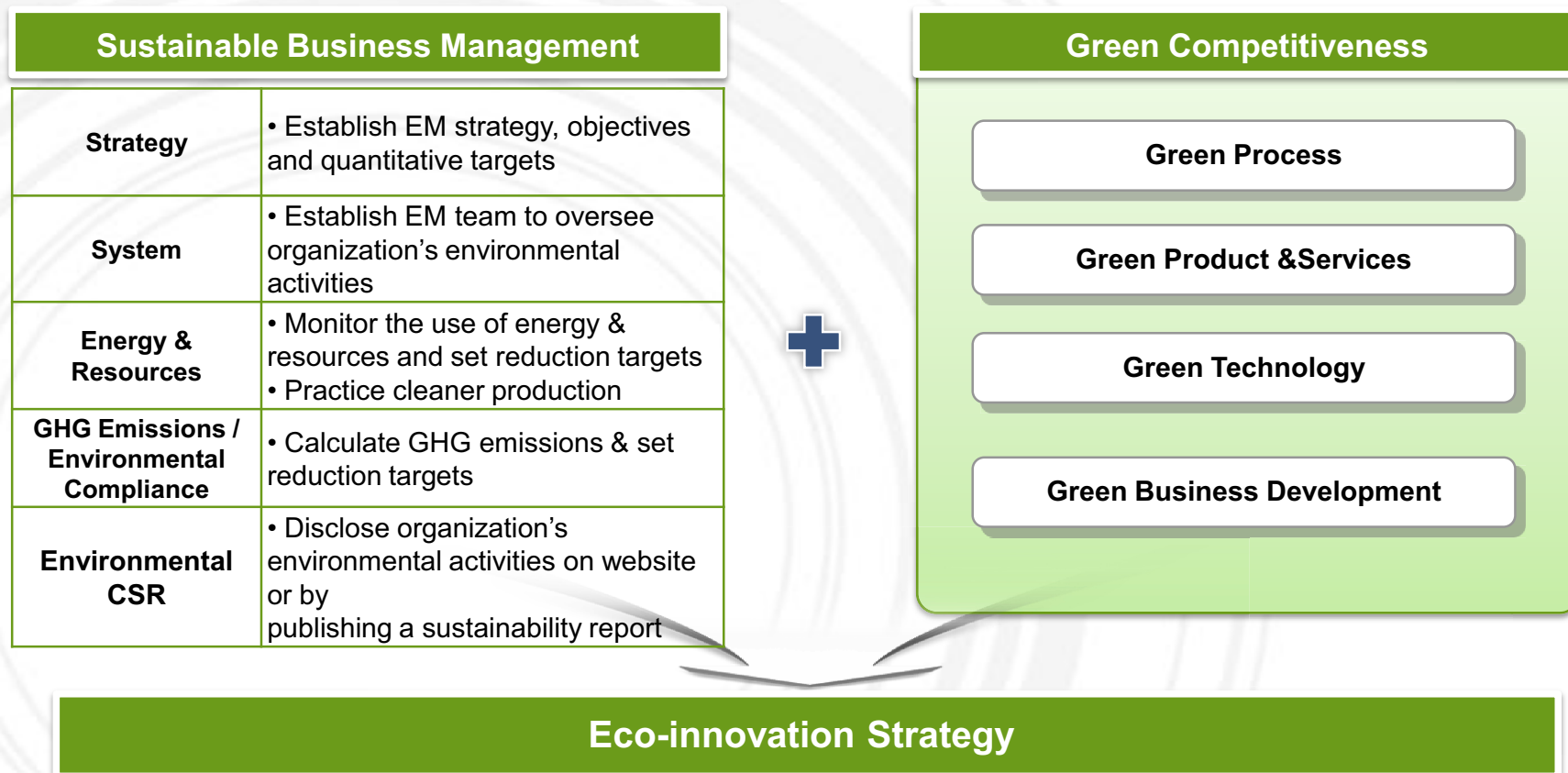
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# Eco-innovation Strategy

**Eco-innovation** is **innovation that results in a reduction of environmental impact**, no matter whether or not that effect is intended.

Eco-innovation can be analyzed along three dimensions:

- 1) **Targets**: the focus areas of eco-innovation such as products, processes, marketing methods, organizations and institutions
- 2) **Mechanisms**: the ways in which changes are made in the targets (modification, redesign, alternatives and creation)
- 3) **Impacts**: effects of eco-innovation on the environment





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# Sustainable Business Management

## Sustainable Business Management Recommendations

### 1. Environmental Strategy & Policies

- Establish an environmental management strategy
- Set qualitative objectives and quantitative targets based on the EM strategy
- Increase green procurement such as the purchase of eco-friendly office supplies and recycled packaging materials
- Enhance equipment efficiency

### 2. Environmental Management System

- Appoint an environmental management representative and establish an environmental management team and committee
- Establish an internal bulletin board to share EM information with employees
- Conduct an internal audit annually
- Attend EM training sessions provided by governmental organizations or global corporations

### 3. Energy & Resources

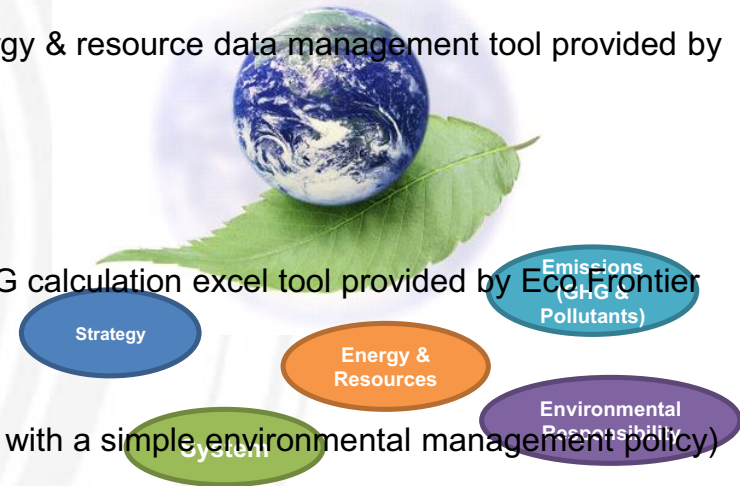
- Monitor the use of energy & resources using relative indicators (use energy & resource data management tool provided by Eco Frontier)
- Set quantitative reduction targets
- Compare environmental performance and targets annually

### 4. GHG Emissions and Environmental Pollution

- Calculate GHG emissions (Scope 1 & 2) from total energy use using GHG calculation excel tool provided by Eco Frontier
- Set GHG emissions reduction target

### 5. Environmental CSR

- Disclose company's environmental management status on website (start with a simple environmental management policy)
- Publish a sustainability report





# Environmental Strategy Establishment

## Establishment of Corporate Environmental Strategy (Policy, Objectives, Targets)

### Environmental Policy

- Environmental policy is your declaration of commitment to the environment as well as to health & safety of your employees.
- To develop an environmental policy, make a list of general environmental concerns that could be addressed in your company.
- The environmental policy should serve as the framework for setting environmental objectives and targets.

### Qualitative Objectives

- Environmental objectives are established based on the company's environmental vision and policy.
- Environmental targets are established for each environmental objective to measure change in improvement.
- Implementation plan should be developed for each environmental objective and relevant targets.
- Environmental objectives and targets should be included in the company's medium and long-term goals as well as a system for monitoring the performance results of the implementation plan.

### Quantitative Targets

# Environmental Strategy Establishment

## **SAMPLE Environmental Policy**

---

**Company A** aims to promote and maintain environmentally responsible practices to benefit our customers, employees, clients and community as a whole. To realize this vision, we will commit to the following:

- Establish and review our environmental objectives and targets.
- Comply with legal regulations and standards pertinent to our industry.
- Minimize emissions to contribute to climate change mitigation.
- Pursue efficient use of energy & resources.
- Practice safe treatment and disposal of wastes.
- Strengthen our green competitiveness.
- Cooperate and communicate with all relevant stakeholders including employees, suppliers, government agencies and our client.

As a responsible manufacturer, **Company A** is committed to design, manufacture, handle and distribute our products to ensure that this policy is met at all times.

**[Name of President]**

**[Signature]**

**[Date]**

**SAMPLE**



# Environmental Strategy Establishment

## SAMPLE Environmental Objective and Targets

Environmental Management Objective	Targets (By Year 2015 with Baseline of Year 2010)
<b>Transparency in environmental management</b>	<ul style="list-style-type: none"> <li>• Post environmental management policy on the company's website</li> <li>• Set up an internal bulletin board that discloses the company's environmental management status</li> <li>• Publish a sustainability report</li> </ul>
<b>Development of eco-friendly products &amp; services</b>	<ul style="list-style-type: none"> <li>• Increase the use of recyclable &amp; recycled packaging materials by 5%</li> <li>• Adopt Type I eco-labeling for bio-fertilizer</li> </ul>
<b>Increase green procurement (purchase of eco-friendly products)</b>	<ul style="list-style-type: none"> <li>• Increase green procurement by 20%</li> <li>• Don't use paper or plastic cups in the office</li> <li>• Increase purchase of recycled packaging material by 50%</li> </ul>
<b>Reduce waste and expand recycling</b>	<ul style="list-style-type: none"> <li>• Reduce waste generation by 5%</li> <li>• Achieve 100% waste separation and recycling</li> </ul>
<b>Reduce energy-use and GHG emission level</b>	<ul style="list-style-type: none"> <li>• Reduce energy-use by 5%</li> <li>• Reduce GHG emissions (scope 1 &amp; 2) by 5%</li> <li>• Conduct a detailed energy audit every 6 months</li> </ul>

**SAMPLE**

# Environmental Management System

To successfully implement environmental management, it is important to designate responsible person(s) for developing and promoting your EMS.

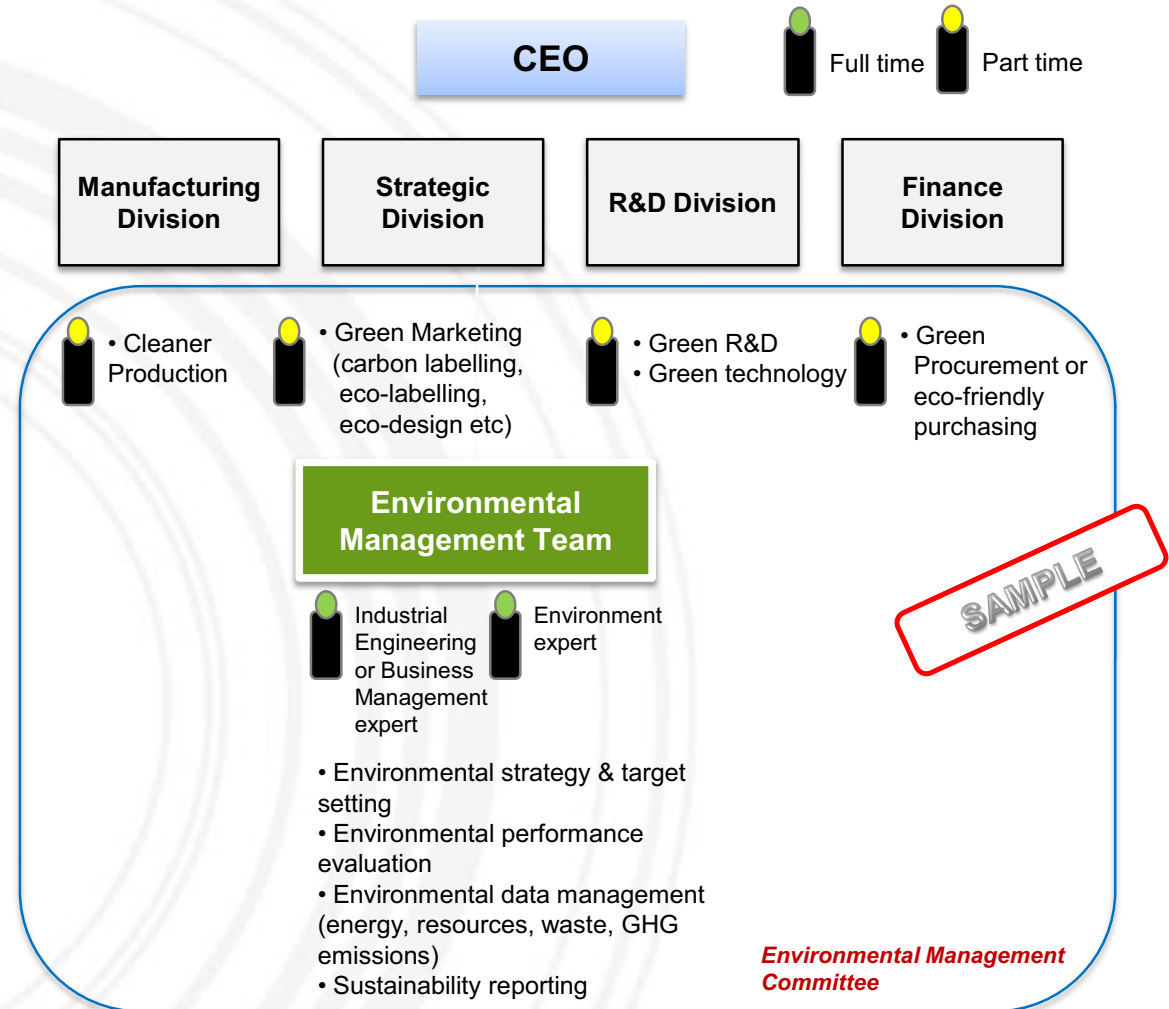
## Organizing an EM Team or Committee

### Appoint an EM Representative

- Top plant manager
- Responsible for all tasks relating to EM
- Responsible for reporting to MD on the progress and results of the organization's EM

### Establish an Environmental Management Team or Committee

- Management of environmental aspects of production
- Management of environmental aspects of energy and resources
- Management in measuring and monitoring environmental performance outcomes
- Management of green procurement
- Management of external communications on environmental management



# Environmental Data Management

Environmental data should be managed in relative terms to compare your environmental targets (e.g., reduction in energy-use by 5% by year 2012) with your performance outcome (energy use in year 2012).

- **Absolute indicators**

- Measure basic data in a given time frame, typically one year
- e.g., tons of CO<sub>2</sub> emitted annually, tons of wastes generated annually

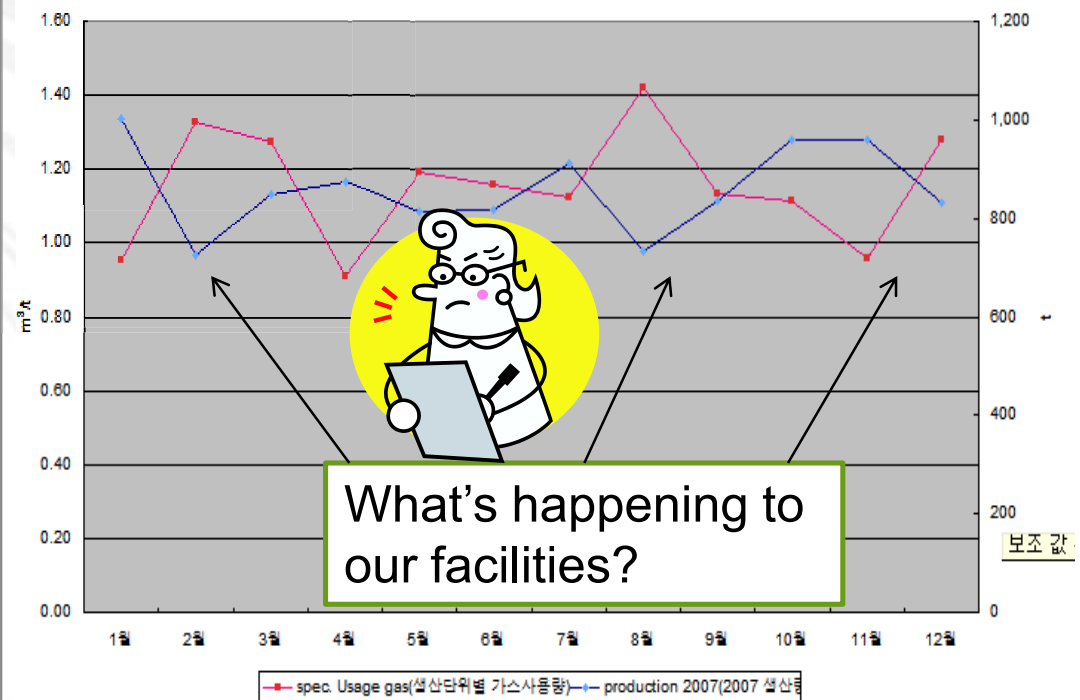
- **Relative indicators (normalized indicators)**

- Measurement of absolute consumption or emission figures relative to reference data
- Used to measure productivity and intensity ratios e.g., waste generated per unit of production(kg)

**\*Relative indicators provide accurate environmental data → better management**

Track, analyze and compare monthly & annual performance

Production compared specific water usage for Sam Young in 2007





# Environmental Data Management

Using the excel tool → Electricity Use (Example)

(Company A) Indicator					
Criteria for Comparison		Electricity Use Indicator			
Month(2010)	Sales/1,000RM	Electricity Use (kwh)	Total Price(RM)	Use/Sales (kwh/1,000RM)	Total Price/Sales(%)
1	464	32,642	2,307,390	70.35	0.5
2	291	32,254	2,527,930	110.84	0.9
3	462	29,102	2,203,710	62.99	0.5
4	526	33,902	1,851,810	64.45	0.4
5	447	26,894	1,670,230	60.17	0.4
6	654	23,832	1,806,190	36.44	0.3
7	514	26,076	2,212,550	50.73	0.4
8	348	24,163	2,181,980	69.43	0.6
9	354	24,509	2,047,000	69.23	0.6
10	417	17,549	2,054,190	42.08	0.5
11	426	22,649	2,233,310	53.17	0.5
12	401	25,675	2,468,170	64.03	0.6
yr2010	5,304.00	319,247	25,564,460.00	60.19	0.48

Step 1: Input the amount of your monthly sales volume.

Step 2: Input monthly electricity use in KWh indicated in your energy bill.

Step 3: Input the monthly electricity rate indicated in your energy bill.

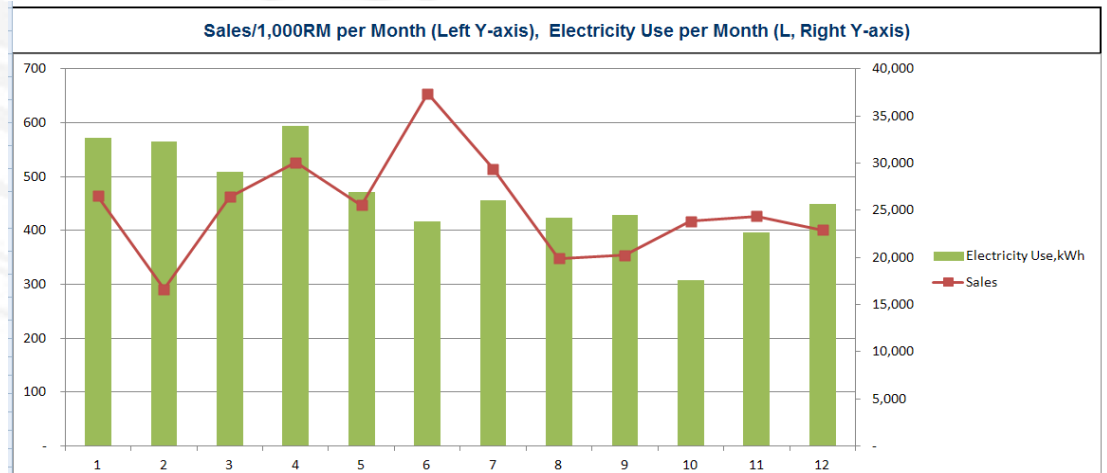
# Environmental Data Management

Using the excel tool → Electricity Use (Example)

A graph & table automatically constructed based on the inputs from steps 1,2,3



Repeat steps 1, 2, 3 for other indicators (waste, materials, harmful substances, water, fuel)



Month (2010)	1	2	3	4	5	6
Use/Sales (kwh/1,000RM)	70.35	110.84	62.99	64.45	60.17	36.44
Unit Price(RM/kwh)	70.69	78.38	75.72	54.62	62.10	75.79
Month (2010)	7	8	9	10	11	12
Use/Sales (kwh/1,000RM)	50.73	69.43	69.23	42.08	53.17	64.03
Unit Price(RM/kwh)	84.85	90.30	83.52	117.05	98.61	96.13

2010 Use/ Sales (kwh/1,000RM)	60.19
2010 Unit Price (RM/kwh)	82.31

# GHG Emissions Management

What are GHG Emissions? Where do they come from?

Types of GHGs	Global Warming Potential
CO <sub>2</sub>	1
CH <sub>4</sub>	21
N <sub>2</sub> O	310
HFCs	140 ~ 11,700
PFCs	6,500 ~ 9,200
SF <sub>6</sub>	23,900

- GHG Emissions are gases in Earth's atmosphere that prevent heat from escaping into space. GHGs increase the Earth's surface temperature resulting in climate change and global warming.
- There are 6 types of GHGs.
- The 6 types of GHGs can come from 3 different scopes of emissions.

GHG calculation tool include

## Scope 1

- **Definition:** GHG emissions from sources that are owned or controlled by a Federal agency
- **Examples:**
  - Vehicles and equipment
  - Stationary Sources
  - On-site landfills & wastewater treatment
  - Fugitive emissions

## Scope 2

- **Definition:** GHG emissions resulting from the generation of electricity, heat, or steam purchased by the company.
- **Examples:**
  - Purchased electricity
  - Purchased Heating / Cooling
  - Purchased Steam

## Scope 3

- **Definition:** GHG emissions from sources not owned or directly controlled by the company but related to the company's activities.
- **Examples:**
  - Business travel
  - Employee commuting
  - Contracted solid waste disposal
  - Contracted wastewater treatment
  - Others

\* The GHG emissions data management tool is available on ASEIC's portal site. <<http://www.aseic.org/main.do>>



# GHG Emissions Management

## 1. Station Combustion (Scope 1 Emission)

Scope 1- Stationary combustion				Step 1		
				A	B	C
Calculation						
Factory Site	Period	Process	Equipments	Fuel Type	Collecting Methods	Fuel Consumption
	2011			LNG	measured	0
	2011			Gasoline	measured	0
	2011			Lamp oil	measured	0
	2011			Coal	measured	0
	2011			Diesel	measured	0
	2011			Others	measured	0
	2011			LPG	measured	0
Scope 1 Stationary Combustion Emission						

Step 1: Indicate year

Step 2: Select fuel type (LNG, Gasoline, Lamp oil, coal, diesel, LPG, Others)

Step 3: Input the total amount of fuel consumption

Step 4: Repeat steps 1, 2 & 3 if the facility uses more than one type of fuel

# GHG Emissions Management

## 2. Mobile Combustion (Scope 1 Emission)

Scope 1- Mobile Combustion						Step 1					
						A	B	C	D	E	
Calculation	Factory Site	Period	Vehicle	Use	Registration number	Manufactured Year Production	Fuel Type	Collecting Methods	Fuel Consumption	Unit	Mile
		2011	Company Vehicle A	Transportation of Confectionery			Diesel	measured	34,796	l	-
		2011					Diesel	measured		l	-
		2011					LPG	measured		Nm3	-
Scope 1- Mobile Combustion Emission											

Step 1: Indicate year

Step 2: Select fuel type (gasoline, diesel, LPG)

Step 3: Input the total amount of fuel consumption

Step 4: Repeat steps 1, 2 & 3 if the facility uses more than 1 vehicle type

# GHG Emissions Management

## 3. Electricity (Scope 2 Emission)

Scope 2 - Electricity			Step 1					
			A	B	C	D	E	
							Emission Factor	
<b>Period</b>	<b>Process or Place</b>	<b>Facility</b>	<b>Fuel Type</b>	<b>Collecting Methods</b>	<b>Electricity Consumption</b>	<b>Unit</b>	<b>CO<sub>2</sub> Default emission Factor</b>	<b>D en F</b>
2011				measured	10,950,000	kWh	0.6900	0.0
Scope 2 - Emission by Electricity								

Step 1: Indicate year

Step 2: Input annual electricity consumption in kWh.

Nations have different electricity emission factors; therefore, refer to national government website for accurate electricity emission factor or follow IPCC guideline.



# GHG Emissions Management

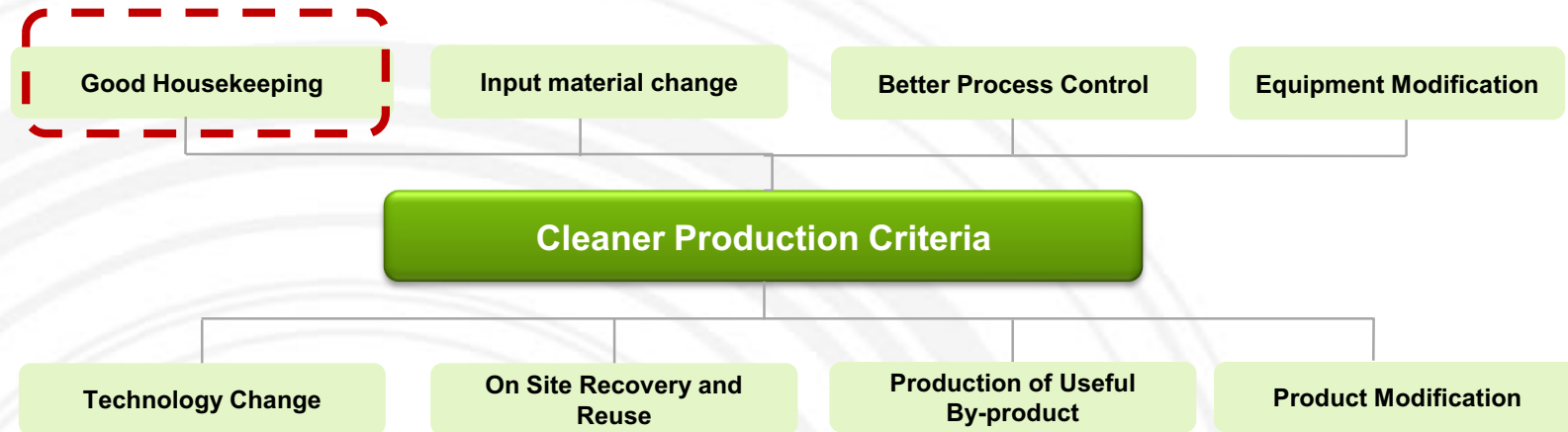
## Total GHG Emissions for Scope 1&2

**Total GHG emissions automatically calculated – A table is constructed showing accumulated GHG emissions for scopes 1 & 2**

Emission Type		Emission total Amount	Emission Subtotal Amount	Types of GHGs					
				CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	HFCs	PFCs	SF <sub>6</sub>
SCOPE 1	Stationary combustion	Fuel	0	0.0	0.0	0.0	-	-	-
	Mobile combustion	Vehicle	93	92.8	91.3	0.1	1.4	-	-
	Sub total		93	92.8	91.3	0.1	1.4	0.0	0.0
SCOPE 2	Electricity	Purchasing Electricity	7,566	7,566.2	7,555.5	1.5	9.1	-	-
	Sub total		7,566	7,566.2	7,555.5	1.5	9.1	0.0	0.0
<b>GHG Total Emission (Scope 1 + 2)</b>			<b>7,659</b>	<b>7,659.0</b>	<b>7,646.8</b>	<b>1.7</b>	<b>10.6</b>	<b>0.0</b>	<b>0.0</b>

# Cleaner Production

“Cleaner production is the continuous application of an integrated preventative environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment” (United Nations Environment Programme, 1991)



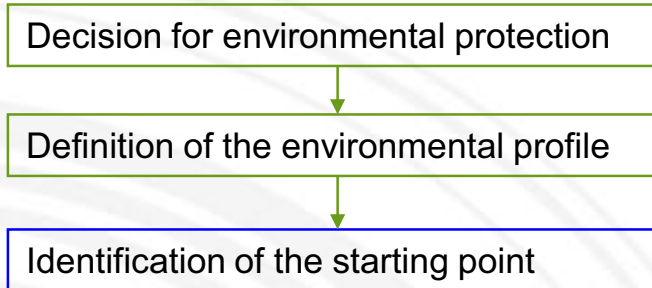
- **Good housekeeping:** appropriate provisions to prevent leaks and spills and to achieve proper, standardized operation and maintenance procedures and practices. → **Lowest cost and most basic form of cleaner production**
- **Input material change:** replace hazardous or non-renewable inputs with less hazardous or renewable materials or by materials with a longer service life-time
- **Better process control:** modification of the working procedures, machine instructions and process record keeping for operating processes at higher efficiency and lower rates of waste and emission generation
- **Equipment modification:** modification of the production equipment so as to run the processes at higher efficiency and lower rates of waste and emissions generation
- **Technology change:** replacement of technology processing sequence and/or synthesis pathway in order to minimize the rates of waste and emissions generation during production
- **On-site recovery / reuse:** reuse of wasted materials in the same process or for another useful application within the company
- **Production of useful by-products:** transformation of previously discarded wastes into materials that can be reused or recycled for another application outside the company
- **Product modification:** modification of product characteristics in order to minimize the environmental impacts of the product during or after its use (disposal) or to minimize the environmental impacts of its production (e.g., automatic control)

# Cleaner Production - Step(Solve the roots of the problems)



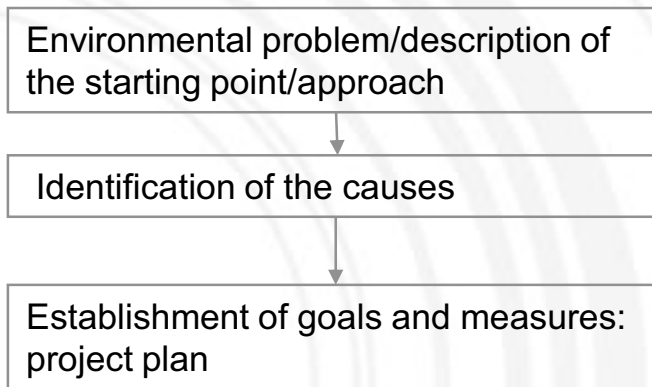
Stage 1

Determine the necessary measures



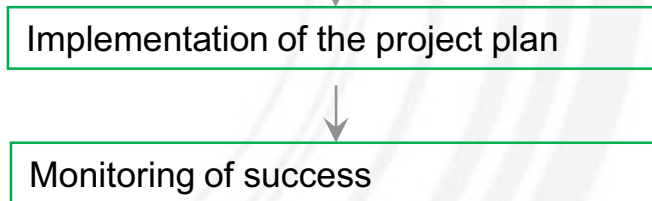
Stage 2

Plan the environmental project



Stage 3

Implement the environmental project





# Cleaner Production – Material management

## 1. Material management- Summary

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Material management is a scientific technique, concerned with Planning, Organizing & Control of flow of materials, from their initial purchase to destination.

### TO ACHIVE

1. Right quality(environment, human health, material use)
2. Conservation of materials (resource)
3. Clean working environment
4. Efficient working environment

### PURPOSE OF MATERIAL MANAGEMENT

- To reduce waste
- To implement environmental regulation
- To reserve stocks to prevent supply shortage
- To avoid environmental risk
- To achieve a safe working environment

### RECOMMENDATIONS

**Manage materials and products on a life-cycle basis.**

1. Select a few materials/products for an integrated life-cycle approach, and launch demonstration projects.
2. Expand the focus of existing environmental programs to encompass life-cycle materials management more fully.
3. Promote specific materials management approaches that can help address climate change.
4. Promote greener products, product stewardship, and product-to-service transformations.
5. Strengthen market signals to reduce waste and other adverse environmental impacts throughout the life cycle of materials.

### METHODS

Alternative eco-friendly materials

Introduction of efficient technologies

Efficient production plan and stock management

Use the **proper** amount of material

Chemical management

Green purchase

# Cleaner Production – Material management

## 2-1. Material management - Common issue : Spray process (painting, glue...)

**Issue** : Efficiency of spraying process (Overuse management)

**Needs/Problem** : - Dissipation of paint due to open work place without dust collecting facility  
- Inefficient working and waste of material

**Approach** : Find a case study that deals with improving the spray painting process

1. Check the amount of waste → Reduce material and reuse some materials
2. Make **standard operation (Appropriate pressure, find the best point of distance depending on the concentration of paint and size of work-piece)**
3. Use HVLP type gun (high efficiency transfer with low pressure air)
4. Use appropriate tools such as laser targeting device, inside pipe tool, auto gun washer, and washing solvent distiller

• **Benchmark** : Alternative efficient equipment and proper spraying distance can be checked by the eyes.



• Laser pointer gun



• Orbiter: coating equipment inside pipe

# Cleaner Production – Material management

## 2-2. Material management - Common issue : Chemical management

**Issue** : Management of raw materials (chemical)

**Needs/Problem** : - Material waste due to inefficient management  
- Environmental regulations and harmful effects on human health

**Approach** : Managing waste paint

1. Educate employees about toxic substance .
2. Check the amount of chemical waste.
3. Initiate an effective chemical management method.
4. Build a chemical database (testing and analysis).

**Benchmark** : Individual store, Installation of MSDS



Chemical database management

Merck KGaA

General Info

Substances and chromatography

100003 Acetonitrile GR for analysis ACS

Synonyms: Methyl cyanide

Categories of danger: highly flammable, harmful, irritant

Formula Hill: C<sub>2</sub>H<sub>3</sub>N

Chemical formula: CH<sub>3</sub>CN

Molar mass: 41.05 g/mol

CAS number: 75-05-8

EC index number: 600-071-00-3

HS code: 29239995

EC No.: 200-855-2

Storage class (VDI): 3A

Storage temperature: at +15°C to +25°C

Packing category (road): B

WDF: B

WDR: 2 - water pollution

Disposal: 1

Product category: Substance

Cause of hazard in self-preservation

SDS: available

RECS: AL710000

Flame class CH (Swiss): 2 - very strong oxidizer

R phrase: R 11, R 22, R 23, R 24, R 25, R 26, R 27, R 28, R 31, R 32, R 33, R 34, R 35, R 36, R 37, R 38, R 39, R 40, R 41, R 42, R 43, R 44, R 45, R 46, R 47, R 48, R 49, R 50, R 51, R 52, R 53, R 54, R 55, R 56, R 57, R 58, R 59, R 60, R 61, R 62, R 63, R 64, R 65, R 66, R 67, R 68, R 69, R 70, R 71, R 72, R 73, R 74, R 75, R 76, R 77, R 78, R 79, R 80, R 81, R 82, R 83, R 84, R 85, R 86, R 87, R 88, R 89, R 90, R 91, R 92, R 93, R 94, R 95, R 96, R 97, R 98, R 99, R 100

S phrase: S 16, S 22

H<sub>3</sub>C-C#N

1 of 10530 B 0

Version: 2.4.0 | Edition: 20021 International

# Cleaner Production – Material management

## 3. Material management Tool – MFA (Material flow analysis)

Overview on material input and consumption of a company;  
Places, amount of and causes for the production of waste and emissions (noise, exhaust air, sewage, etc.);  
Assessing and estimating future development;  
Actions for improvement.

### Purposes

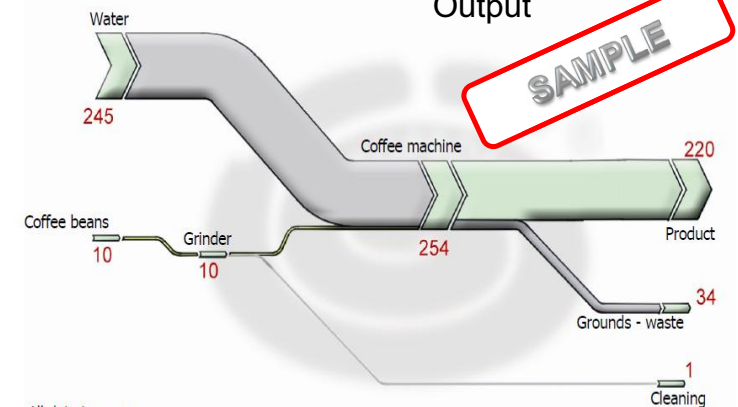
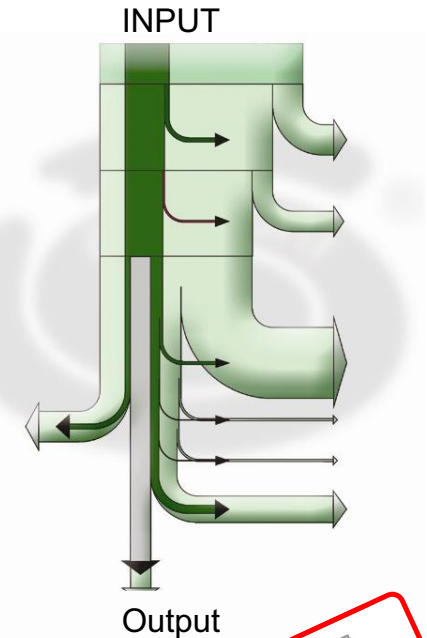
- tracking material flow in the company;
- tracing waste back to where it is produced;
- processing data in a way that enables right decisions;
- detecting and identifying weak points and opportunities for improvement in the process; and
- setting useful priorities for actions to avoid waste and emissions.

### Steps

1. defining the objectives, targets and the parameters under consideration;
2. delimiting the balancing area;
3. delimiting the balancing period;
4. acquiring and designating the production steps;
5. drawing up the flow chart: material flows – in qualitative terms;
6. balances: material flows – in quantitative terms;
7. interpretation and conclusions

### Useful graph

- **Flow Charts for representing material flows and process flows**
- **X-Y Charts for representing time series**
- **Bar Charts and Histograms for illustrating distributions and compositions**
- **Sankey Charts for visualizing material flows true to scale**



source - Eco profit



# Cleaner Production – Material management

## 4. *Material management - Case Study in Korea : Improve material efficiency using material flow analysis*

### BEFORE

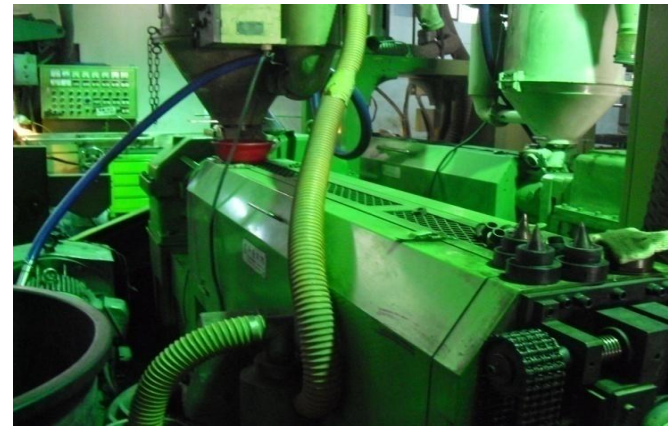
#### ■ Before MFA



- 4kg of PVC residue left in extruder screws after extrusion process

### AFTER

#### ■ After MFA



- After the material flow analysis (MFA), the company was able to input only the needed amount of PVC

- Improvement result: **Save 8,300 USD/yr**
  - Minimize the use of materials & reduce waste



# Cleaner Production – Energy management

## 1. Energy management - Summary

### Objectives of corporate energy management

- Improve security and quality of energy supply
- Reduce energy cost (short-term and long-term)
- Reduce environmental impacts
- Commence or reinforce energy conservation activities
- Achieve sustainability and energy efficiency
- Mobilize resources and cooperate with partners
- Increase the company's environmental image

### Tasks and procedure

#### Energy management serves to prepare decisions and give:

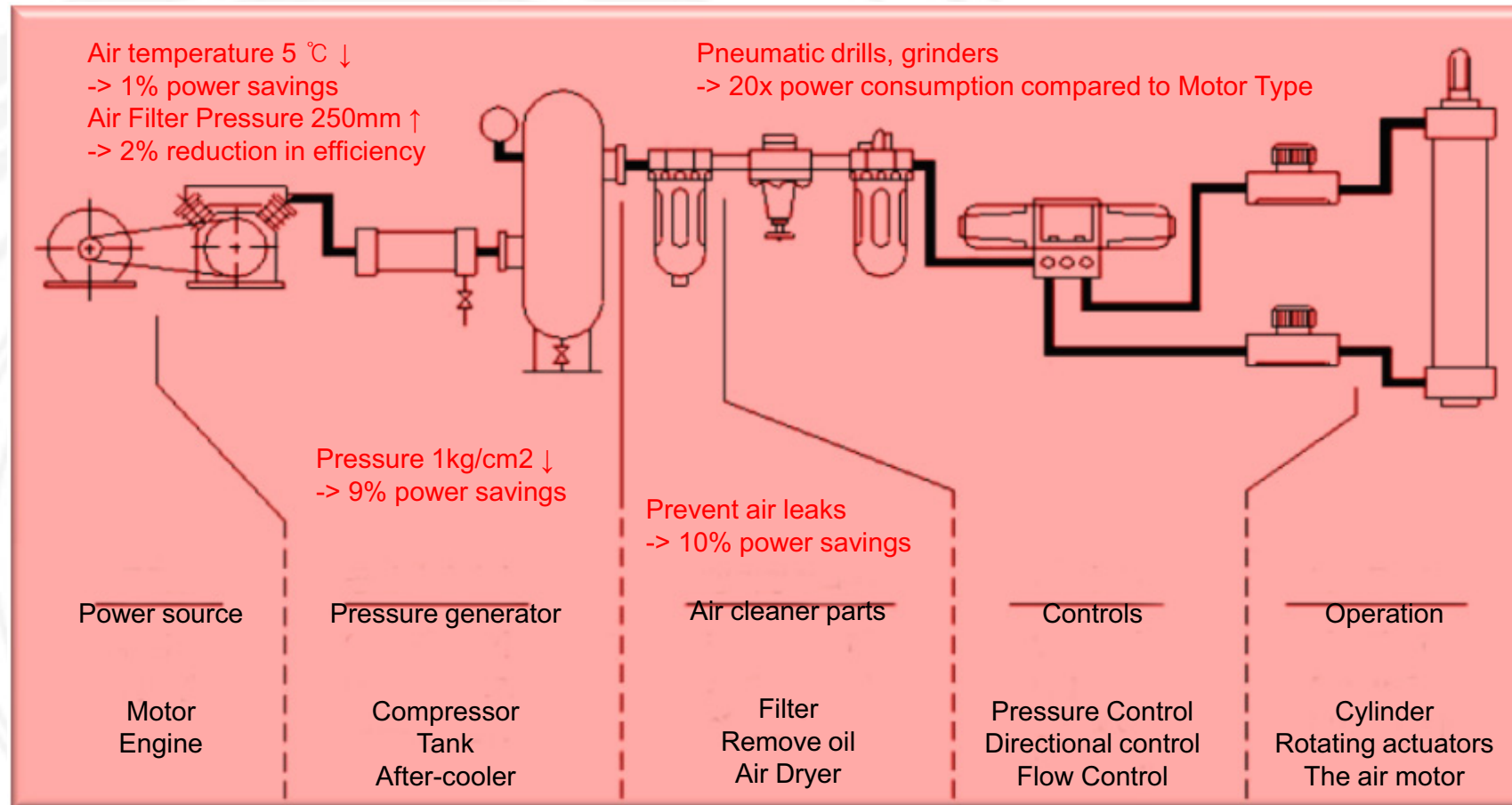
- Advice to managers based on well-targeted data collection (the fewer the better)
- Data analyses and evaluation (efficiency indicators and benchmarking, comparison with previous consumption periods, identifying weak points) – (try rough analyses)
- Analysis of technical, economic and environmental problems (e.g. energy concept or detailed analyses)
- Proposal of concrete measures (catalogue of measures, including action plan: short-term, mid-term and long-term)
- Detailed planning and implementation of (small-scale) energy efficiency measures
- Controlling (efficiency indicators, comparison with previous consumption, comparison of target and actual values)



# Cleaner Production – Energy management

## 2-1. Electricity - Common Issue : Air compressor

● air compressor



# Cleaner Production – Energy management

## 2-1. Electricity - Common Issue : Air compressor

**Issue :** Current operation status of air compressor

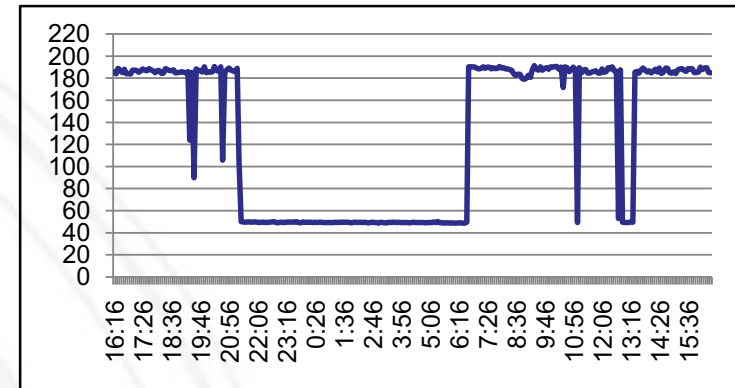
**Needs/Problem :** Need for analyzing energy efficiency of air compressor

**Approach :** Check operation condition, then optimize

1. Check operation pressure and leakage point
2. Check power consumption
3. Check intake outdoor air
4. Check operation condition of air dryer
5. Suggest increasing method of loading rate

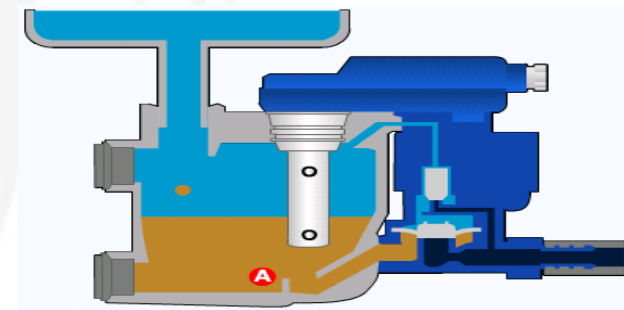
**Benchmark :** Prevention of material loss by installing condensate trap  
Finding efficient operation method by analyzing process patterns

Utilization of cool outdoor air for the intake



(Case study)

Reduction of standby power consumption by changing to \*auto on-off control system on unloading time.  
(\* If unloading time of air compressor is long, air compressor is off automatically)



# Cleaner Production – Energy management

## 2.2 Electricity - Common Issue : Fan

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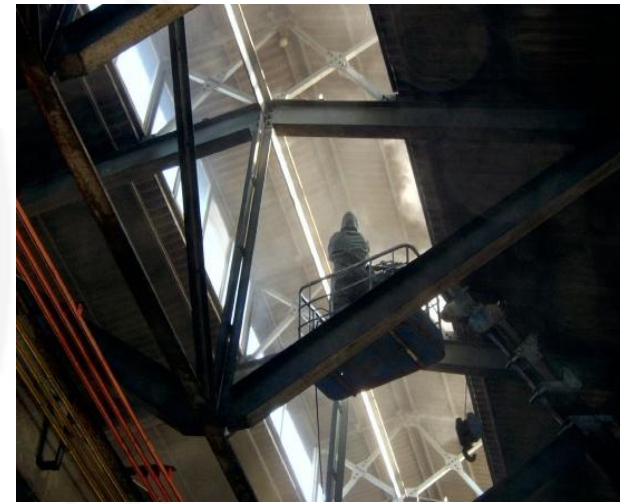
**Issue :** Efficiency of internal ventilation fan in factory

**Needs/Problem :** Efficiency analysis of exhaust fan / Decreased usage time of electric fan is necessary

**Approach :** Evaluate the efficiency of exhaust fan

1. Check power consumption
2. Compare facility capacity with actual power consumption

**Benchmark :** Using exhaust pipe at the ceiling as a natural source of ventilation method .  
Install inverter to fan





# Cleaner Production – Energy management

## 2.3 Electricity - Common Issue : Light

**Issue** : High Efficiency lighting lamp

**Needs/Problem** : Energy loss caused by low efficiency lighting lamp

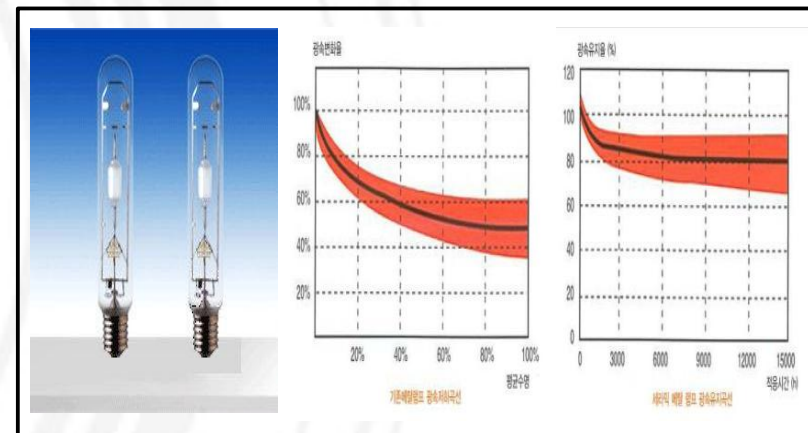
**Approach** : Check present condition of lighting  
Analyze economical effect of changing to high efficiency lighting lamp

**Benchmark** : Replace low efficiency lighting lamp with high efficient types.  
Install auto on-off system by using timer and sensor.

LED Lighting lamp



Lighting lamp for metal halide lamp alternative





# Cleaner Production – Energy management

## 2-4. Electricity - Common Issue : Dust collector

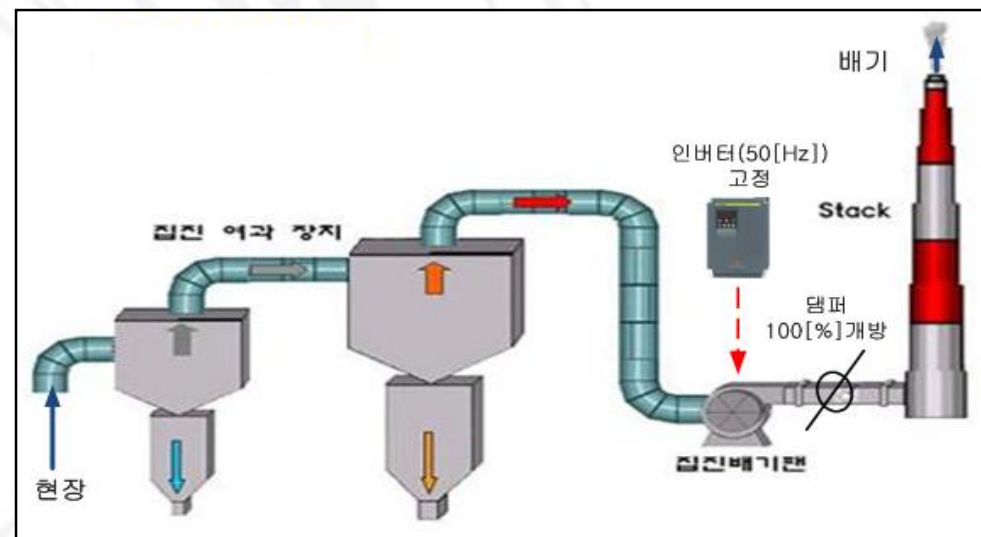
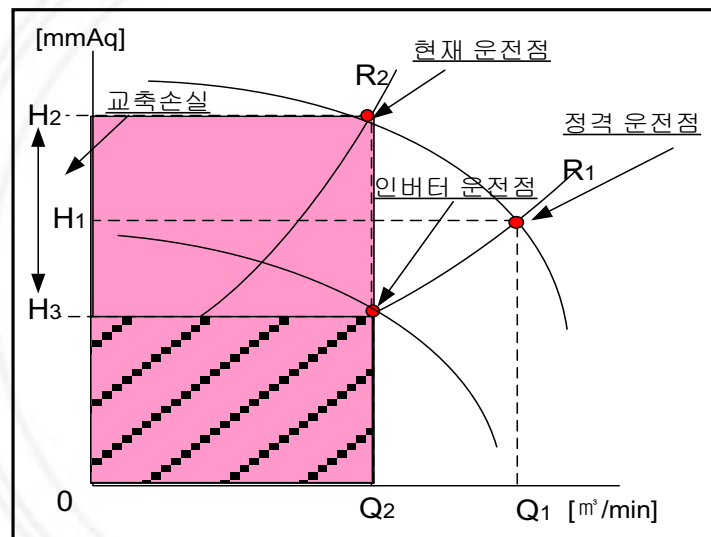
**Issue :** Energy efficiency measures for dust collector

**Needs/Problem :** Analysis of optimum efficiency and capacity

**Approach :** Check the condition and capacity of dust collector.

1. Check the power consumption.
2. Check the possibility of a adding to the dust collector.

**Benchmark :**

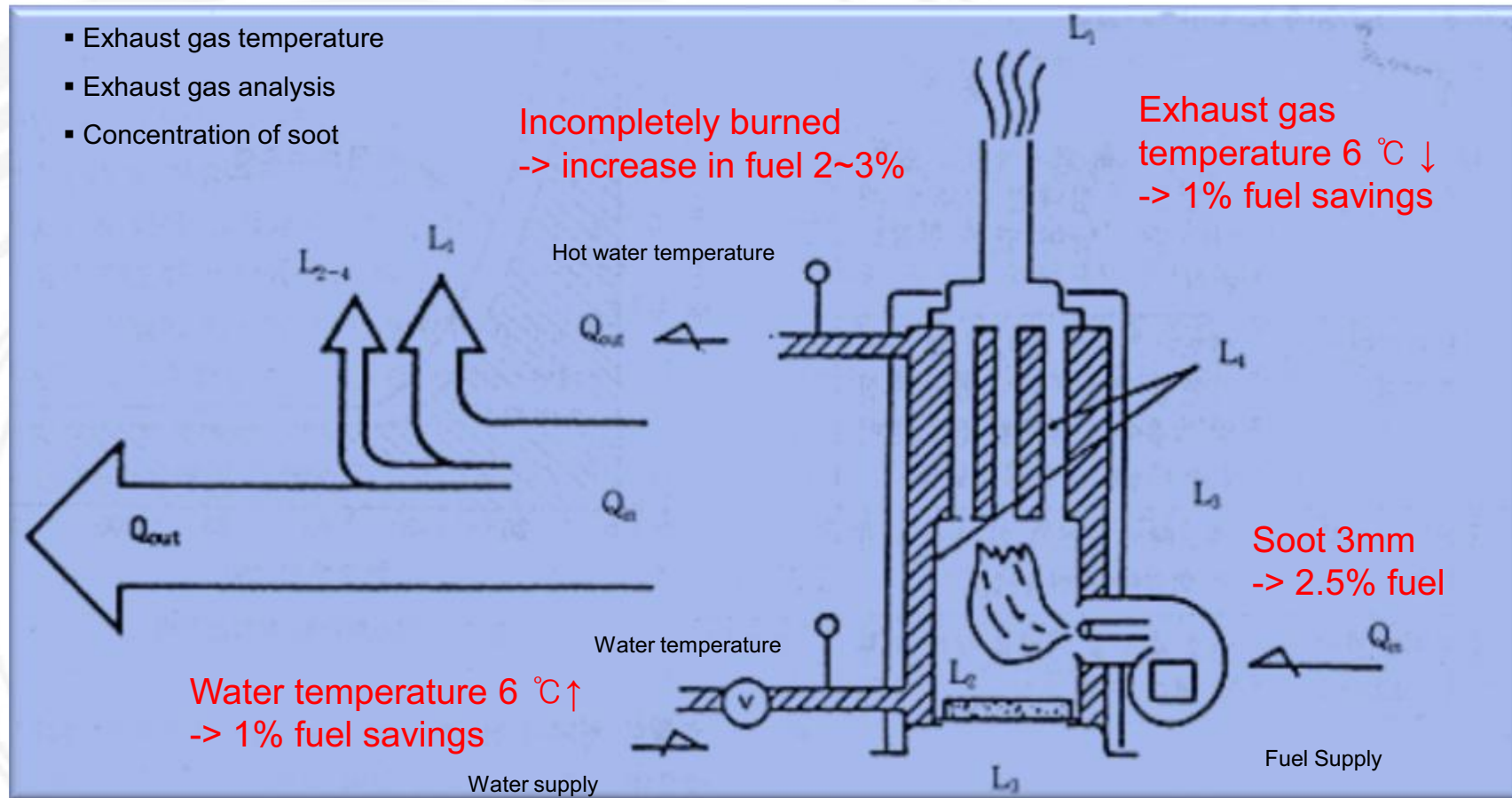


# Cleaner Production – Energy management

## 3-1. Heat energy - common issue : Boiler

● boiler

- Exhaust gas temperature
- Exhaust gas analysis
- Concentration of soot



# Cleaner Production – Energy management

## 3-1. Heat energy - common issue : Boiler

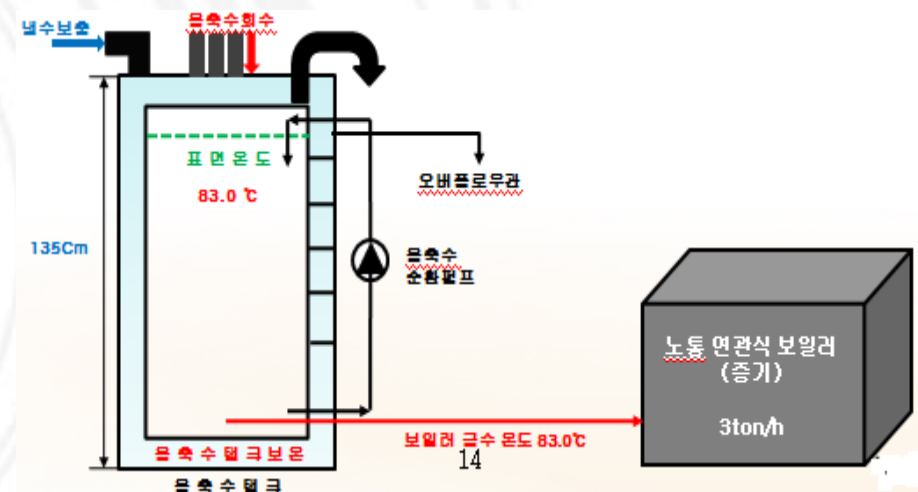
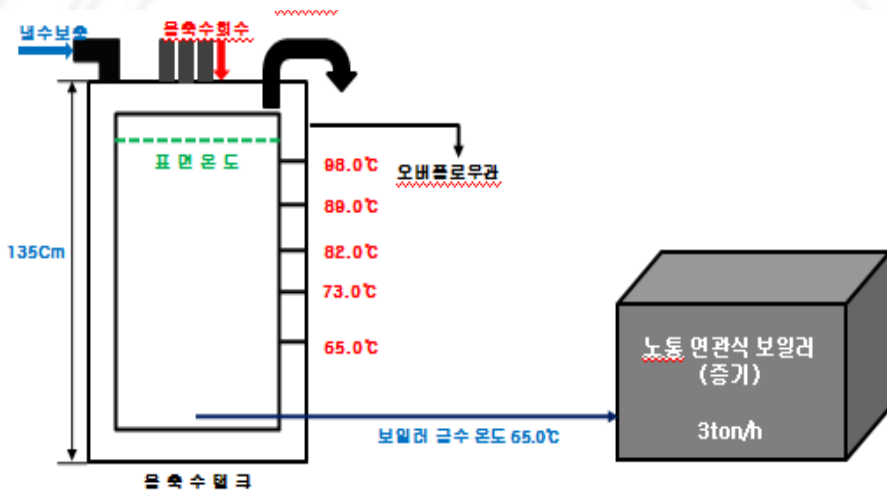
**Issue :** Recovery of waste steam from coal boiler

**Needs/Problem :** Steam loss during the ironing process

**Approach :** Check the temperature of condensed water and fine recovery method of waste heat

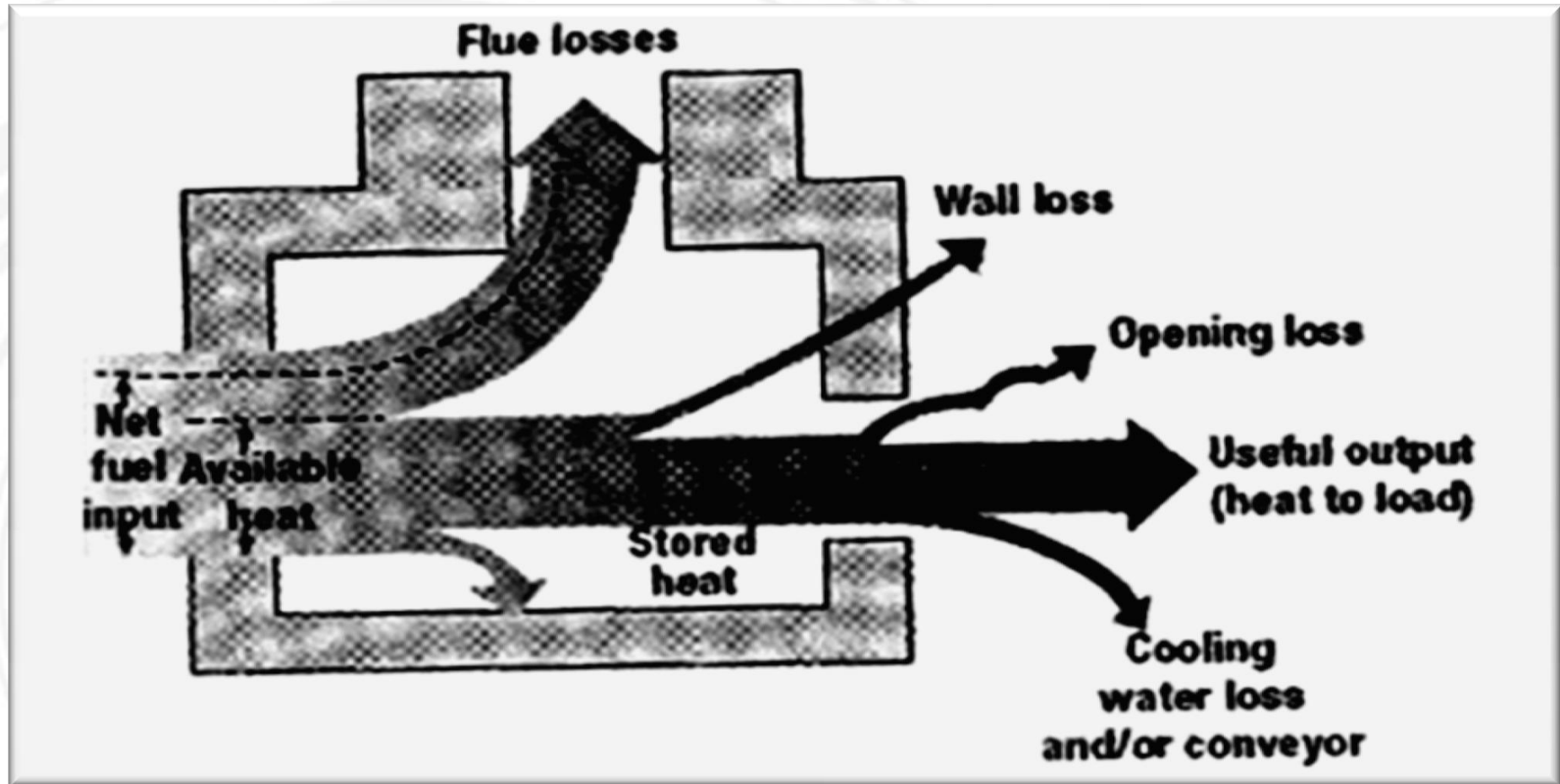
1. Check the insulation of transfer pipeline.
2. Assess the economic feasibility by changing the electric boiler.
3. Check the possibility of recovering water during condensation.

**Benchmark :**



# Cleaner Production – Energy management

## 3-2. Heat energy - common issue : Heating furnace





# Cleaner Production – Energy management

## 3-2. Heat energy - common issue : Heat treating furnace

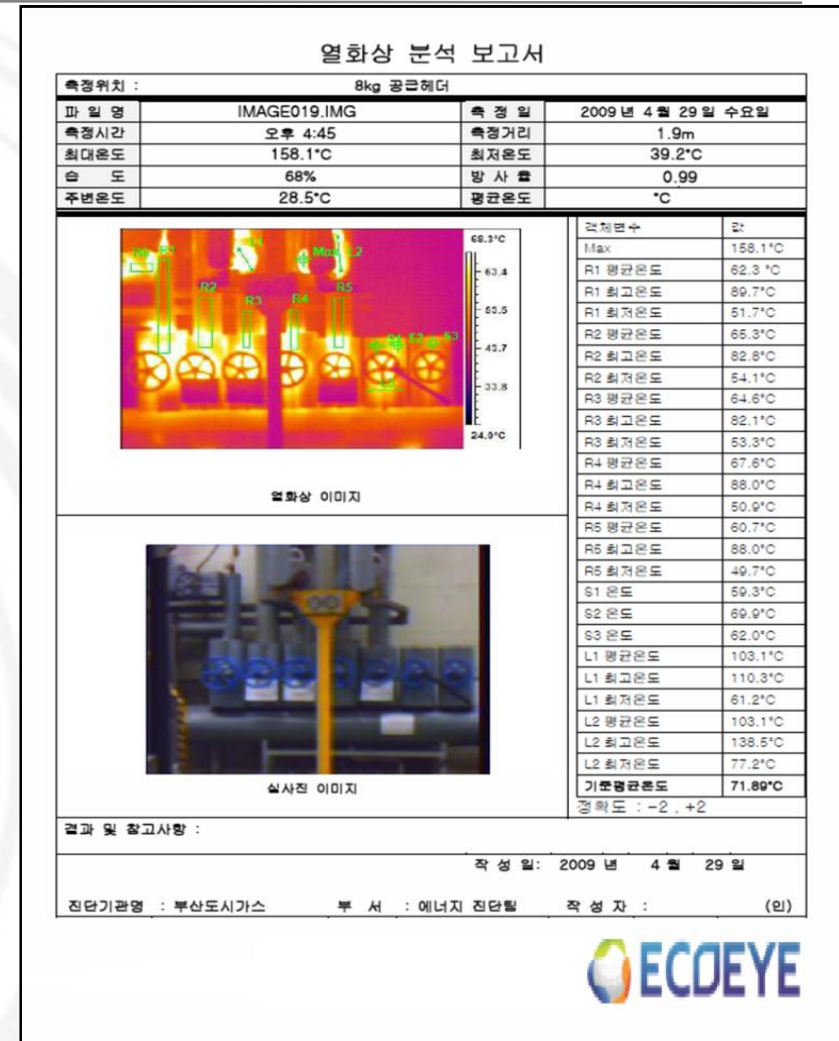
**Key Issue** : Performance and efficiency of enamel furnace

**Needs/Problem** : Need for investigating flaws in operation and efficiency

**Approach** : Energy audit for operation condition

1. Check the availability of waste heat of exhaust gas
2. Check radiant heat linkage.
3. Analyze the condition of exhaust gas.

**Benchmark** : Recycling heat by heat exchanger  
Protecting heat leakage by insulation





# Cleaner Production – Energy management

## 3-2. Heat energy - common issue : Heat treating furnace

**Issue** : Recovering the waste heat from the heat-treating furnace

**Needs/Problem** : Large energy consumption from the furnace in the galvanizing process for zinc

**Approach** : Use heat recovery method and prevent the loss of radiant heat.

1. Analyze the exhaust gas.
2. Check if heat recovery is possible.
3. Check the internal pressure of the furnace.
4. Check the consumption of LNG by fuel.
5. Calculate the calories for the heat wasted.

**Benchmark** :



Increasing the inlet-air temperature using heat exchanger



Generation steam by using tubular waste heat boiler

# Cleaner Production – Energy management

## 3-3. Heat energy - common issue : Dryer

**Issue** : Efficiency of painting dryer

**Needs/Problem** : Optimizing the operation of painting dryer is necessary.

**Approach** : Check the operation and the time involved.

1. Assess energy efficiency
2. Avoid the loss of radiant heat

**Benchmark** :



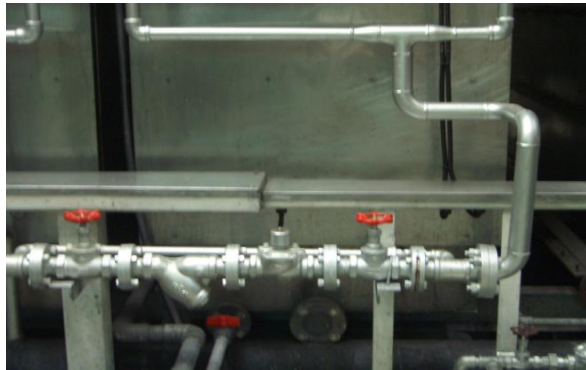
품명	특성특징 상세설명	온도℃ (Max)	밀도 (kg/m <sup>3</sup> )	두께 (mm)	표준규격 (mm)	용도
Pyro-Log		1316 1430 1430	128~240 160~240 192, 240	150~200	600×900	-대차용 단열 -로내 바닥용 단열 -각종로의 Peep Hole Shapes
Pyro-Bloc Module		1316 1430 1430	128~240 160~240 192~240	100~300	305×305	-가열, 단조, 열처리로 등 단열재 -석유화학 히터, 발전설비
Pyro Combi-15		1500	192~240	300	320×305	-단조 가열로 단열재 -각종 고온도용 공업로 등
Fold-Module		1316 1430	128~170	100~300	300×300	-소각로, 소성로 -기타 공업용 로
Veneering Module		1430 1700		50, 75	300×300	-단조로, 가열로, 열처리로 -균열로, 소성로

# Cleaner Production – Energy management

## 4. Cleaner Production - Case Study in Korea : Prevent heat loss

Water is circulated to produce heat → Add protective material to prevent heat loss

**BEFORE**



**AFTER**



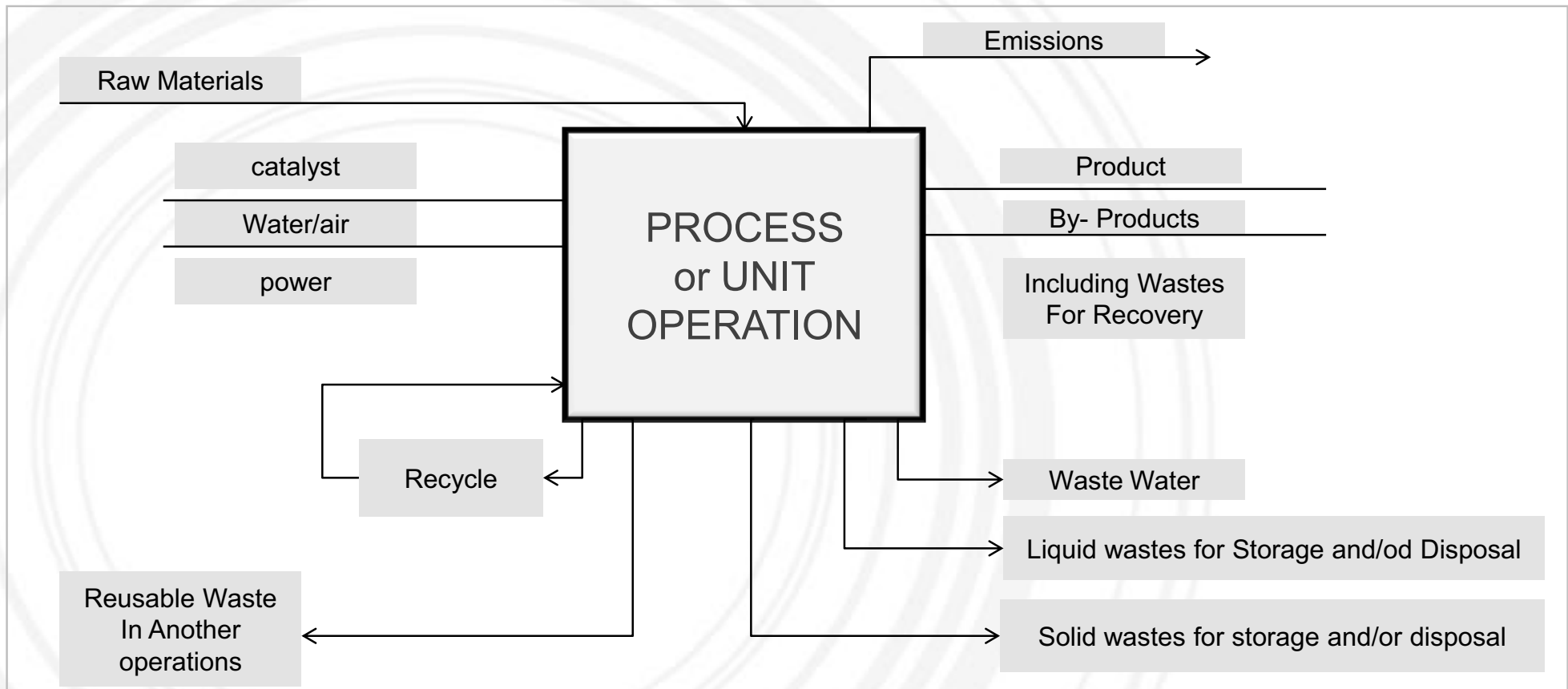
Period	No. of pipe hangers	Hours of labor	Monthly energy costs	Indicator
SEP 2005	735	208	4,255 USD	20.46 USD / hr
SEP 2006	1091	616	6,685 USD	10.68 USD / hr (47% save)

➤ Improvement result: **Saved**  $(20.46 \text{ USD/hr} \times 616 \text{ hr} - 10.68 \text{ USD/hr} \times 616 \text{ hr}) \times 0.47 = 2,831.51 \text{ USD}$

# Cleaner Production – Waste management

## 1. Waste Management - Summary

- Starting on the corporate structure: visualizing the waste flows depending on the types, amounts, destination and costs of waste;
- Reviewing waste logistics for weak points and opportunities; and
- Identifying opportunities for waste prevention and reduction as well as cost reduction; and
- Establishing, implementing, and reviewing actions.



# Cleaner Production – Waste management

## *2. Waste Minimization - Methods*

---

### **Resource optimization**

Minimizing the amount of waste produced by organizations or individuals goes hand-in-hand with optimizing their use of raw materials. For example, a dressmaker may arrange pattern pieces on a length of fabric in a particular way to enable the garment to be cut out from the smallest area of fabric

### **Reuse of scrap material**

Scraps can be immediately re-incorporated at the beginning of the manufacturing line so that they do not become a waste product. Many industries routinely do this; for example, paper mills return any damaged rolls to the beginning of the production line, and in the manufacture of plastic items, off-cuts and scrap are re-incorporated into new products.

### **Improved quality control and process monitoring**

Steps can be taken to ensure that the number of rejected batches is kept to a minimum. This is achieved by increasing the frequency of inspection and the number of points of inspection. For example, installing continuous automated monitoring equipment can help identify production problems at an early stage.

### **Waste exchanges**

This is where the waste product of one process becomes the raw material for a second process. Waste exchanges represent another way of reducing waste disposal volumes for waste that cannot be eliminated.

### **Ship to point of use**

This involves making deliveries of incoming raw materials or components direct to the point where they are assembled or used in the manufacturing process to minimize handling and the use of protective wrappings or enclosures.



# Cleaner Production – Waste management

## 3. Waste Management – Tool (source : Eco profit)

### Establishing internal waste logistics



- **informing on the correct waste separation;**
- **suitable container systems;**
- **optical design of the waste collection points**
- **involving the employees in the individual areas;**
- **involving the cleaning personnel;**
- **motivating all those concerned**

# Cleaner Production – Waste management

## 4. Cleaner Production - Case Study in Korea : Improve Waste Management

### BEFORE



- Inadequate waste management results in high disposal costs
- No waste separation, no recycling

### AFTER



- Establish waste logistics.
- Promote reusable packaging.
- Reduce dead space.
- Place notice sign in front of waste disposal site.

Waste treatment cost/year

5,517 USD / last year → 3,767 USD / current year (given the same production amount)

Improvement result

**32% reduction in disposal costs = Save 1,750 USD / yr**

# Cleaner Production – Improvement of working environment

## 1.1. Improvement of working environment - Common Issue : Welding Hume

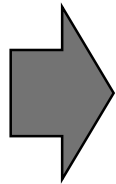
**Issue** : Efficiency of welding machine

**Needs/Problem** : Energy loss caused by low efficiency welding machine

**Approach** : Check the present condition of welding machine

1. Check the working distance.
2. Check power consumption.
2. Check the economic feasibility.
3. Check the operation efficiency.

**Benchmark** : <http://www.ilhung.co.kr>



(High efficiency welding machine equipped with hume for sucking smoke and dust)

OR



(Removeable Hume collector)

OR



(Local exhaust ventilation)



# Cleaner Production – Improvement of working environment

## 1-2. Improvement of working environment - Common Issue : Oil management

**Issue :** Oil Management (e.g., lubricant oil)

**Needs/Problem :** Overuse of oil, inappropriate management of iron scrap

**Approach :**

1. Check type and amount of oil
2. Recycle the used oil
3. Check the cost and toxicity
4. Separate the type of oil

•**Benchmark :** Auto supplier, Separation management, Recycling of used oil

Auto Supplier



Separation management



Collection of used oil





# Cleaner Production – Lean Process

## *1. Lean manufacturing summary*

---

**Lean manufacturing, lean enterprise, or lean production**, often simply, "**Lean**," is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination. Working from the perspective of the customer who consumes a product or service, "value" is defined as any action or process that a customer would be willing to pay for.

Lean manufacturing is a variation on the theme of efficiency based on optimizing flow; it is a present-day instance of the recurring theme in human history toward increasing efficiency, decreasing waste, and using empirical methods to decide what matters, rather than uncritically accepting pre-existing ideas. As such, it is a chapter in the larger narrative that also includes such ideas as the folk wisdom of thrift, time and motion study, Taylorism, the Efficiency Movement, and Fordism. Lean manufacturing is often seen as a more refined version of earlier efficiency efforts, building upon the work of earlier leaders such as Taylor or Ford, and learning from their mistakes. However, the modern view takes a more holistic approach where the definition of waste is far more generic. Irregular production with ups and downs in production levels would be considered waste. The goal of Lean then becomes the creation and maintenance of a production system which runs repetitively, day after day, week after week in a manner identical to the previous time period

- ▣ **Initiative between 3 EPA offices and US Dept of Commerce**
- ▣ **Promotes lean manufacturing to businesses to achieve greater environmental results**
- ▣ **Resource: Lean and Environment Toolkit**
- ▣ **[www.epa.gov/lean](http://www.epa.gov/lean)**

# Cleaner Production – Lean Process

## 2. Lean manufacturing & environment

Waste Type	Examples	Environmental Impacts
Defects	Scrap, rework, replacement production, inspection	<ul style="list-style-type: none"> <li>• Raw materials consumed in making defective products</li> <li>• Defective components require recycling or disposal</li> <li>• More space required for rework and repair, increasing energy use for heating, cooling, and lighting</li> </ul>
Waiting	Stock-outs, lot processing delays, equipment downtime, capacity bottlenecks	<ul style="list-style-type: none"> <li>• Potential material spoilage or component damage causing waste</li> <li>• Wasted energy from heating, cooling, and lighting during production downtime</li> </ul>
Overproduction	Manufacturing items for which there are no orders	<ul style="list-style-type: none"> <li>• More raw materials consumed in making the unneeded products</li> <li>• Extra products may spoil or become obsolete requiring disposal</li> </ul>
Movement	Human motions that are unnecessary or straining, carrying work in process (WIP) long distances, transport	<ul style="list-style-type: none"> <li>• More energy use for transport</li> <li>• Emissions from transport</li> <li>• More space required for WIP movement, increasing lighting, heating, and cooling demand and energy consumption</li> <li>• More packaging required to protect components during Movement</li> </ul>
Inventory	Excess raw material, WIP, or finished goods	<ul style="list-style-type: none"> <li>• More packaging to store work-in-process</li> <li>• Waste from deterioration or damage to stored WIP</li> <li>• More materials needed to replace damaged WIP</li> <li>• More energy used to heat, cool, and light inventory space</li> </ul>
Complexity	More parts, process steps, or time than necessary to meet customer needs	<ul style="list-style-type: none"> <li>• More parts and raw materials consumed per unit of production</li> <li>• Unnecessary processing increases wastes, energy use, and emissions</li> </ul>
Unused creativity	Lost time, ideas, skills, improvements, and suggestions from employees	<ul style="list-style-type: none"> <li>• Fewer suggestions of P2 and waste minimization Opportunities</li> </ul>

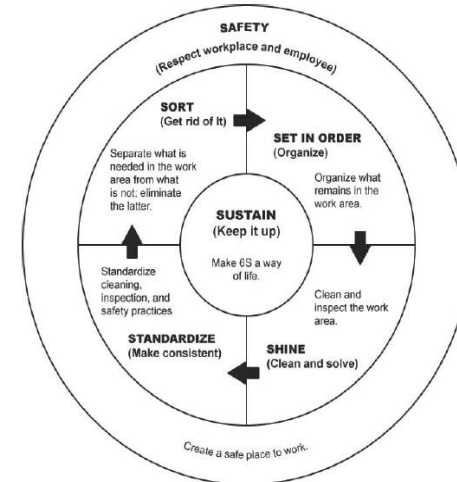
# Cleaner Production – Lean Process

## 3-1. Cleaner Production Lean Process - Tool : 6S

- 6S is a method used to create and maintain a clean, orderly, and safe work environment. 6S is based upon the five pillars (5S) of the visual workplace in the Toyota Production System, plus a separate pillar for safety. 6S is often the first method companies implement in their Lean journey, since it serves as the foundation of future continual improvement efforts.

### The Six Pillars of 6S

- ❖ **Sort (Get rid of it):** Separate what is needed in the work area from what is not; eliminate the latter.
- ❖ **Set in order (Organize):** Organize what remains in the work area.
- ❖ **Shine (Clean and solve):** Clean and inspect the work area.
- ❖ **Safety (Respect workplace and employee):** Create a safe place to work.
- ❖ **Standardize (Make consistent):** Standardize cleaning, inspection, and safety practices.
- ❖ **Sustain (Keep it up):** Make 6S a way of life.



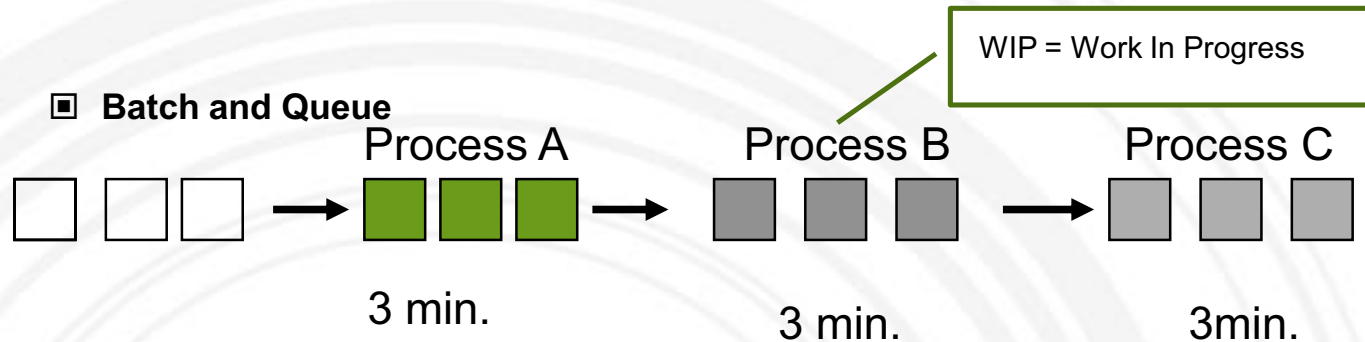
The six pillars work together to support improvement efforts at your company. They help increase productivity, reduce defects, make accidents less likely, and reduce costs. 6S also fosters a culture of continual improvement and employee engagement that is essential for successful implementation of Lean. 6S often makes it easier to implement other Lean methods such as cellular manufacturing, one-piece flow, and just-in-time production.

6S can help your company reduce waste and improve environmental performance leading to increased system productivity. You can also use 6S to minimize risks to the health of workers and the environment. Full implementation of 6S requires looking not only at the quantity, usefulness, and frequency with which an item is used in a work area, but also the risk or toxicity of the item. It also means paying close attention to what ends up in waste streams and how to manage those wastes.

# Cleaner Production – Lean Process

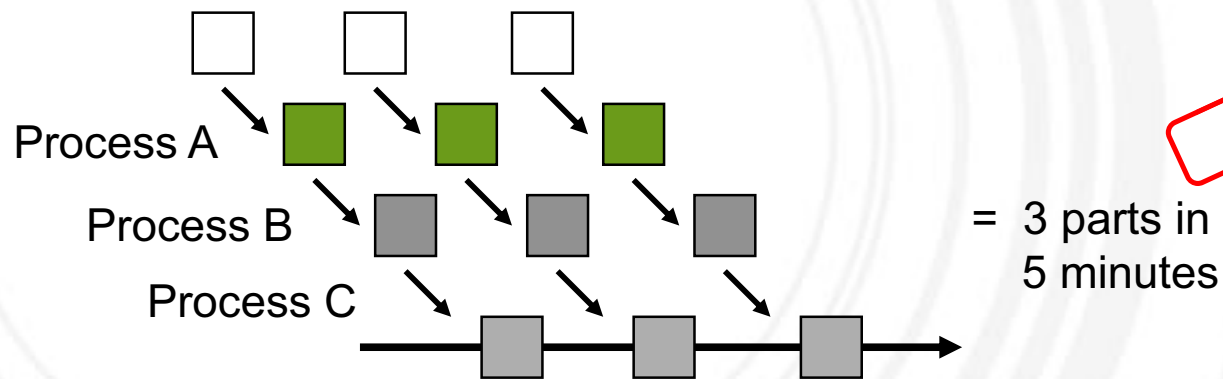
## 3-2. Cleaner Production Lean Process - Tool : Batch Reduction

● It is important to improve your setup time so that you can successfully reduce your batch size



▣ **Continuous Flow**

Note: 1 minute to paint one piece (ignore dry time)

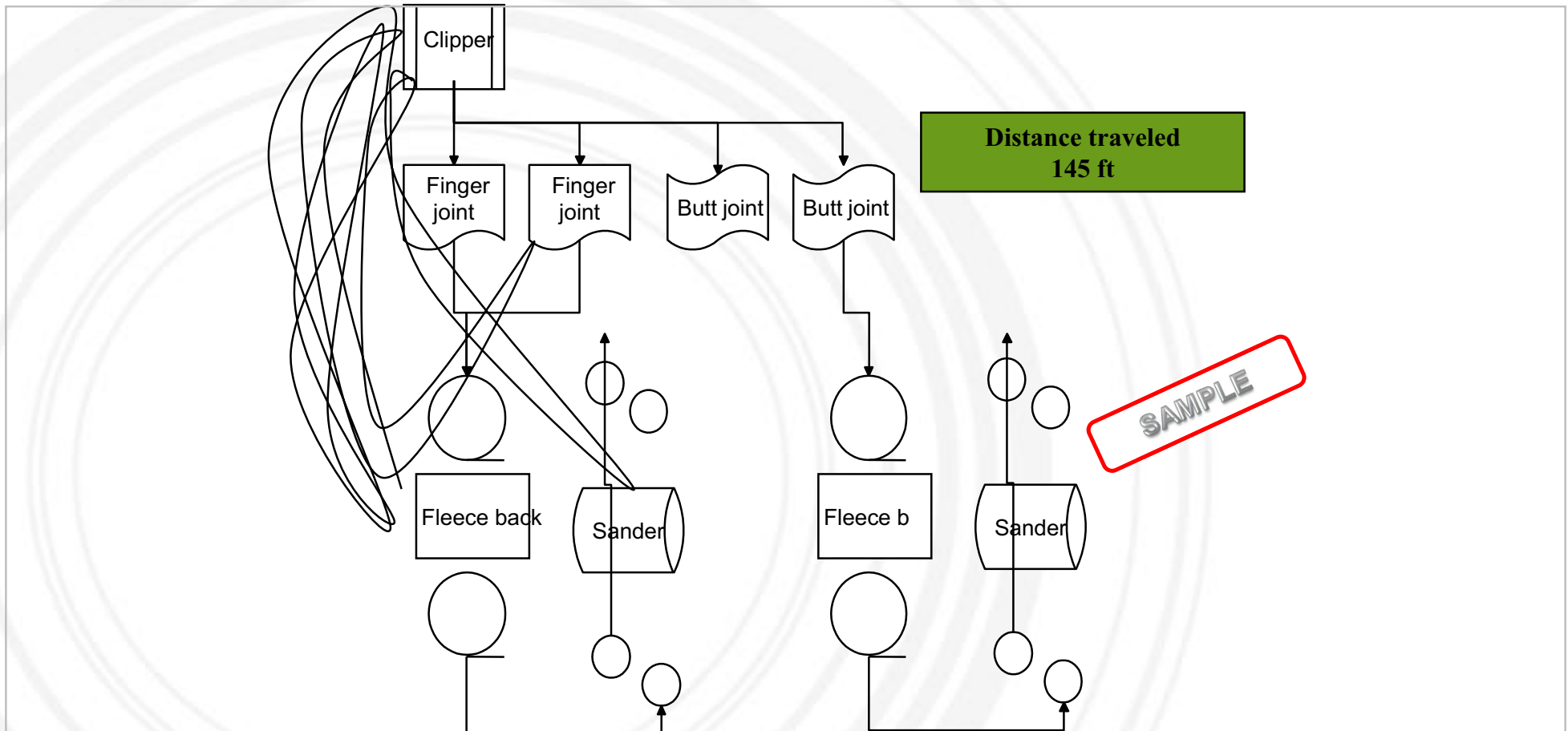




# Cleaner Production – Lean Process

## 3-3. Cleaner Production Lean Process - Tool : Noodle(spaghetti) Diagram

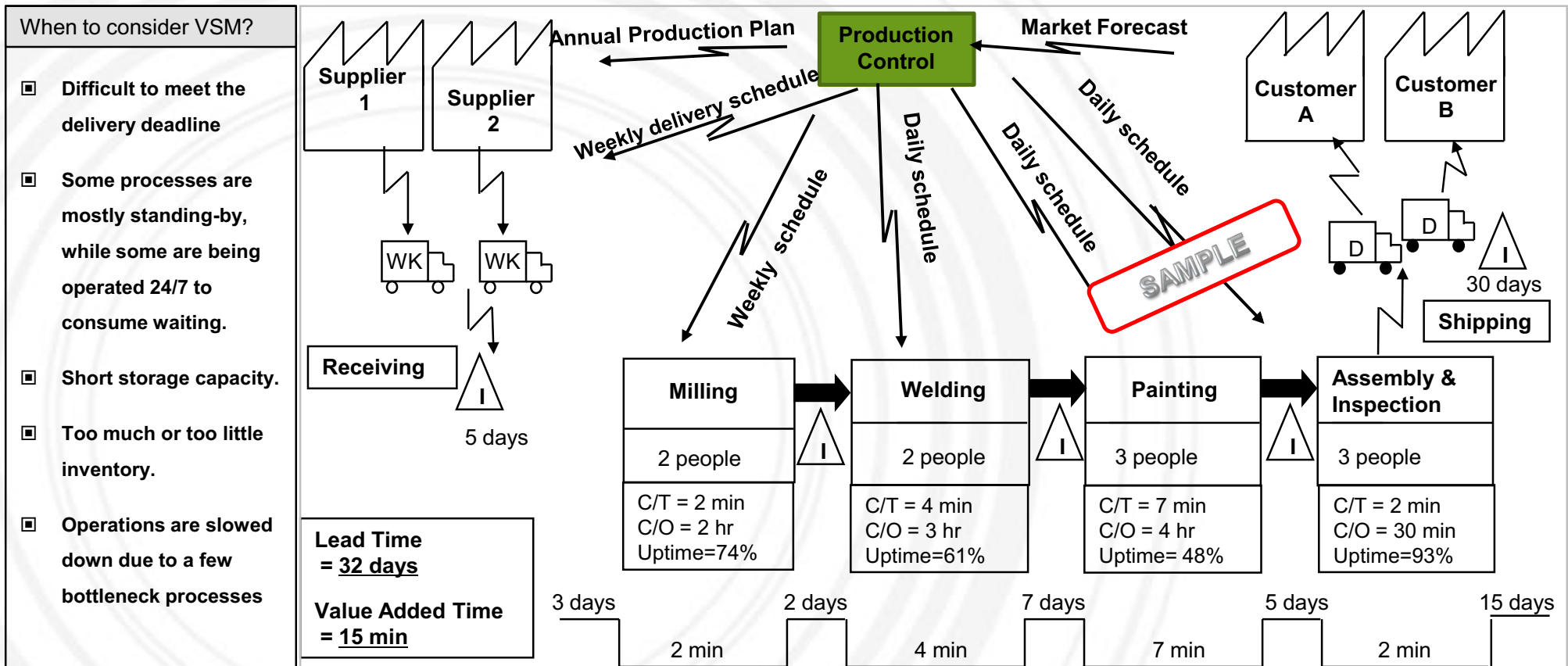
● It is a movement path diagram by a more appetizing name. The Noodle diagram is a great waste observation tool even for people taking their very first steps at kaizen and lean management, and also one that serves even the most seasoned lean practitioners faithfully.



# Cleaner Production – Lean Process

## 3-4. Cleaner Production Lean Process - Tool : Value Stream Map (VSM)

- **(VSM)** is a process mapping method used to document the current and future states of the information and material flows in a value stream from customer to supplier. A value stream is the set of specific actions (value-added and non-value added) required to bring a specific product through three critical management tasks of any business: problem solving, information management, and physical transformation. A tool to reduce muda by distinguishing the process that adds values and that does not add values along with the raw materials and product flows.



# Environmental Transparency

Global companies are disclosing their environmental management practices.

⇒ **WHY:** Interested stakeholders (investors, consumers, buyers, suppliers) pressure companies to measure their sustainability.

⇒ **HOW:** **Transparency** is the first step to Environmental Responsibility of companies

## What and how to disclose environmental information?

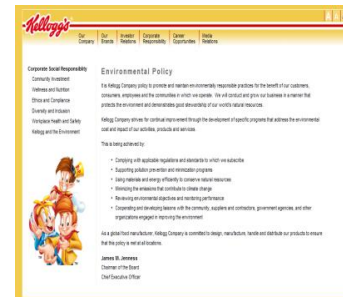
### Information Content

- Use of Electricity, Fuel, Materials
- Waste and Toxic Substance Generation
- Carbon footprint
- Environmental Management Strategies & Targets

### Methods

- Disclose environmental management information on the company's **website**
- Publish a **sustainability report**
- Use **bulletin boards** to share information on the company's environmental management and sustainability activities to employees & clients

## Sample 1



Environmental policy on website

## Sample 2



Environmental management bulletin board

## Sample 3



Sustainability report

# Environmental Transparency

Sustainability reporting is the ultimate form of environmental transparency. The report should include all aspects of the organization's sustainability performance results and targets.

## Sustainability Report

### Contents

- Managing Director's Message
- Company Overview
- Report Overview
  
- 1. Environmental Management Strategy & System
  - Environmental Management Performance & Targets
  - Environmental Management System
- 2. Environmental Management Practices
  - Green Procurement
  - Education & Training Activities
  - Environmental Certification
  - Others
- 3. Energy & Resources
  - Energy efficiency
  - Resource efficiency
- 4. GHG Emissions & Environmental Pollution
  - GHG Emissions & Reduction Target
  - Environmental Compliance
  
- Appendix

### Energy & Resources

Energy-saving activities:

- Schedules adjusted for cooling, heating, and air filtration
- Heat exchangers installed
- Hot water supplied on ground floors
- Floor lamps replaced with high-efficient lights

	Unit	2009	2010
LNG	Nm3	265,626	275,319
Diesel	ℓ	106,947	80,947
Gasoline	ℓ	221,330	242,368
Electricity	kWh	55,314	59,767
Heating System	Gcal	1,059	1,192

SAMPLE



## Contents

### 1. Introduction to ASEM Eco-innovation Project

### 2. Eco-innovation Strategy

### 3. Sustainable Business Management

#### 3.1 Environmental Strategy Establishment

#### 3.2 Environmental Management System

#### 3.3 Environmental Data Management

#### 3.4 GHG Emissions Management

#### 3.5 Cleaner Production

#### 3.6 Environmental Transparency

### 4. CNC International

#### 4.1 Overview

#### 4.2 Item



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# CNC International

## 1. Basic information of Company

Company name	CNC International		
Representative	Karun Sitthiampornphan	Company Size	<input type="checkbox"/> Large company <input checked="" type="checkbox"/> Midium <input type="checkbox"/> Small
Address	313 C.P. Tower 18th Floor, Silom Rd., Silom, Bangrak, Bangkok 10500 Thailand		
Type of Industry	non woven fabrics	Main product	SPUNBOND
Sales Volumes	140 Million USD(TOTAL GROUP)	No of employees	153

## 2. OVERVIEW

CNC International 1996 was founded. CPPC, Charoen Pokphand Group is a subsidiary of the plastics division.

- After energy analysis, a better insulation method is recommended.
- Provide heat loss reduction plan.
- Suggest proper maintenance of the Electricity Management Office room temperature for energy saving.
- Share information on the calendar's power-saving method.
- Propose the use of air compressor to save power.
- Propose air Compressor measures outside air intake to provide proper pressure.
- Use cooling water pump installation inverter.
- Use air dryer to come up with a reasonable operating plan.

# CNC International

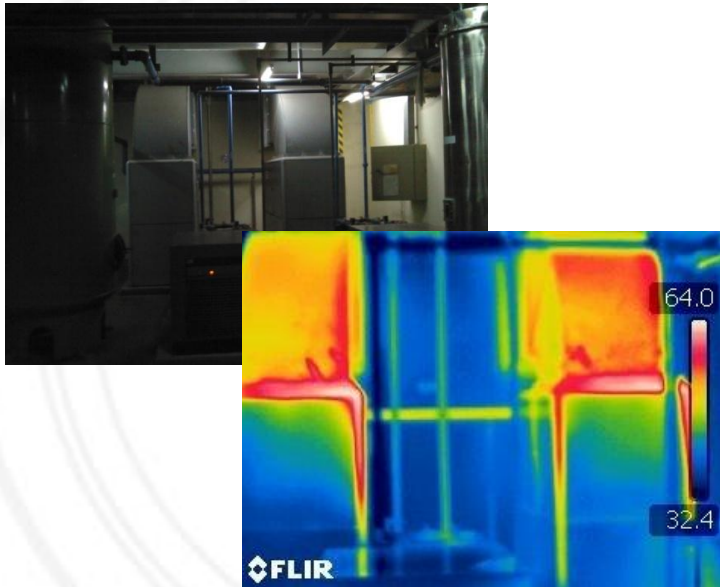
## 2. ITEM

### Case 1. Air Compressor

- **State of worksite:**

Air compressor discharge pressure 7.5 (kg / cm<sup>2</sup>) high.

Air compressor inlet temperature is too high.



- **Betterment :**

Discharge pressure lowering electricity savings  
Improvement of the air compressor inlet temperature

- Air Compressor discharge pressure ( 7.5 bar → 5 bar)
- Lower the air compressor inlet temperature

- **Expected Effectiveness :**

- Annual Fuel savings = 108,186(kWh/Yr)
- Annual Amount of savings = 108,186(kWh/Yr × 2.8(BHT/kW)  
= 302,921(BHT/Yr)
- Investment = Do not consume

# CNC International

## 2. ITEM

### Case 2. Chiller inlet air temperature Lower

- **State of worksite:**

Chiller Plant Room installed outside the building.

It is exposed to direct sunlight leading to high temperature of the air intake.



- **Betterment :**

Solution : Shading net installed disconnects direct sunlight



- **Expected Effectiveness :**

- Annual Fuel savings = 58,740(kWh/Yr)
- Annual Amount of savings = 58,740(kWh/Yr × 2.8(BHT/kW)) = 164,472(BHT/Yr)
- Investment = 250,000



# CNC International

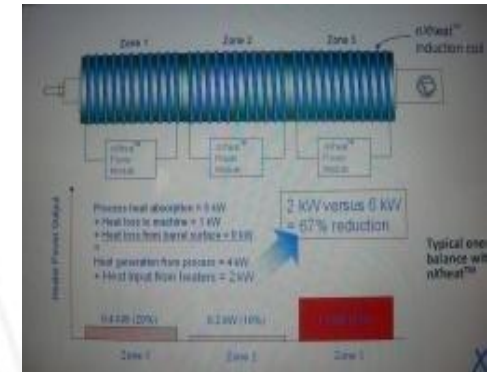
## 2. ITEM

### Case 1. Bend heat melting screw

- **State of worksite:**

CNC is a manufacturer of non-woven fabrics for diapers or packaging purpose etc. Factory have 75kw, 150kw x 2, polymer melting extruder for fiber spinning

- **Betterment** : Exchange of the electrical heater in the injection molding.



- **Expected Effectiveness** : Bend heater system of the Polymer melting extruder switch to INDUCTION heating system which can save energy 60%.



## **ASEM SMEs Eco-Innovation Consulting Project :**

*- Eco-Innovation Guideline for CNC International -*

**ASEM SMEs Eco-Innovation Center (ASEIC)**

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