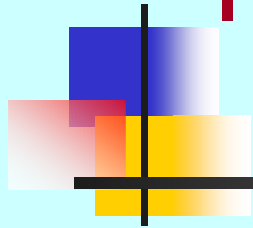


Development of Technologies for Improving Energy Conservation

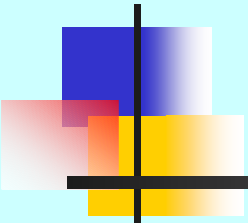


May 27, 2004

Yoshihiro Ogisu

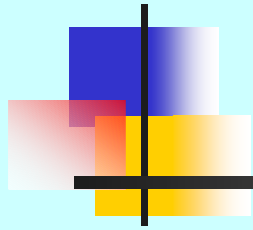
Lecturer

Waseda University/Kokushikan University



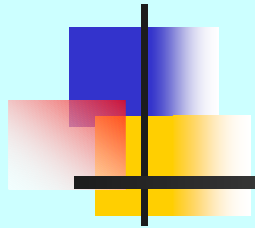
Contents

1. Purpose of Energy Conservation
2. What Should Be Done for Energy Conservation
3. Strategy for Conservation Technology
4. Method of energy conservation activities
5. Effect of Measures and Dissemination Rate of Typical Equipment for Energy Conservation
6. Measures for energy saving in various sectors
7. Concluding comment



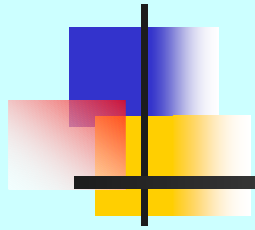
Purpose of Energy Conservation

- (1) Prevention of world climate change
- (2) To conserve the resource of fossil energy
- (3) To improve the efficiency of production and management



What Should Be Done for Energy Conservatin

- Stop the leakage!
- Waste heat recovery
- Heat insulation
- Stop the power with no meaning!
- Change the machine to more energy efficient type
- Thermodynamic improvement
- **Development of new technologies**



Development of New Technologies!

Points of New Technologies

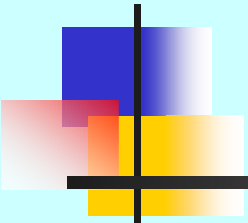
Low cost

New function and Design

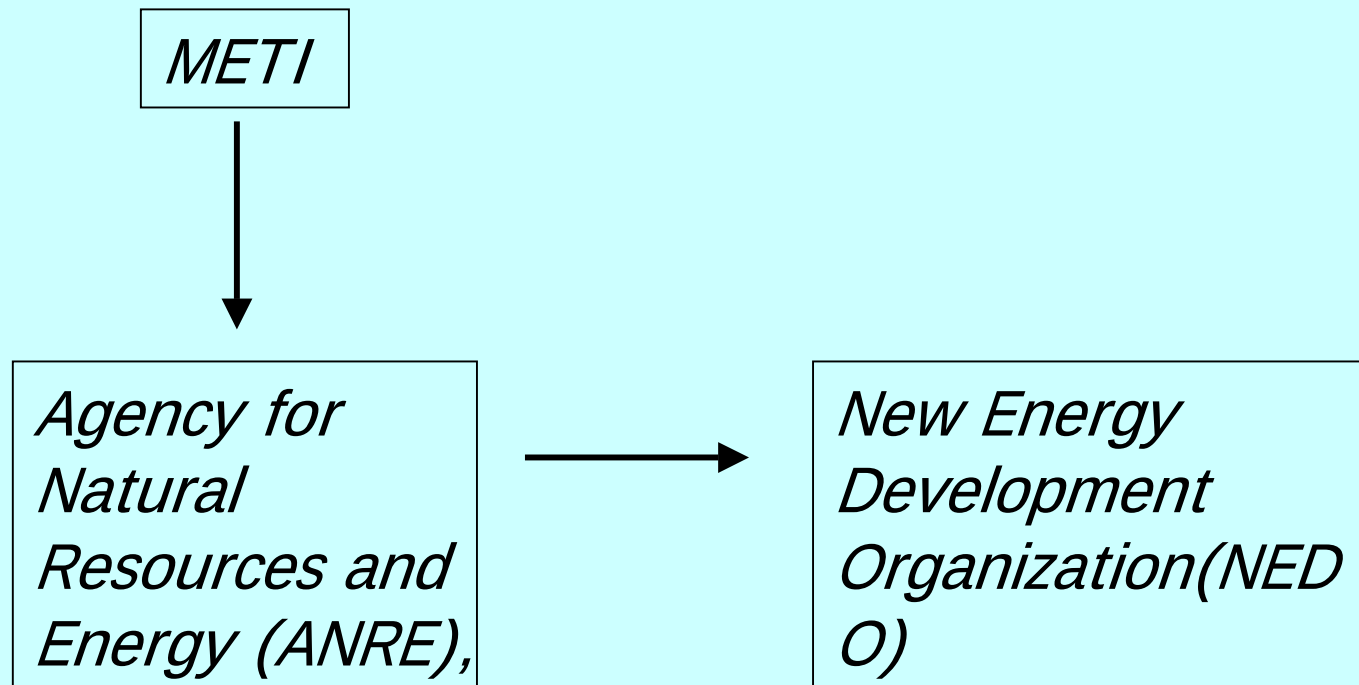
Low energy consumption

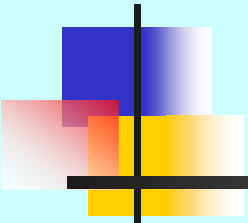
Small and light weight

No environmental problems



Flow of National R&D Fund for Energy Technology



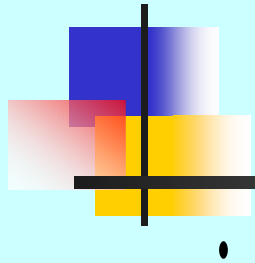


Strategy for Energy Conservation Technology Development

June 12, 2002

Four priority points

- Needs oriented (or user oriented)
- Development with marketing strategy
- Innovative point of view
- Spill-over of the technology

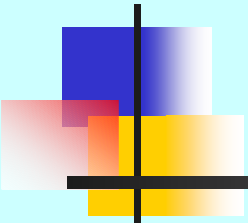


Direction of strategy in Commercial and residential sector

Thermal energy use both for improvement of residential quality and thermal efficiency

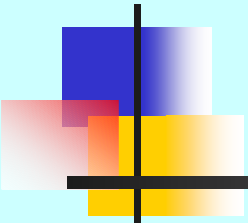
(1) Direction of improvement in Commercial sector

- Efficient HVAC and lighting systems
- Highly insulated Buildings
- New energy saving technologies in accordance with improved OA equipment



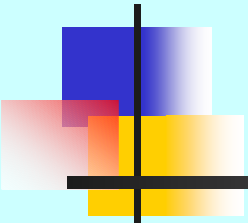
(2) Direction in technology for transportation sector

- Lower fuel consumption rate cars with high driving performance
- Innovative new fuels
- Infra structures for efficient use of motor cars



(3) Direction of development in industrial sector

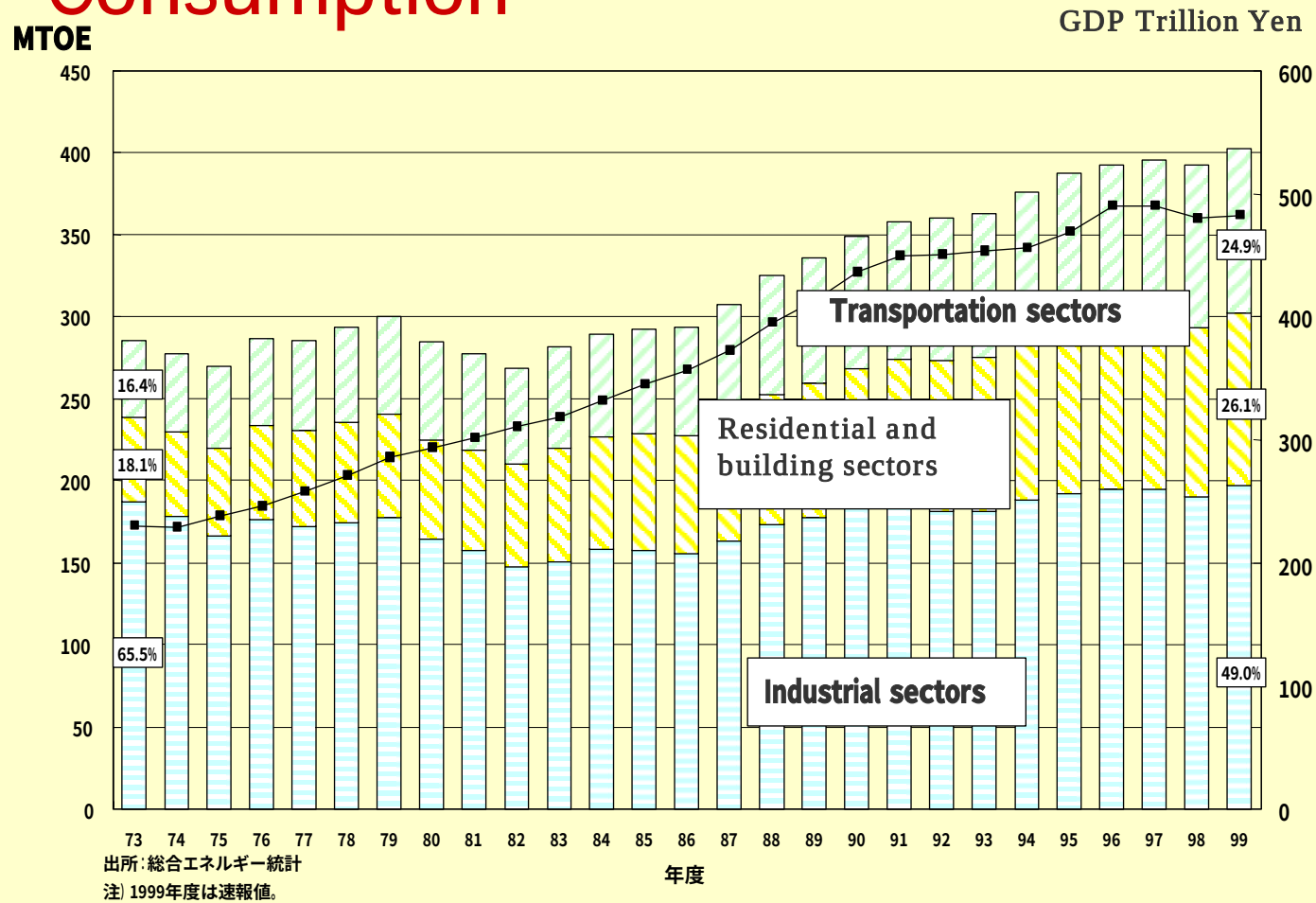
- Reduction of energy consumption in basic part
(for example:energy for clean room, air conditioning, hydraulic power source etc.)
- improvement of general-purpose units in energy consumption
- Energy saving systems under increasing demand for heat in large industrial area

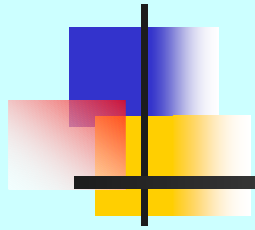


(4) Spill-over of technologies into the various technical fields

- Spill-over of technologies into the various energy using sectors
- Spill-over of advanced technologies in industrial sector into the commercial and residential sector
- Spill-over of technologies into the various technical fields
- Spill-over of basic technologies such as high efficient component units into the wide area of applications

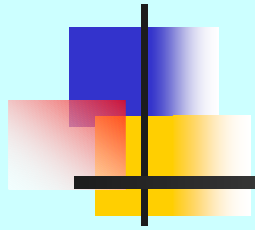
Japanese Annual GDP and Energy Consumption





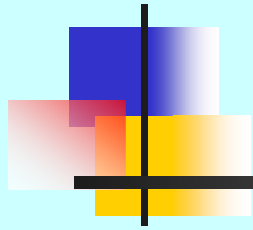
Japanese Annual GDP and Energy Consumption

1. Energy consumption in industrial sector is almost same level.
2. Energy consumption in residential and building sector is increasing
3. Also Energy consumption in transportation sector is increasing.
4. These trends shows what sector should make effort in energy conservation.



Method of Energy Conservation Activities

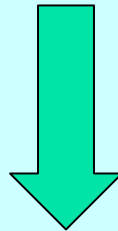
1. Authorizing
2. Checking of energy data
3. Planning
4. Doing
5. Reviewing



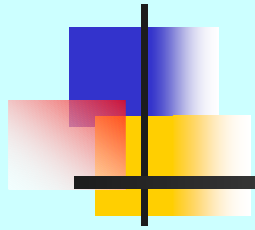
Energy saving activity in industries

TPM (Total Productive Management)

Activity

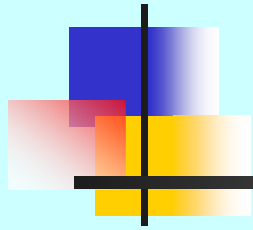


**Effective Result in
Improving Energy Efficiency**



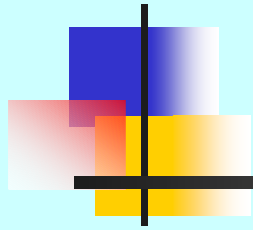
Steps of Energy saving activity in industries

- (1) Selection of the facilities to make investigation
- (2) To make investigation on the facilities
- (3) To make investigation on operation
- (4) Measurement on the energy consumption
- (5) Analysis of the measured data
- (6) To plan how to reduce the energy consumption in the same production capacity
- (7) To make manual for the reduction of energy consumption in the similar facilities



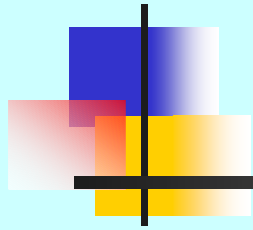
Measures for energy saving in the industry

- (1) Combustion process
- (2) Heat insulation
- (3) Steam traps
- (4) Inverter motor
- (5) Cascading of heat utilization



(1) Combustion process

- To improve the excess air ratio
- To recover the exhaust heat to use for air heater or recovery boiler or preheat of material to be heated in the process.
- Replace the burners to re-generative burners



(2) Heat insulation

To make heat insulation completely

Rock Wool max.
650°C



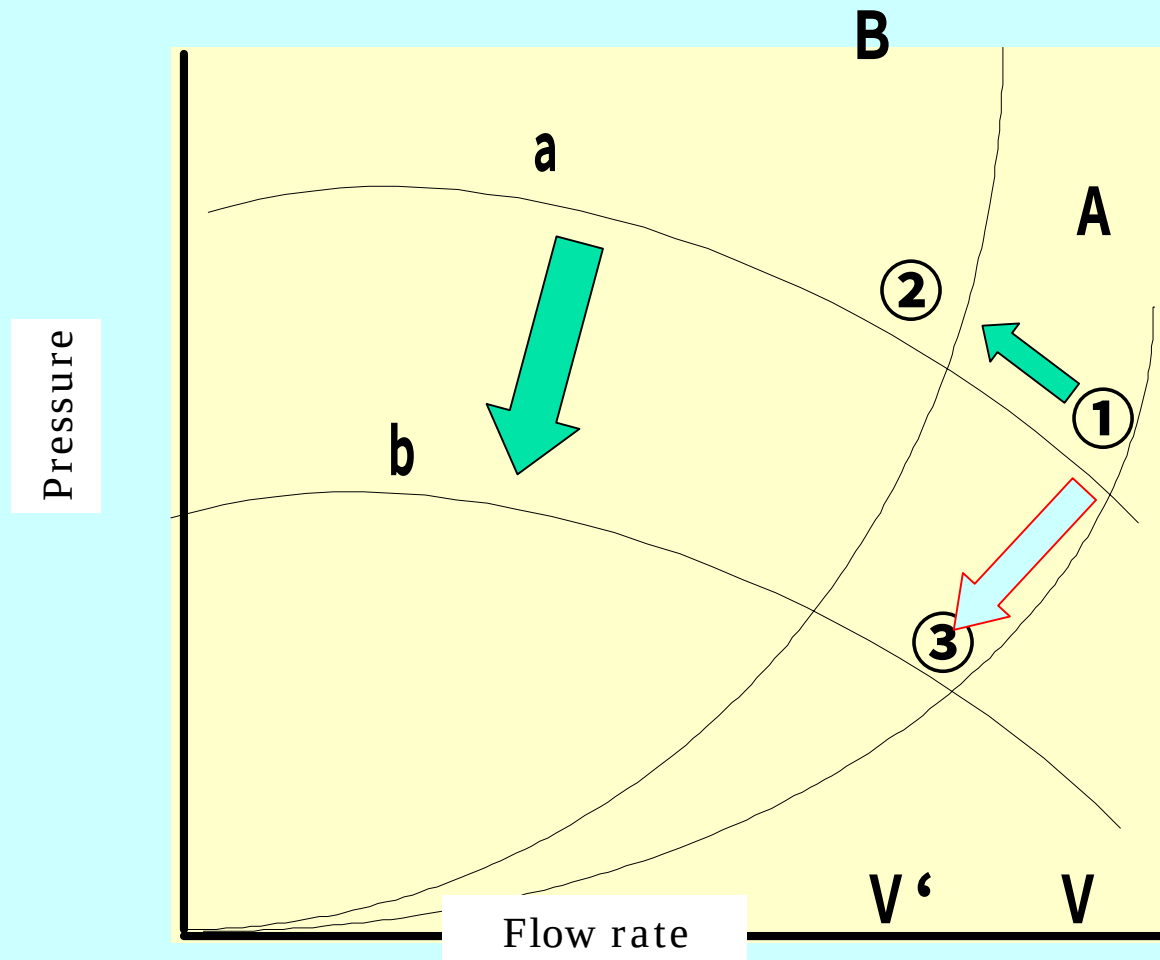
(3) Steam traps

To check the steam traps to
reduce the leakage of
steam

Leakage



(4) To use the inverter motor to control the power of fan, blower and pump to most economical condition.



V: Initial flow rate

V': Controlled flow rate

a: Initial performance curve

b: Controlled performance curve

A: Initial load curve

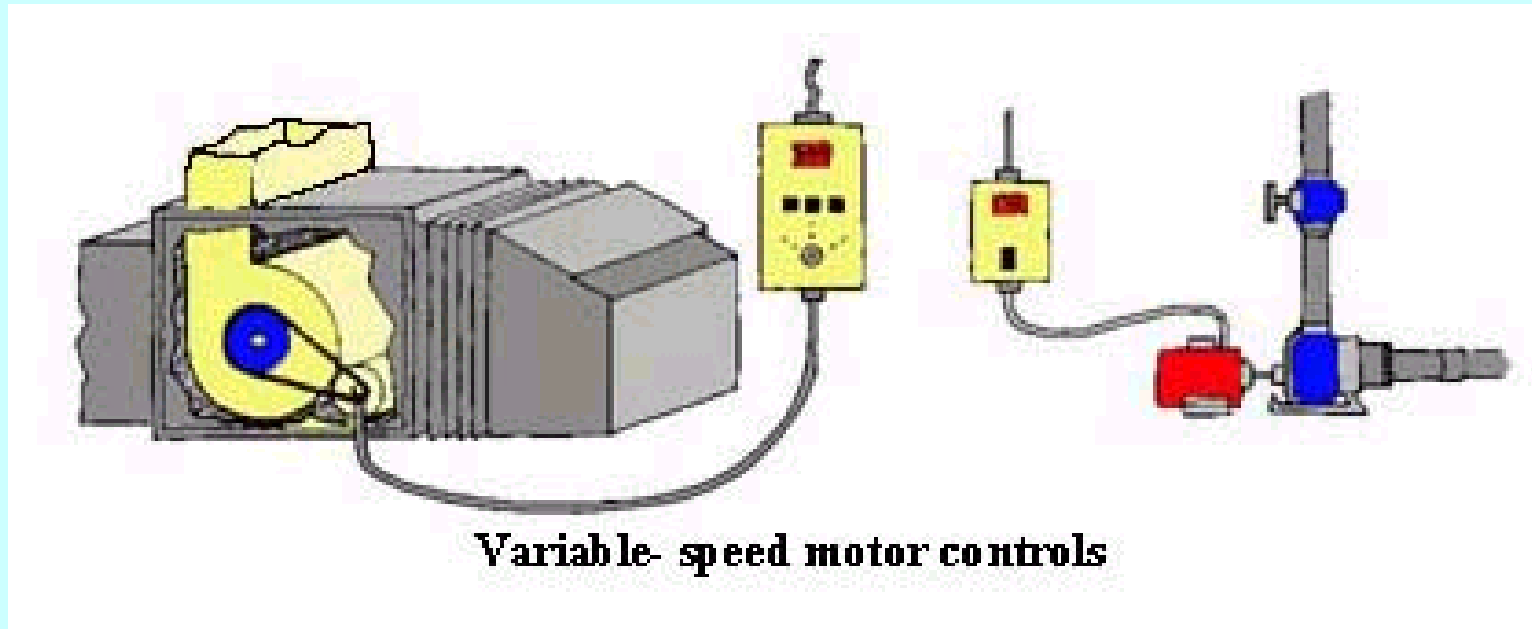
B: Load curve after controlled by throttling valve

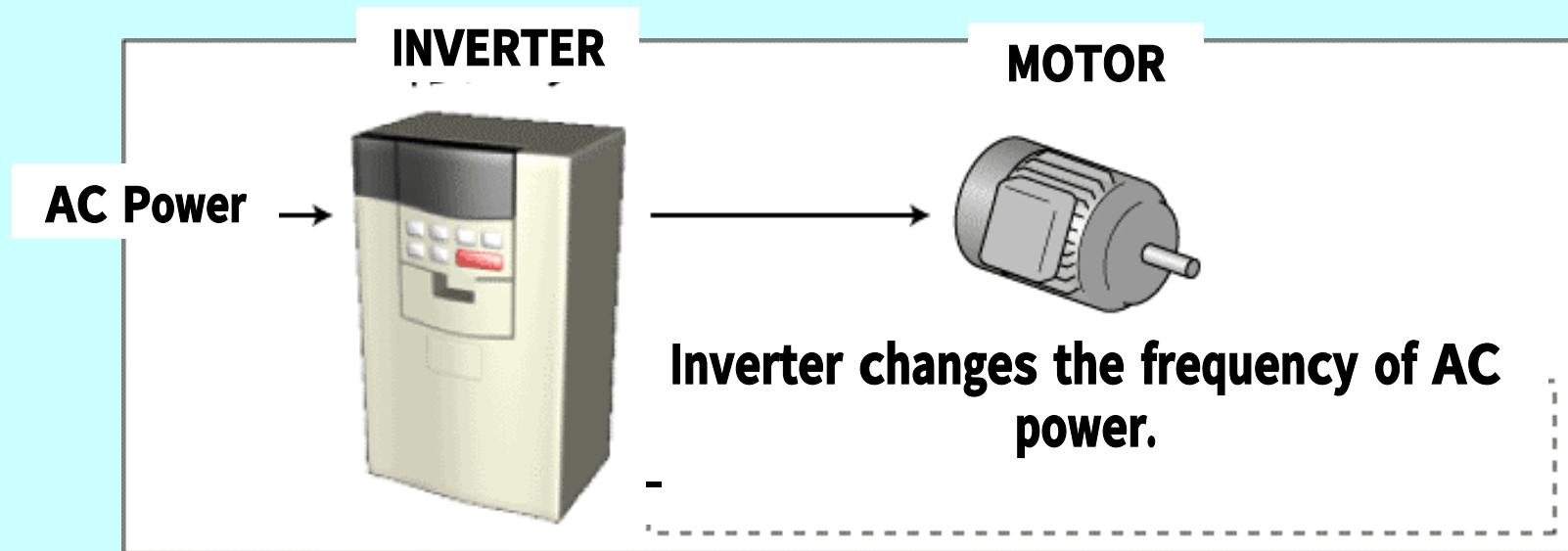
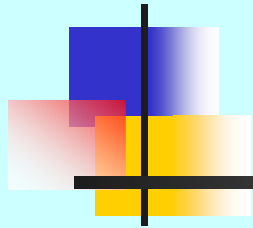
① Initial operating point

② Operating point after throttling

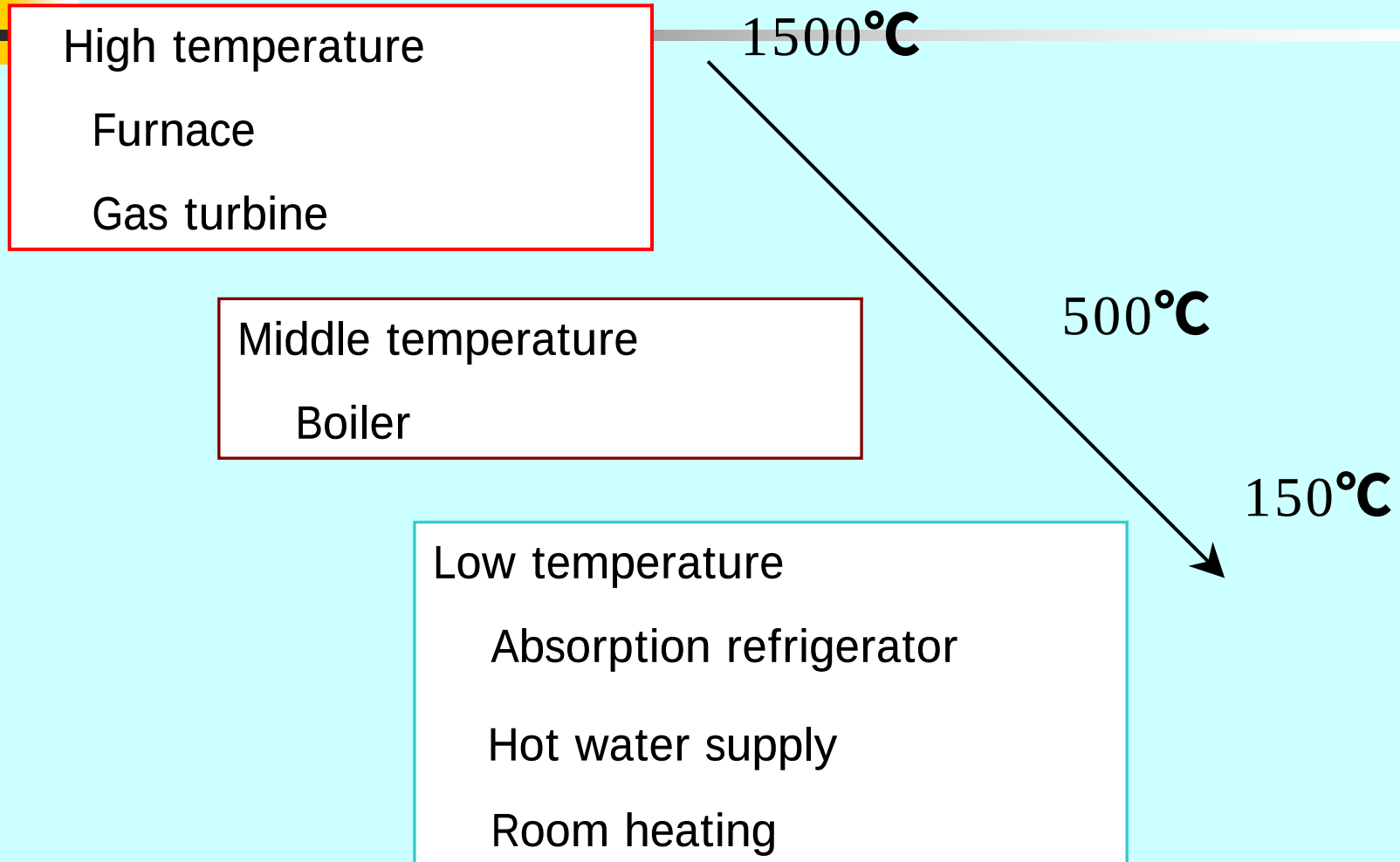
③ Operating point after revolution control

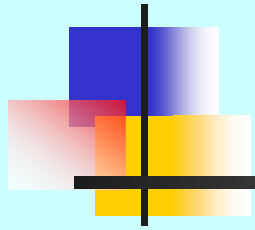
Use Variable-Speed Motor Controllers for Fans & Pumps with Modulating Flows





(5) Cascading of heat utilization

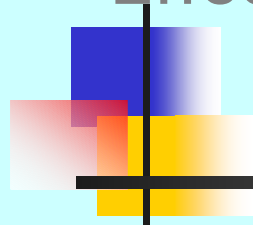




Energy saving by combined process

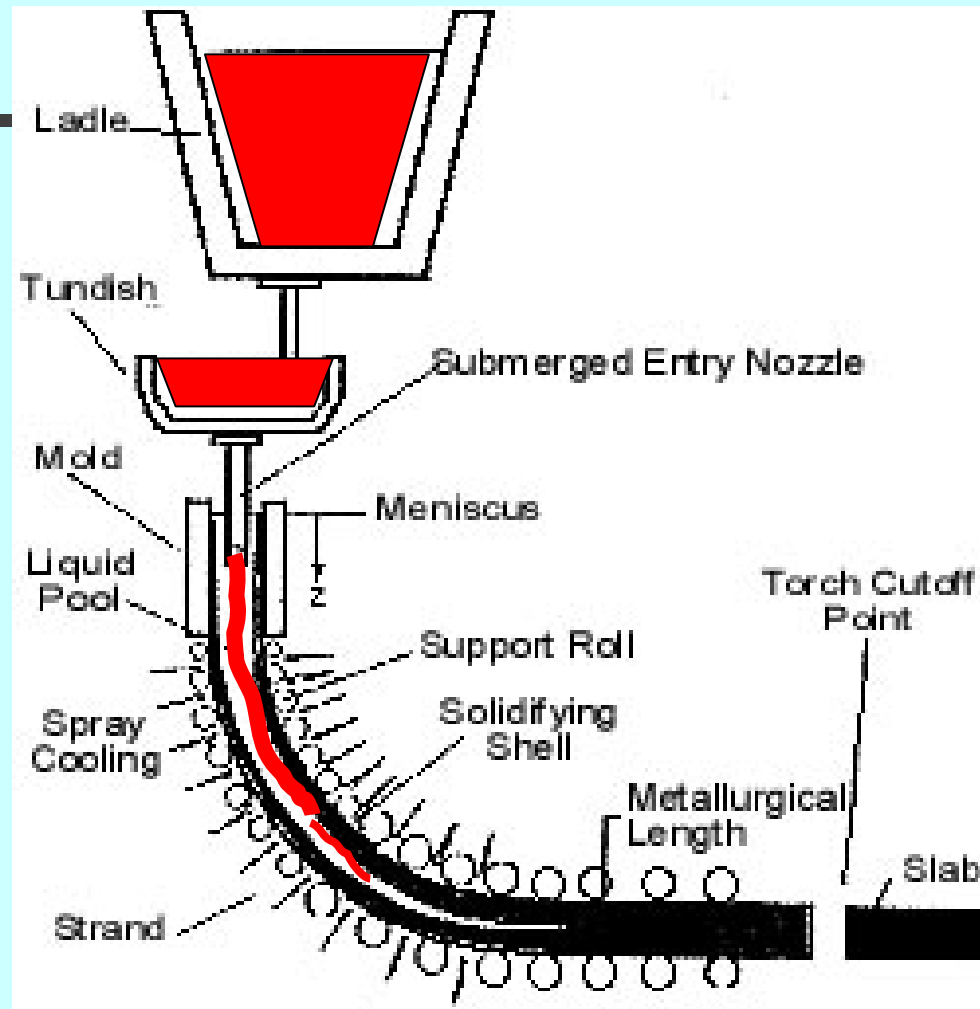
- (1) To use waste heat of the front process in the downstream process
That type of energy using system is named as cascade system.
- (2) Combined cycle power generation is the successful example of combined process.
- (3) Combined heat and power system is useful for the building using a lot of heat and power such as hotels and hospitals.

Effect of Measures and Dissemination Rate of Typical Equipment for Energy Conservation

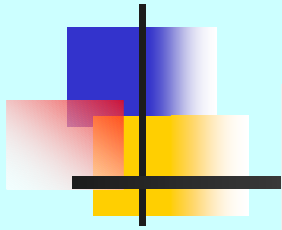


Industry	Decrease of Energy Intensity (94/73)	Typical Energy Conservation Equipment	Dissemination Rate as of 1998
Iron & Steel	29 %	Continuous caster (CC)	100 %
		Blast furnace top gas pressure recovery equipment (TRT)	100 %
		Coke dry quenching equipment (CDQ)	91 %
Petrochemical	58 %	High-efficiency naphtha cracking reactor	100 %
		High efficiency compressor	100 %
		Gas turbine	100 %
Cement	65 %	SP, NSP kiln (Heat recovery)	100 %
Paper & Pulp	61 %	Continuous digester	100 %

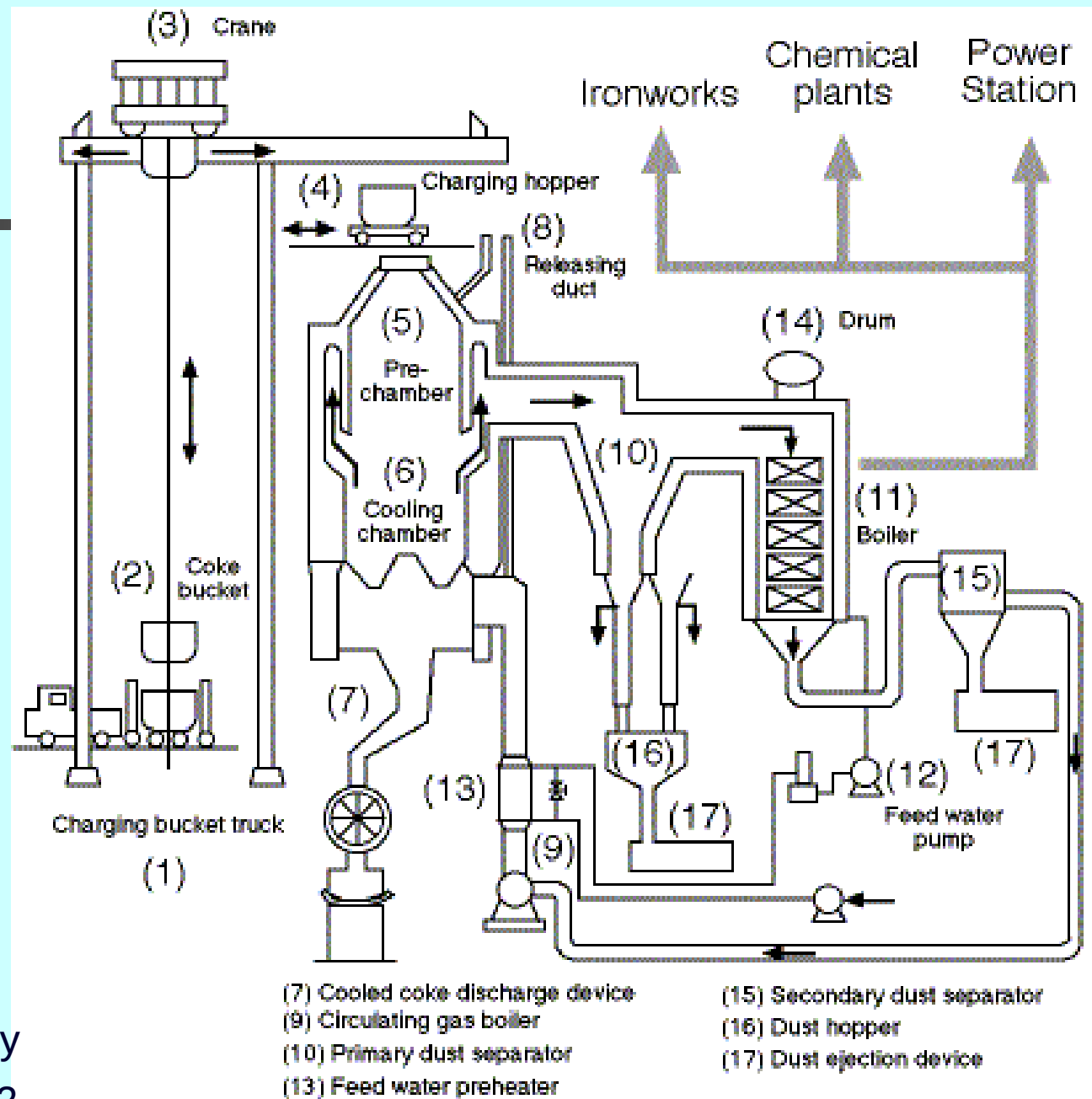
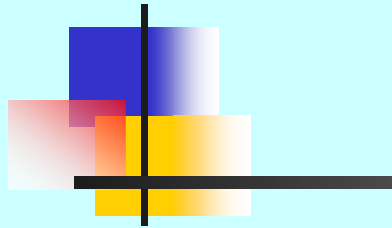
Source : ECCJ
26



Continuous caster (CC)



Beijing Plant: Capacity 65t/h of Cokes (NEDO project)



CADDET Energy
Efficiency, 2002

IDF

Feed

Flow of Solid Raw material

Flow of Gas

Pre-Calcination Furnace

Coal

FDF

Waste Plastics

Coal

Rotary Kiln

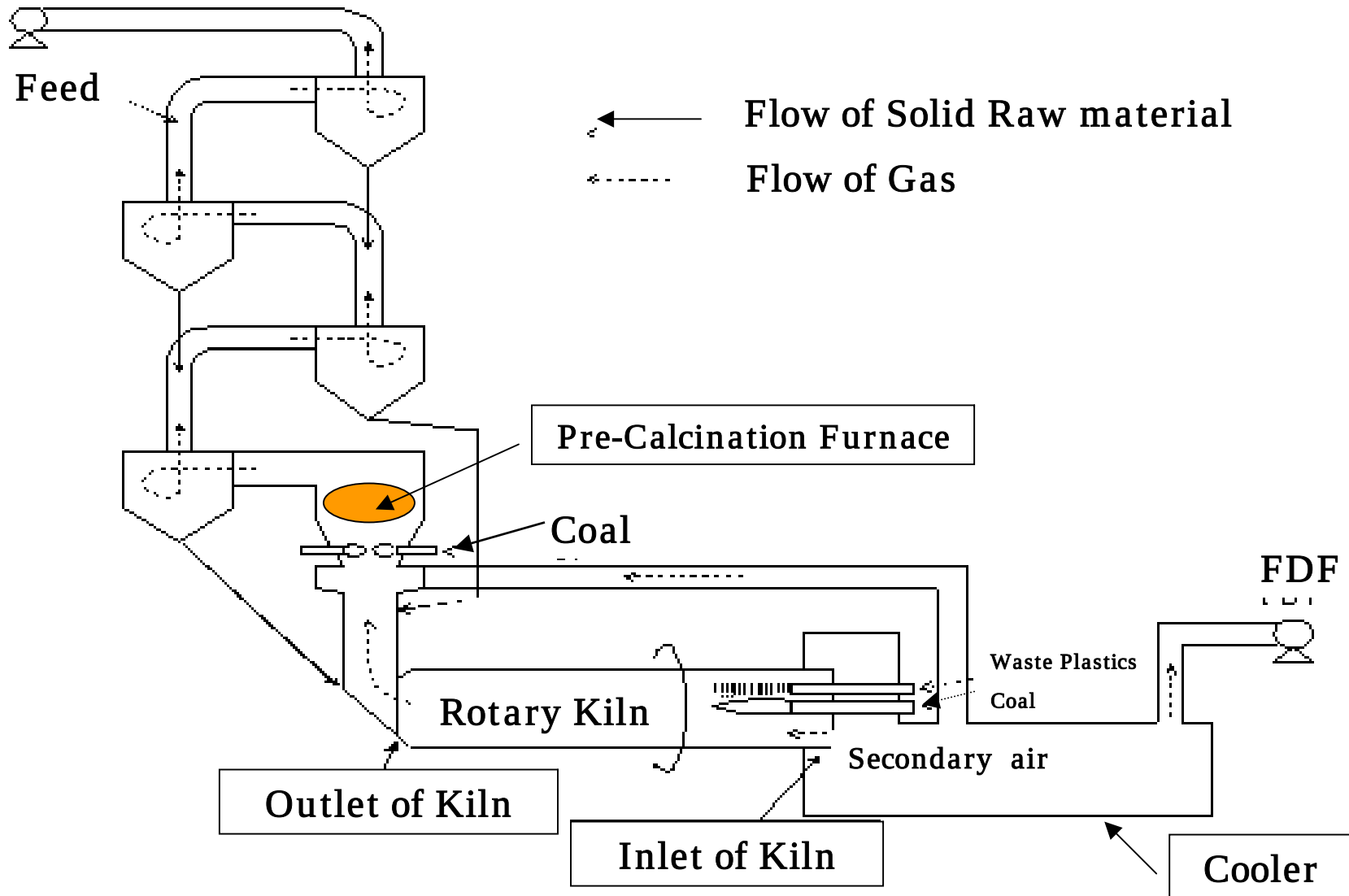
Secondary air

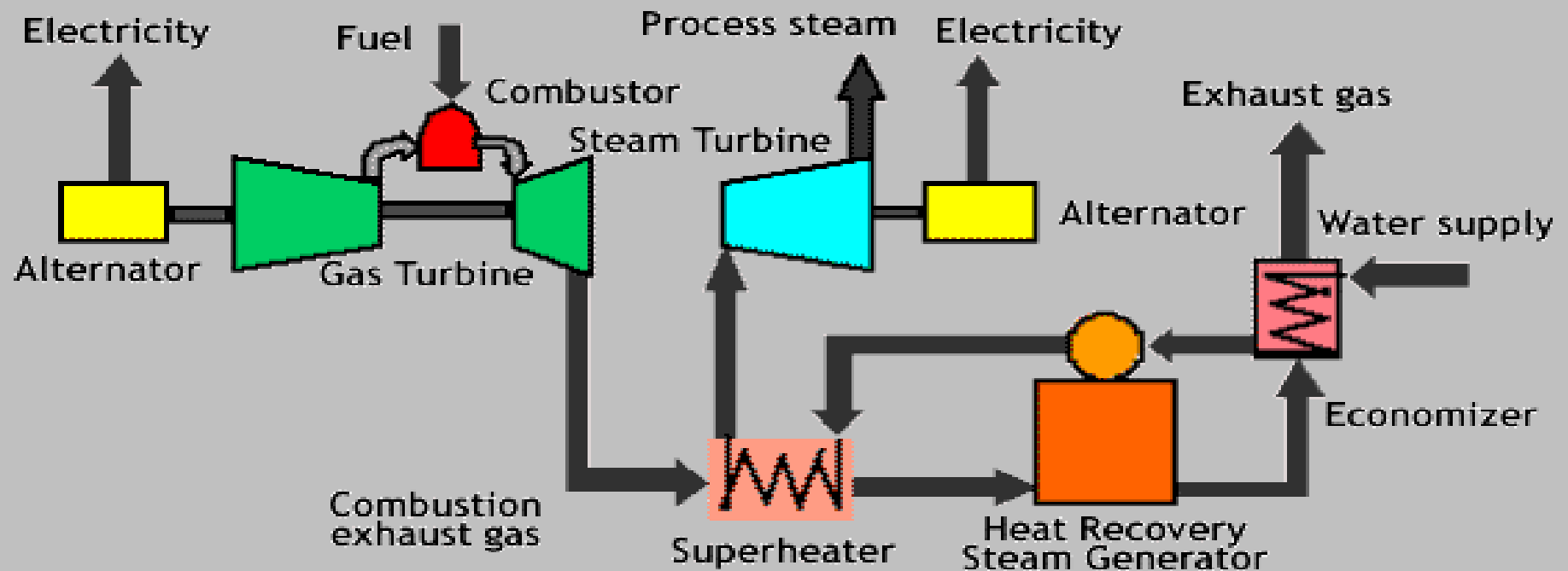
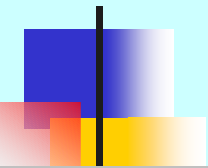
Outlet of Kiln

Inlet of Kiln

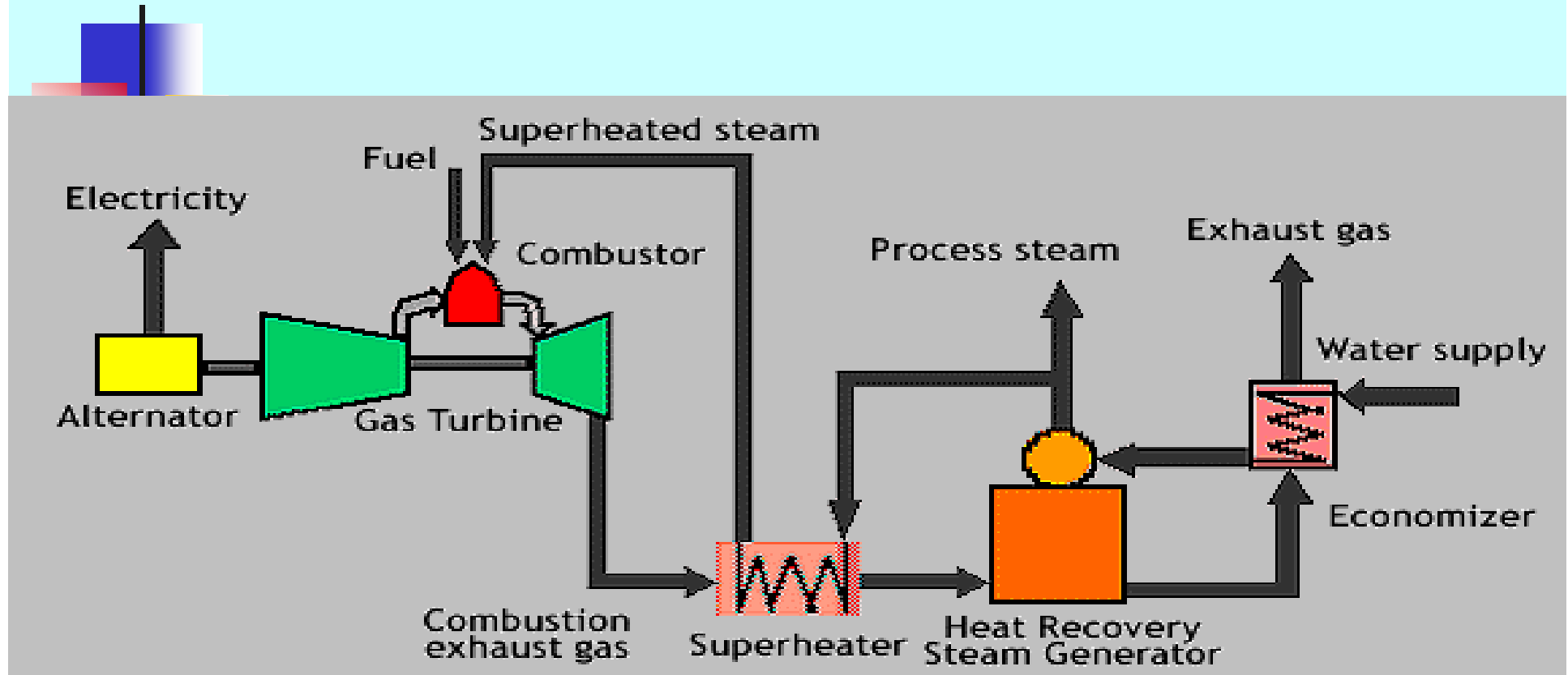
Cooler

New type Cement Kiln



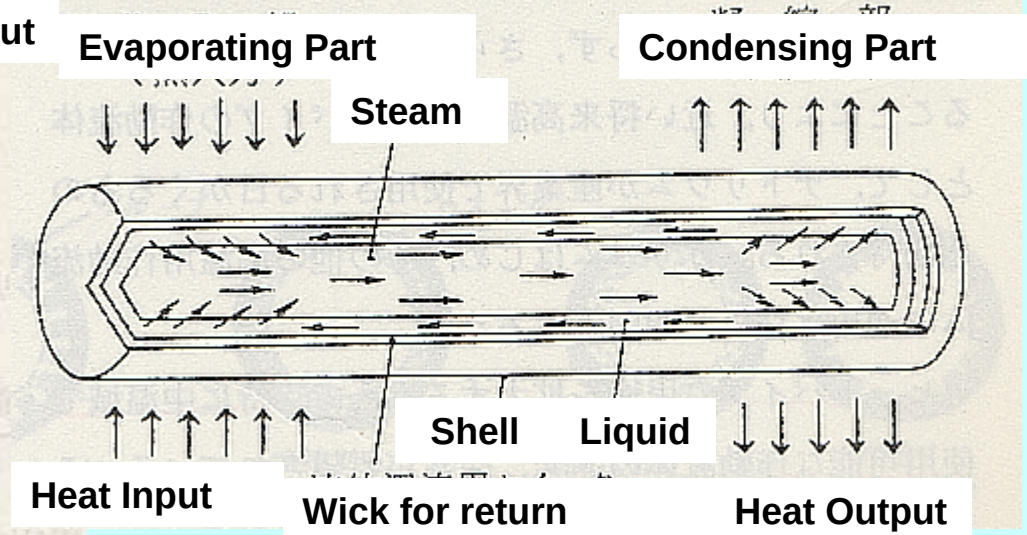
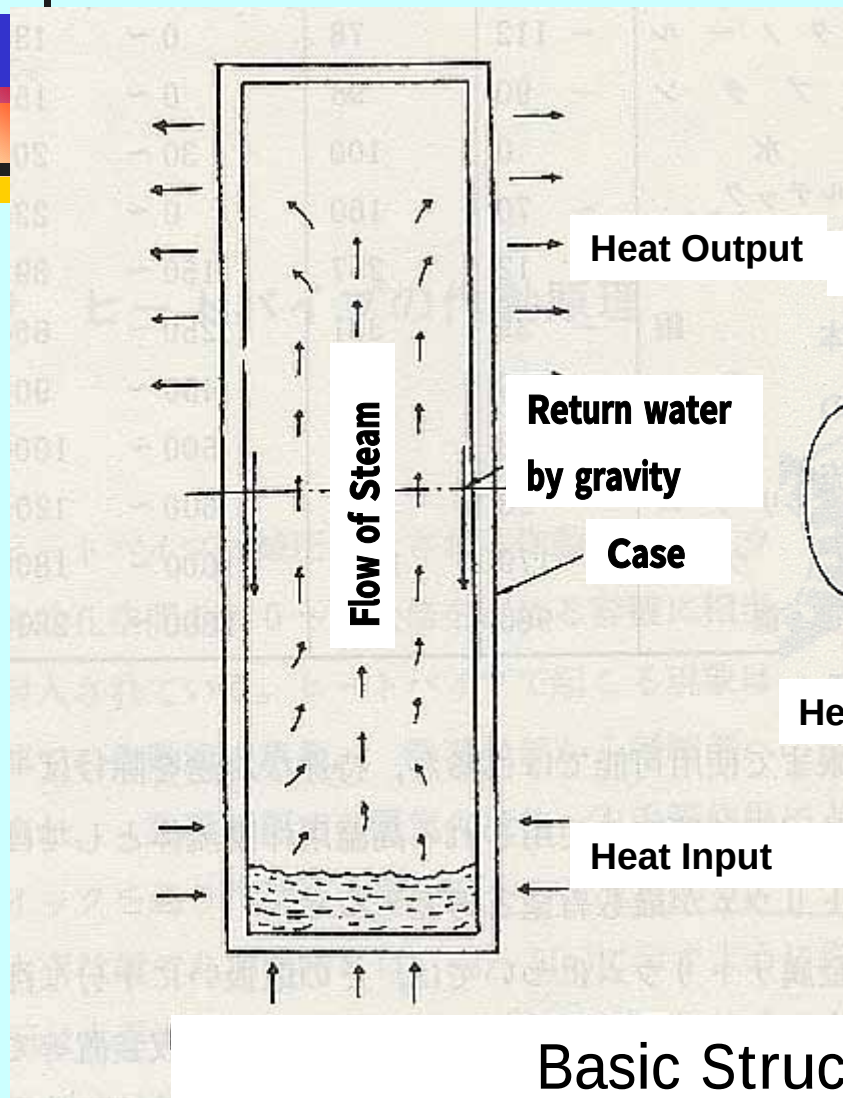


Combined cycle power generation

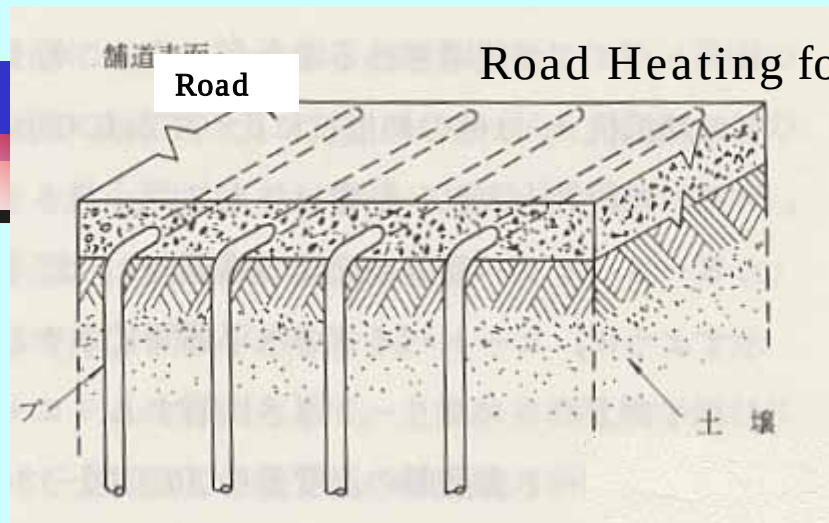


Combined cycle power generation

Chen-cycle

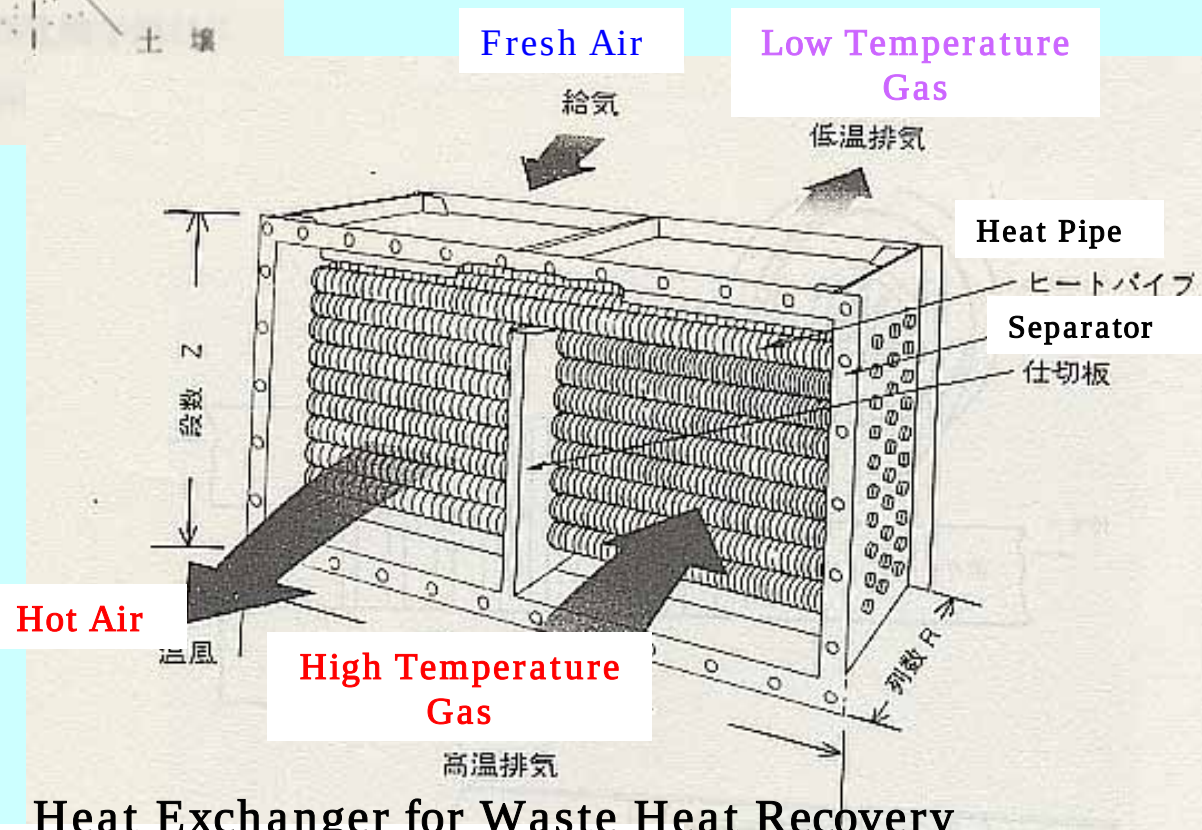


Basic Structure of Heat Pipe

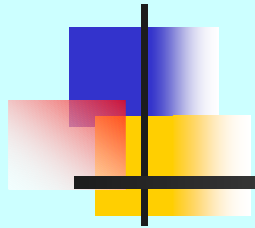


Road Heating for Snow Melting

Heat Pipe

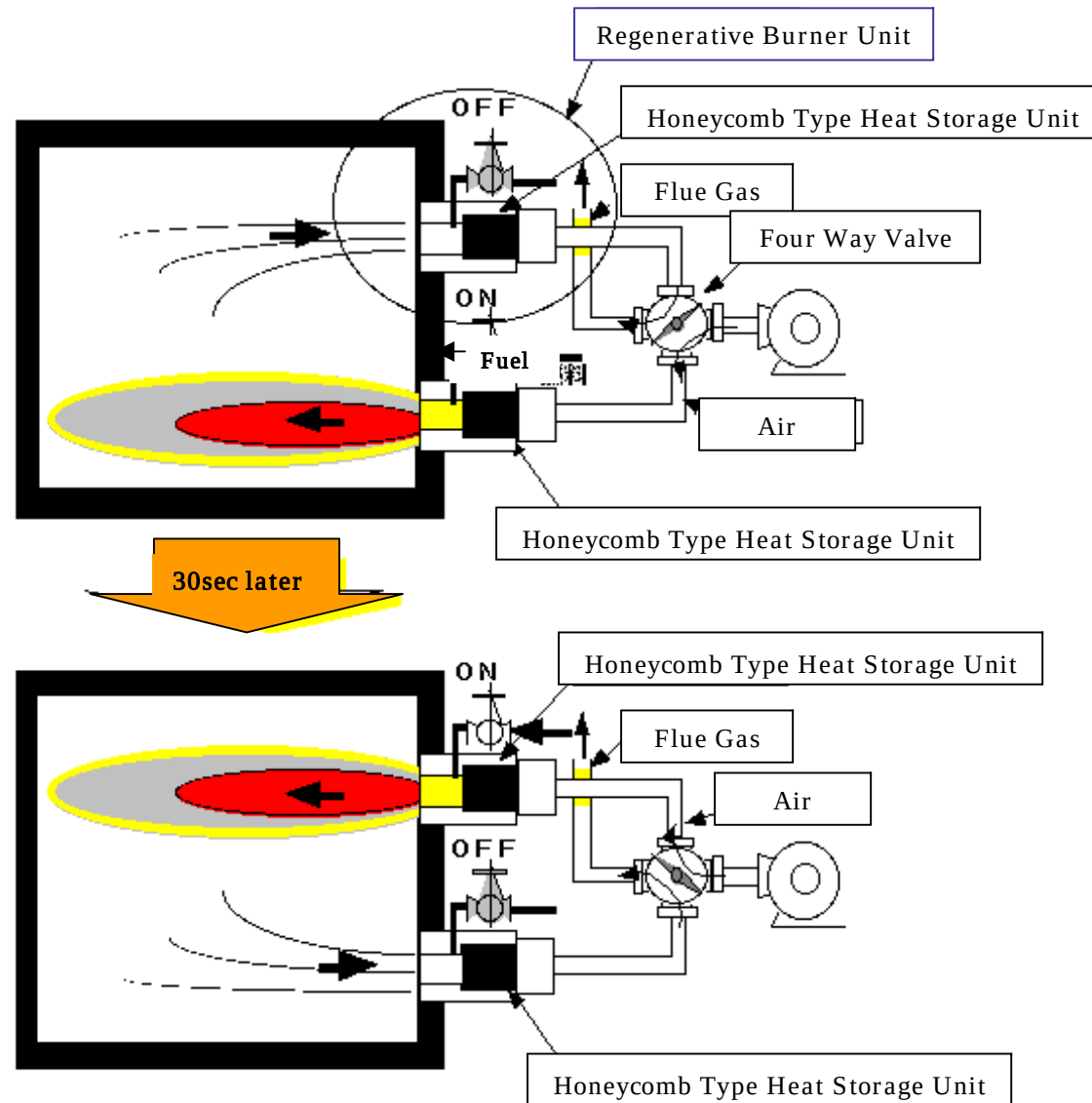


Heat Exchanger for Waste Heat Recovery Application of Heat Pipe

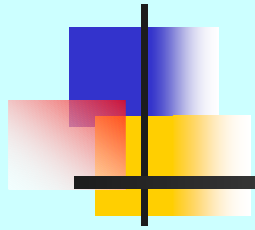


Merit of regenerative burner

- * High thermal efficiency(Improvement is usually more than 30%.)
- * Uniform temperature profile → high quality products
- * Smaller space is needed.
- * High production rate (high heat transfer rate)



Re-generative Burner System



Energy saving in the residential and building sectors

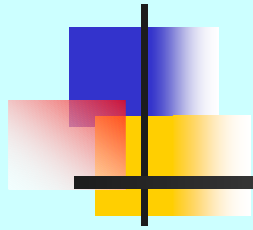
Heat-island phenomena

Extensive use of OA equipment

OA machine to be energy saving type

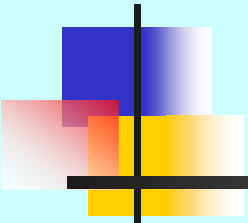
Control the air conditioner to keep proper temperature.

Control of lighting



Energy saving in buildings

- Reduction of cooling load
control of solar heat/ insulation/ventilation
- Energy saving of circulating pump/fan
- Lighting system
- Efficient HVAC system
- BEMS



Energy saving in transportation sector

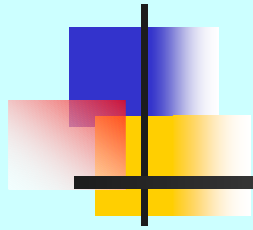
More efficient car (shifting to smaller and light weight car)

Hybrid car, electric car, fuel cell car.

Idling stop mechanism

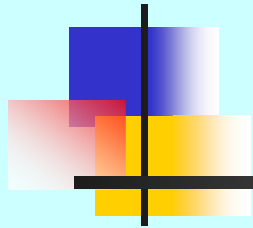
Reducing traffic jam (vics system etc.)

Using public transportation



Energy saving in waste disposal

Three R in waste management,
Reduce,
Reuse, and
Recycle



Concluding comments

- * Energy conservation is necessary both for the global environment and the more efficient business management
- * TPM activity is an effective measure for the energy conservation in the industrial sector
- * Japanese government has decided strategy for energy conservation technology development