



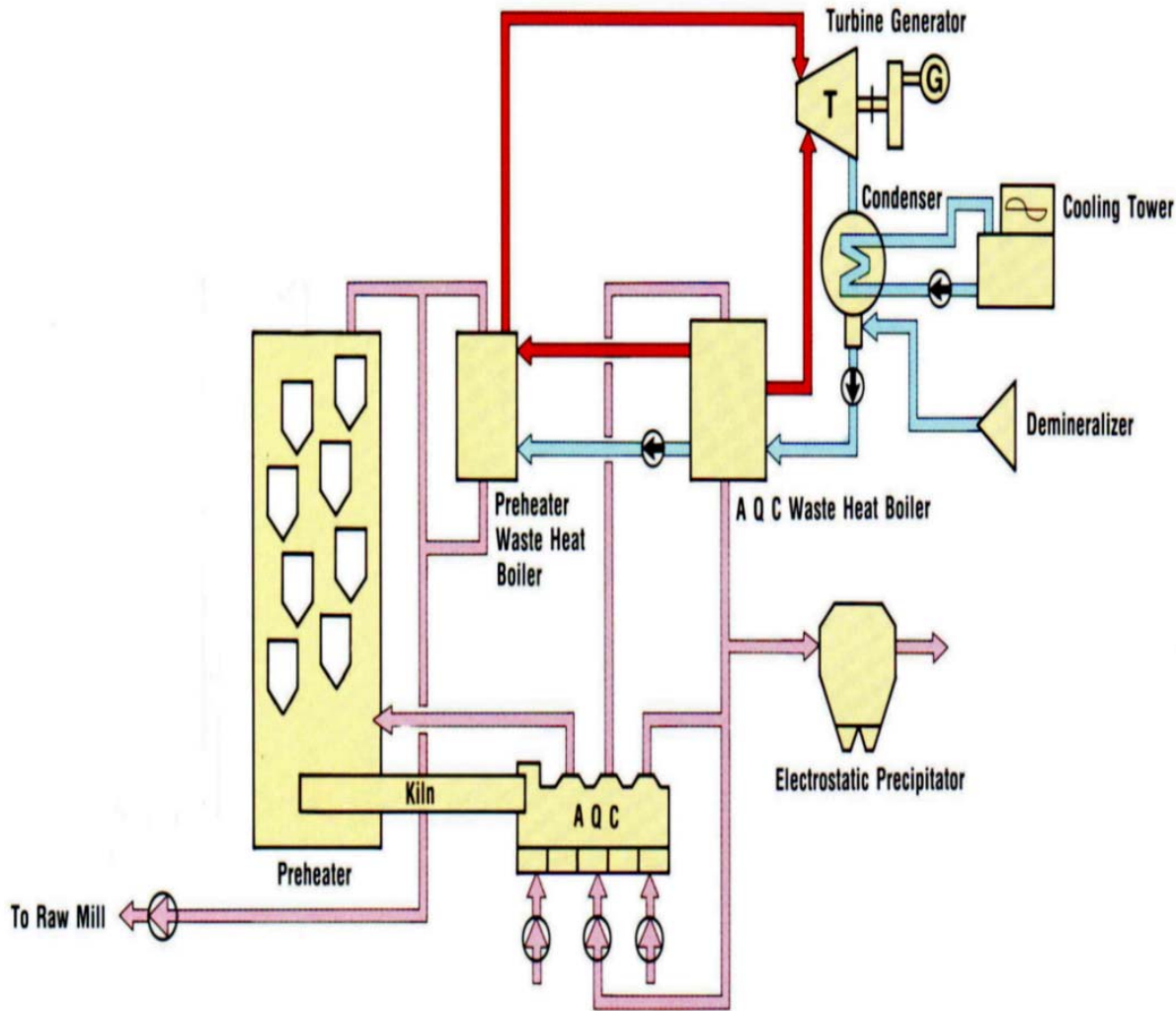
JAPANESE CLEAN TECHNOLOGIES FOR SOUTH AFRICAN CEMENT INDUSTRY

6, September 2012

List of clean technologies applicable to South African cement plants and their benefits

Clean Technology		Benefits
Waste Heat Recovery	Generating power using waste heat from kiln and supplying it to cement production	Reducing purchased power (= Reducing indirect emissions)
Co-processing (of wastes)	Burning effectively combustible waste in cement kiln or waste incinerator.	Contributing to establishment of recycling based society Reducing total fossil fuels consumption Reducing total GHG emissions
Co-processing (of biomass)	Burning effectively biomass in cement kiln or waste incinerator.	reduction Life extension of landfill site due to reduction of volume of wastes disposed
Decomposing of CFC and PFC	Decomposing CFC and PFC in cement kiln without any damage of product	Reduction of fossil fuels consumption required for decomposing CFC and PFC Reducing GHG emissions from CFC and PFC in local

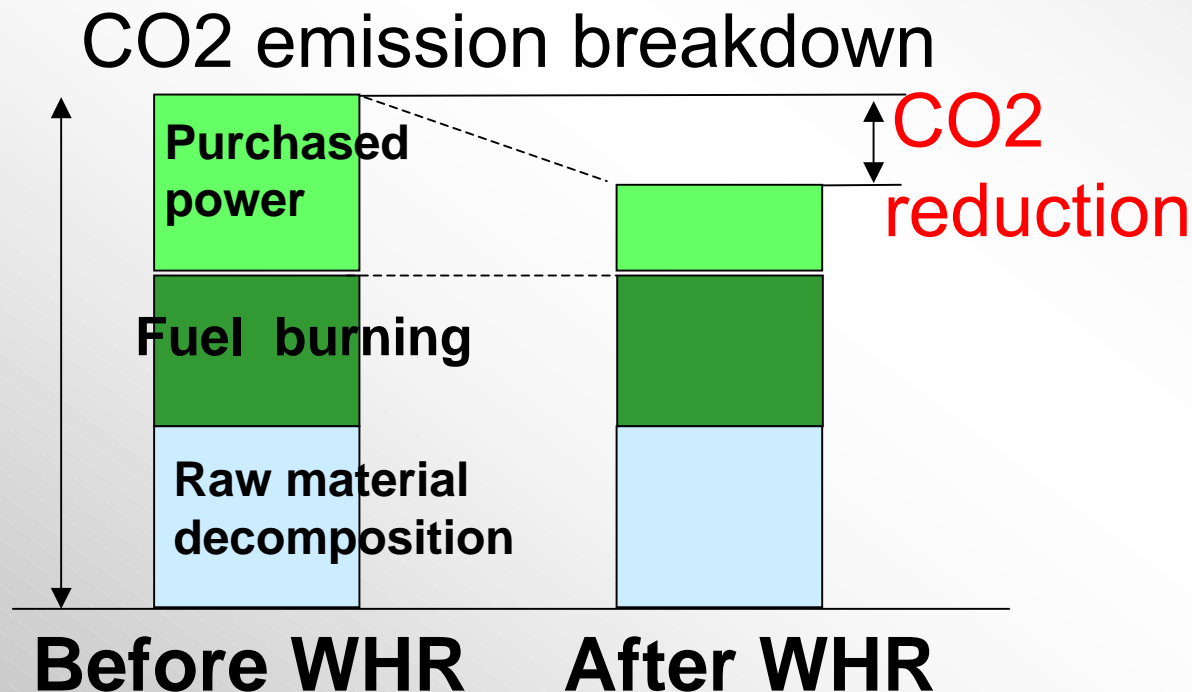
1. Waste Heat Recovery



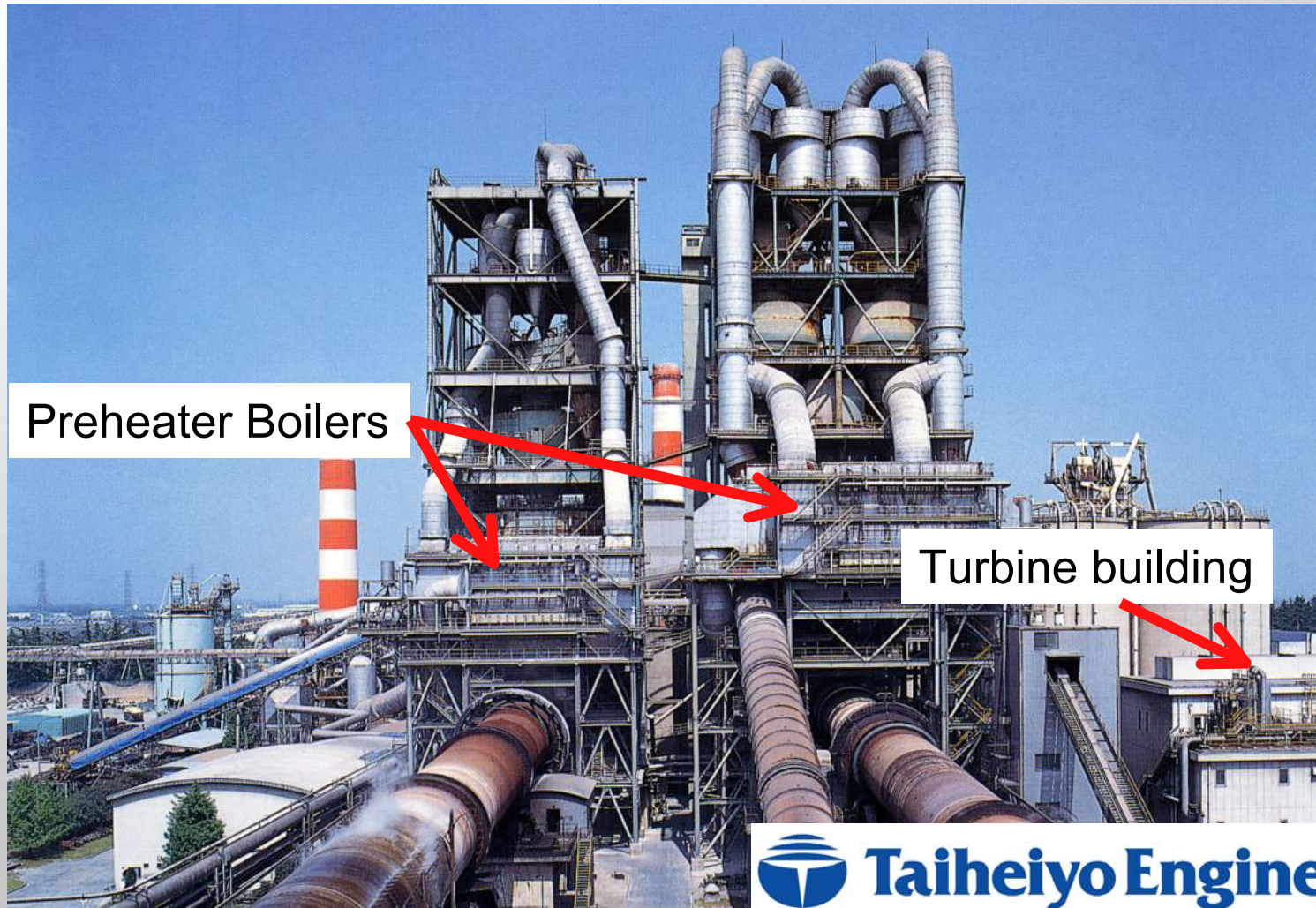
Generating power using waste heat from kiln and supplying it to cement production

CO2 emission reduction by introducing Waste Heat Recovery

About one-third of electricity required for cement manufacturing process
Can be substituted by WHR generated electricity.



Waste Heat Recovery power generation system



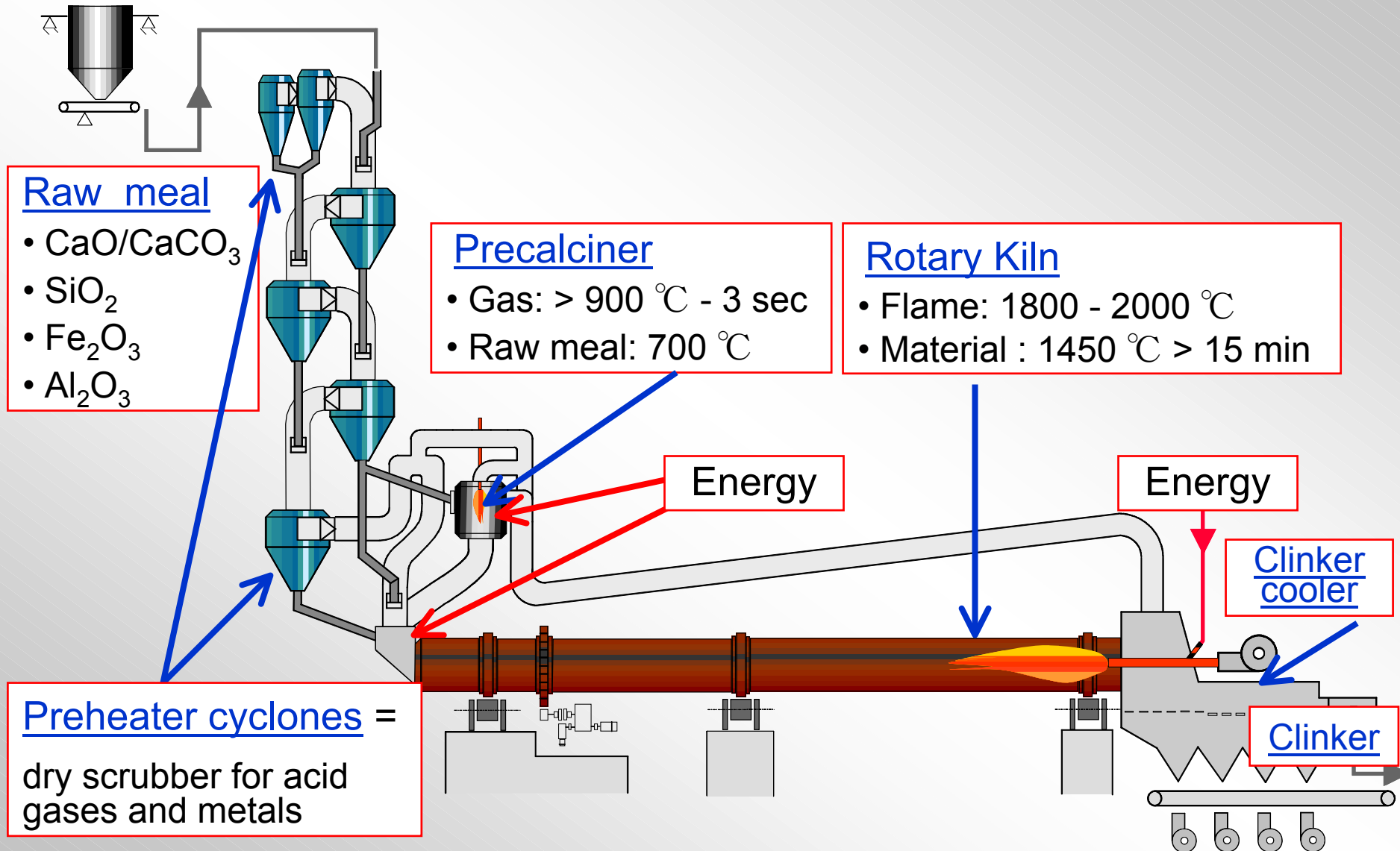
Preheater Boilers

Turbine building



Taiheiyo Engineering

2. Co-processing of waste



Cement Rotary Kilns' Unique Characteristics

1. **High temperature** in a Kiln can decompose almost all of toxic organic substances.
2. Primary raw material, **limestone**, is the most widely used **neutralizing agent** for hazardous materials.
3. Ash component of waste is effectively used as raw material, thereby **no secondary waste** is generated from the cement plant.
4. **Trace elements** such as heavy metals are safely captured in the cement clinker.
5. **Production capacity** of Kiln is very large compared to waste material usage.

Co-processing of Waste in burning process

Alternative Fuels

Alternative Raw Materials

Mineral Wastes (Inorganic)
Coal ash
Sludge
Slag
Molding sand etc.

Calciner

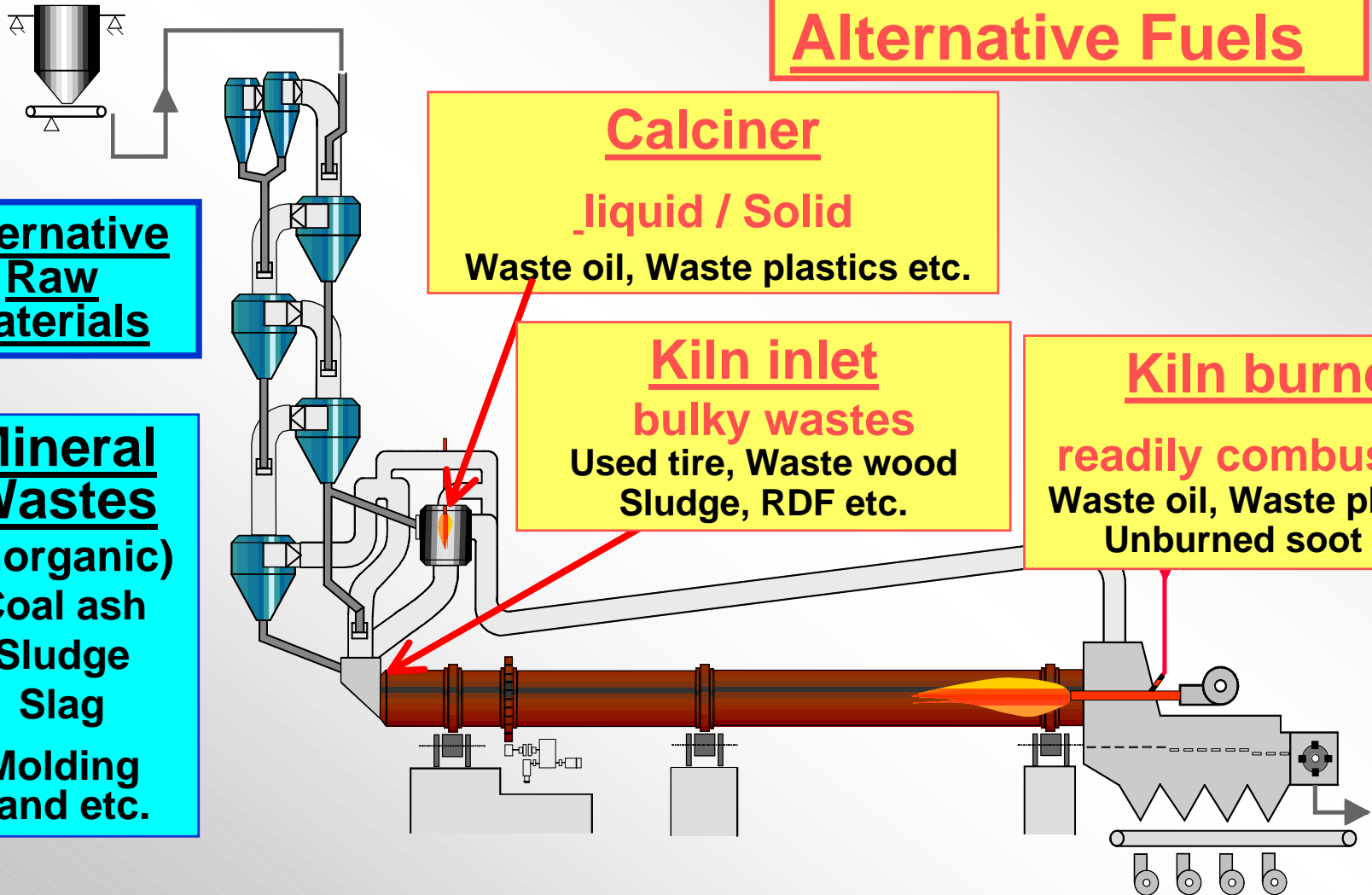
liquid / Solid
Waste oil, Waste plastics etc.

Kiln inlet

bulky wastes
Used tire, Waste wood
Sludge, RDF etc.

Kiln burner

readily combustible
Waste oil, Waste plastics,
Unburned soot etc.



Important points in Co-processing of wastes and countermeasures

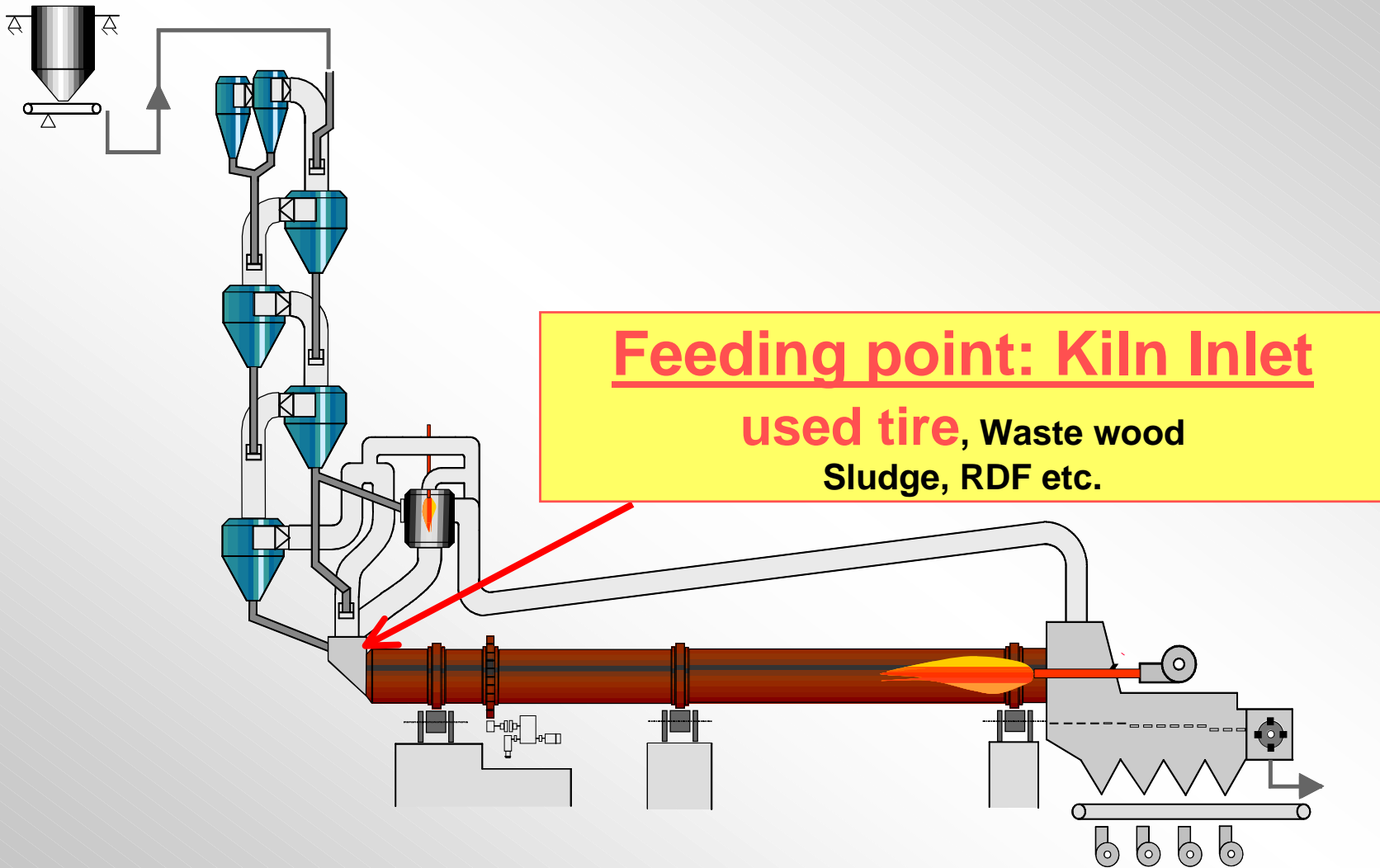
- To keep stable operation
(Automatic control program)
- Uniformity in quality and quantity
(Mixing, Feeder, processing)
- Reduction of 'hazardous' element (Cl, S...)
(Coating prevention)

Examples of Co-processing of waste in Japan

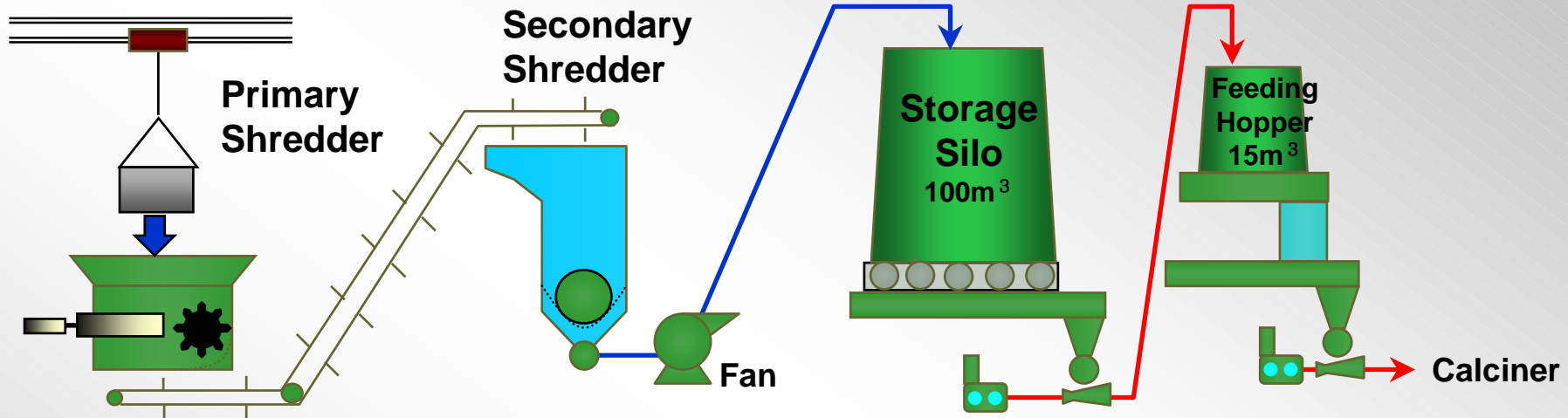


Used tires transported for burning in kiln





Flow diagram for waste plastics pre-treatment at Kumagaya Plant, Japan



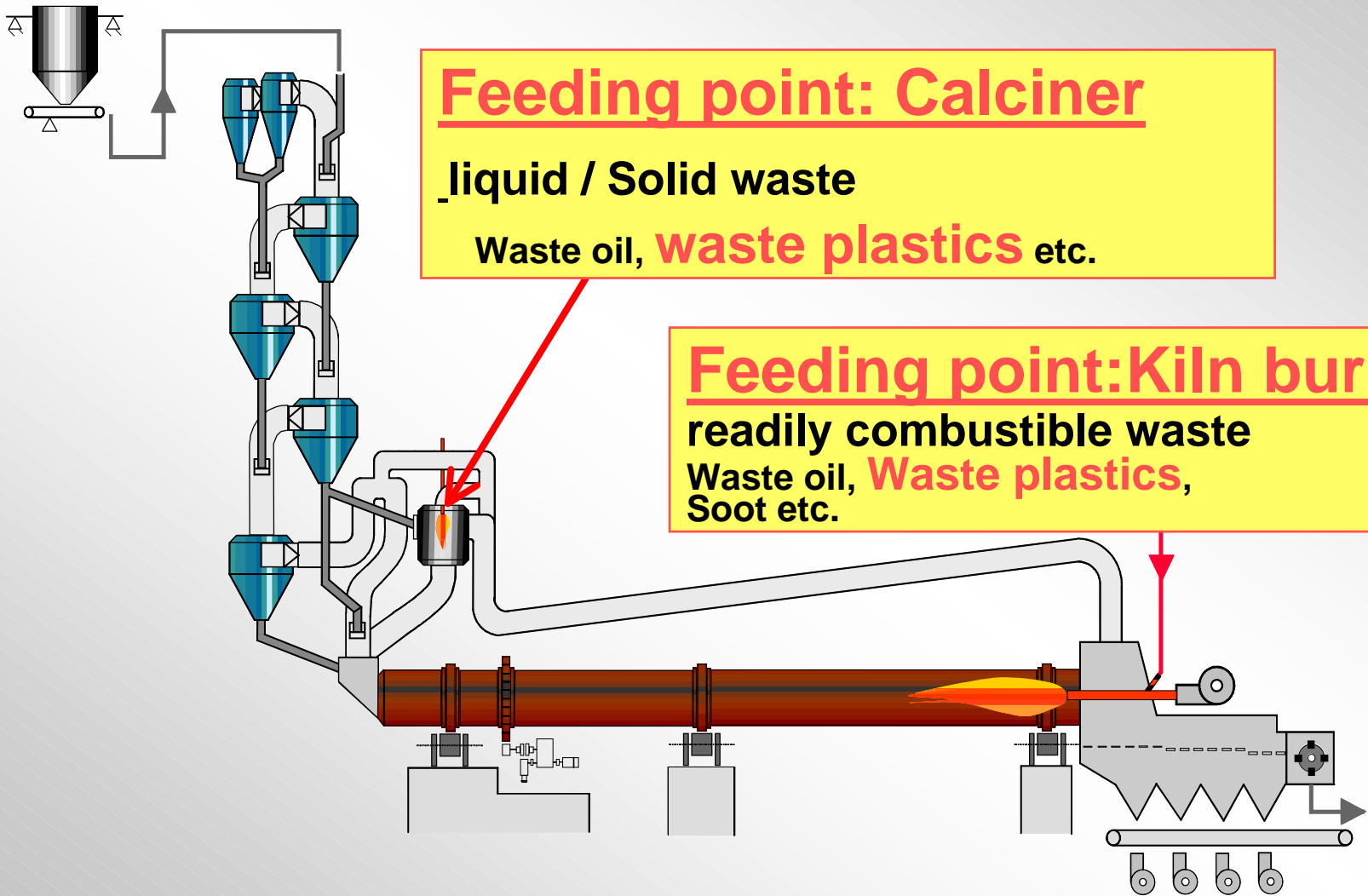
■ Capacity
2.5 t/h

Type of Waste Plastics

Material	Type	Note
Formed PE	sheet	Capacity 8,500 t/y
Bridged PE	sheet · rolled solid	
PET, PE, phenol	rolled	
PET, PE	rolled	

Shredder for waste plastics





Feeding point: Calciner
liquid / Solid waste
Waste oil, waste plastics etc.

Feeding point: Kiln burner
readily combustible waste
Waste oil, Waste plastics, Soot etc.

Blended fuel from wastes

Recyclable wastes (liquid / sludge)

- **Waste oils** (lubricant, cutting, hydraulic, animal/vegetable, ship/vessel etc.)
- **Waste solvent** (alcohol, organic acid etc.)
- **Sludge** (tank sludge, paint, water treatment sludge etc.)
- **Waste alkali**
- **Others**

Blending treatment by waste oil company

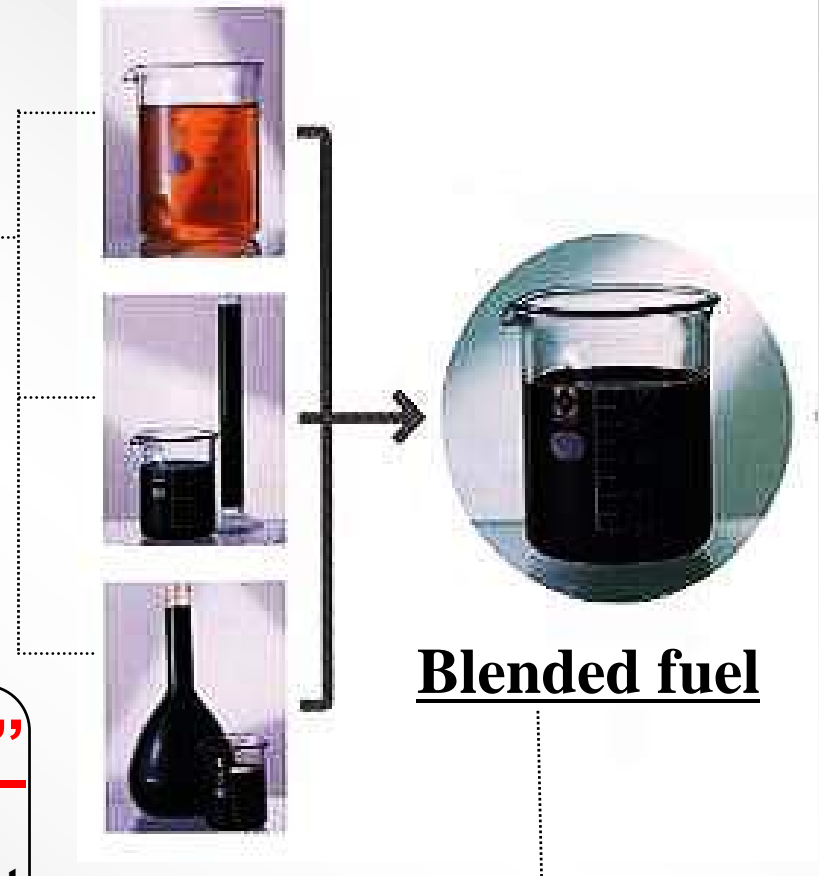
Specification of “Blended fuel”

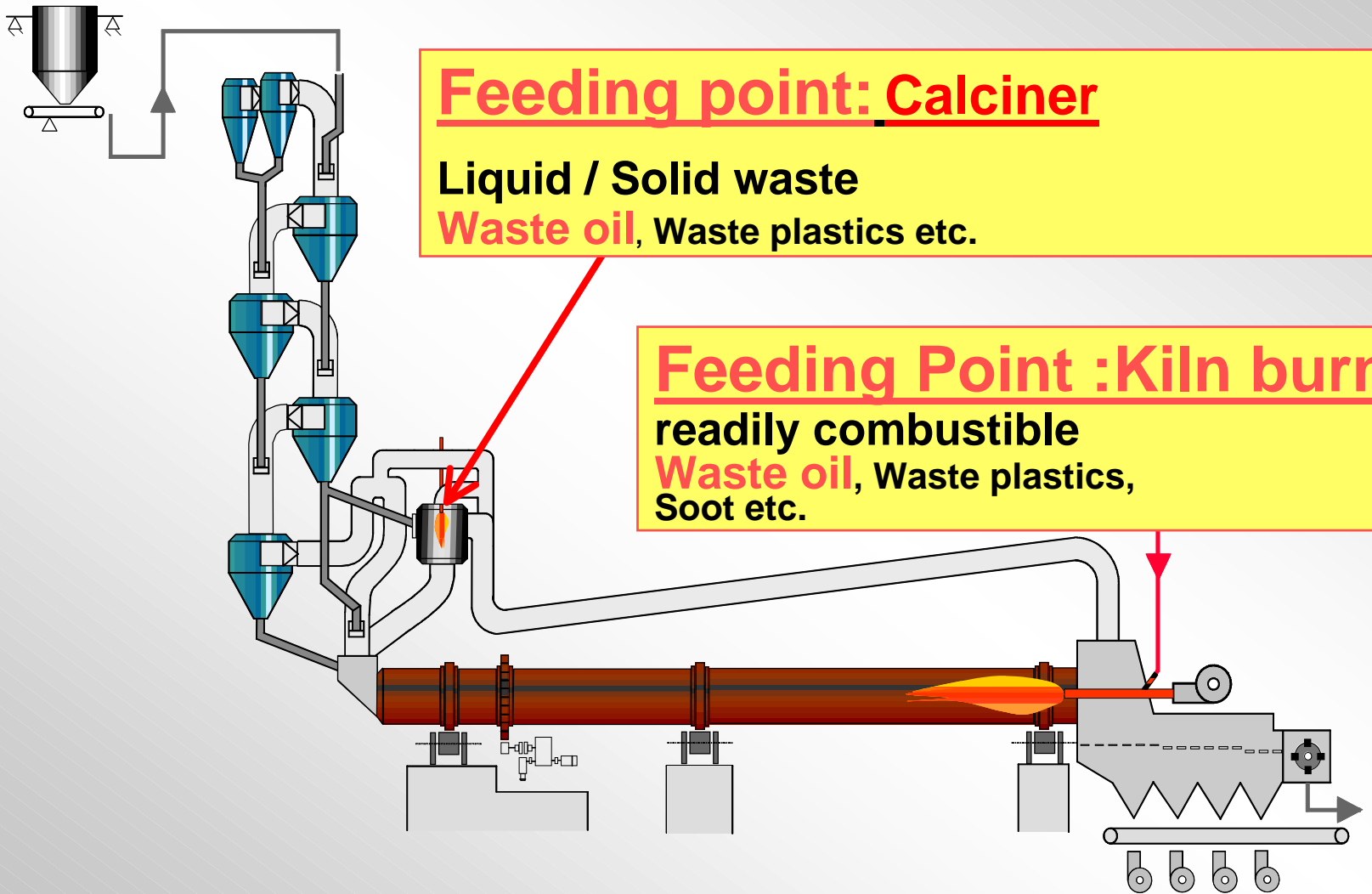
LHV: 4,500 – 5500 kcal/kg

Chlorine, viscosity, moisture, flushing point

➔ **Cement plants**

Recyclable wastes





Feeding point: Calciner
Liquid / Solid waste
Waste oil, Waste plastics etc.

Feeding Point :Kiln burner
readily combustible
Waste oil, Waste plastics,
Soot etc.

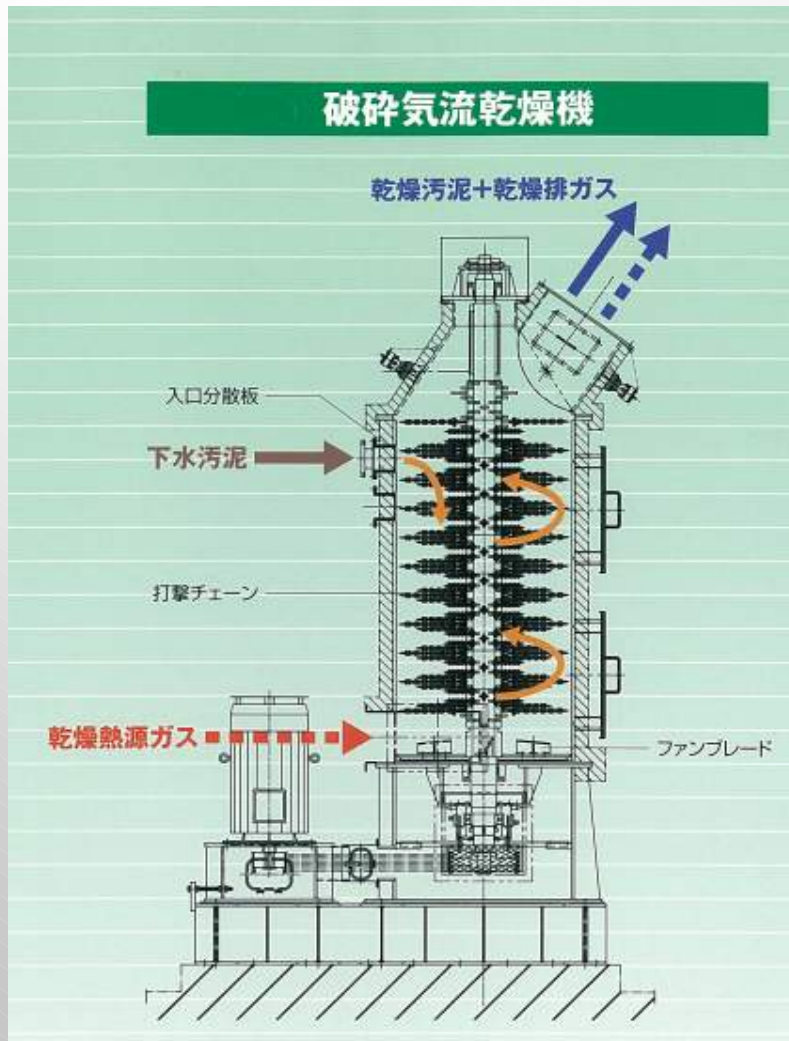
Use of waste “Pachinko” Machine (RDF)



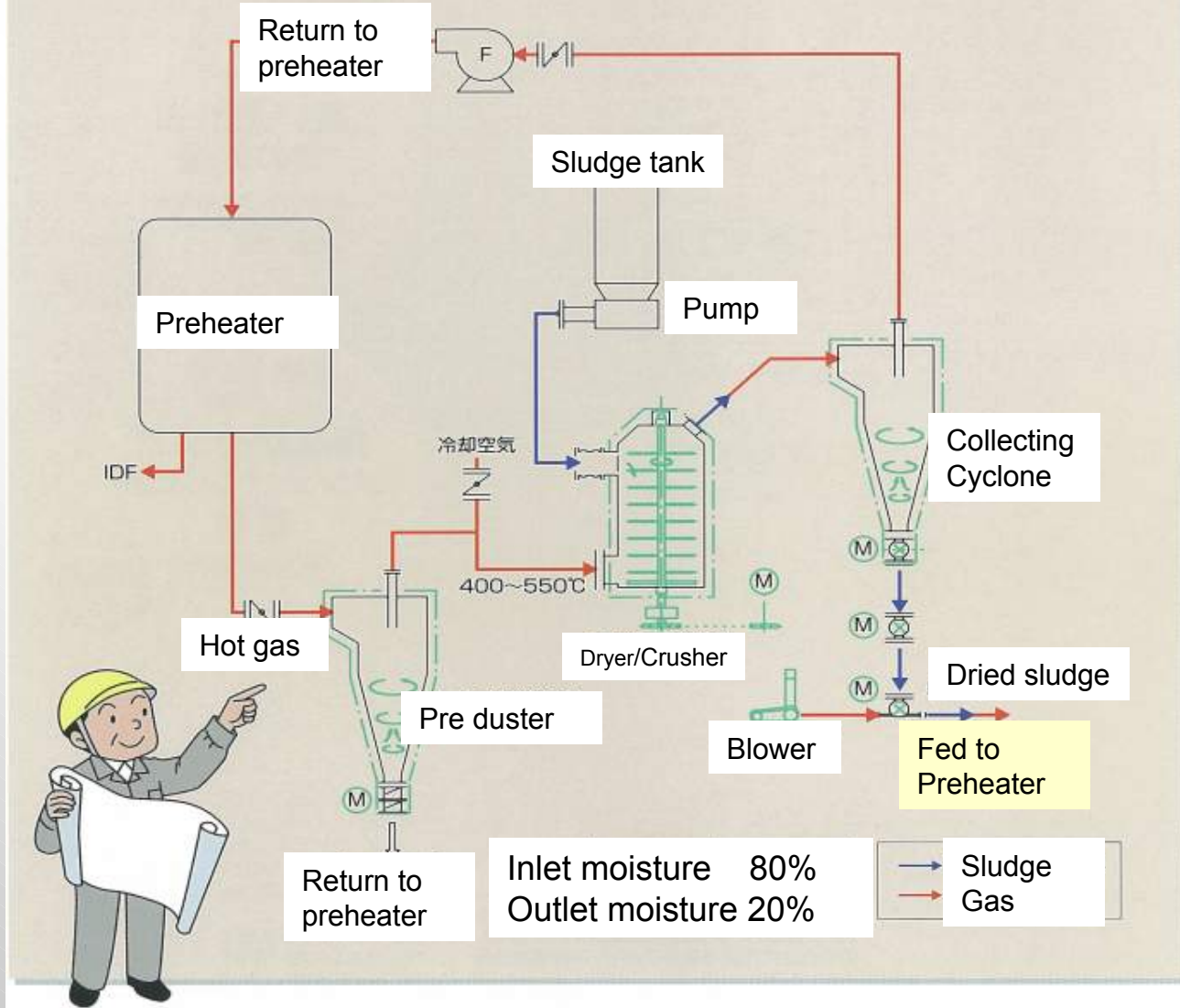
RDF from machines

Waste Pachinko machine, will be processed into RDF after crushing and kneading.

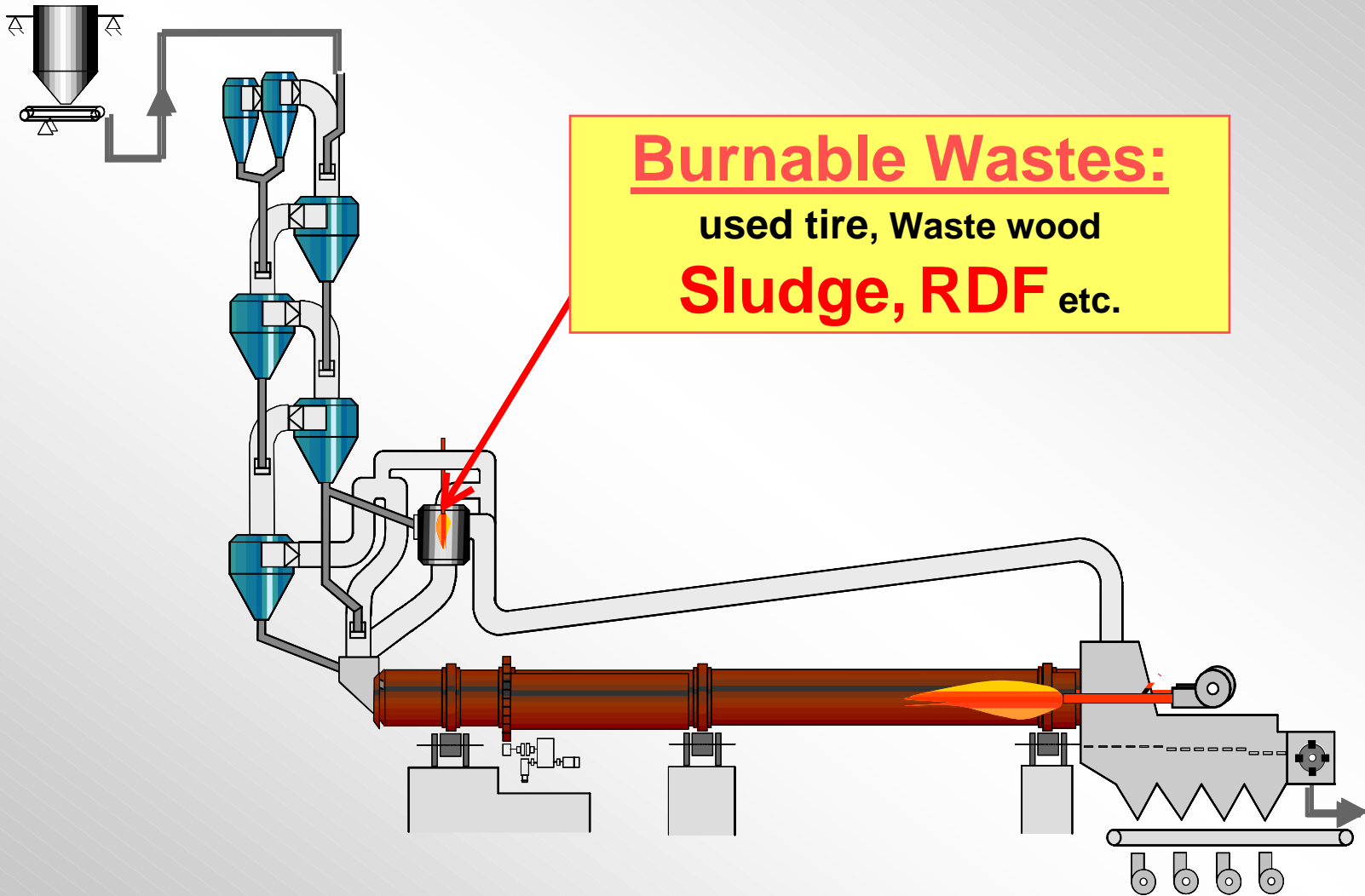
TSDS: Drying /Crushing of Sewage Sludge (TSDS:Taiheiyo Sludge Drying System)



Basic Process Flow of TSDS



Burnable Wastes:
used tire, Waste wood
Sludge, RDF etc.



3. Co-Processing of Biomass

- Biomass co-processed in Japan
 - Wood chip
 - Scrap wood from demolished house
 - Waste straw mat
- Treatment for biomass co-processing is similar to solid waste.

Operation difficulties from Co-Processing

Some of the wastes contain high chlorine and sulfur components.

⇒ coating trouble at preheater and Kiln inlet may occur.

Taiheiyo Chlorine By-Pass System

Taiheiyo Coating Solution System

are the solutions.

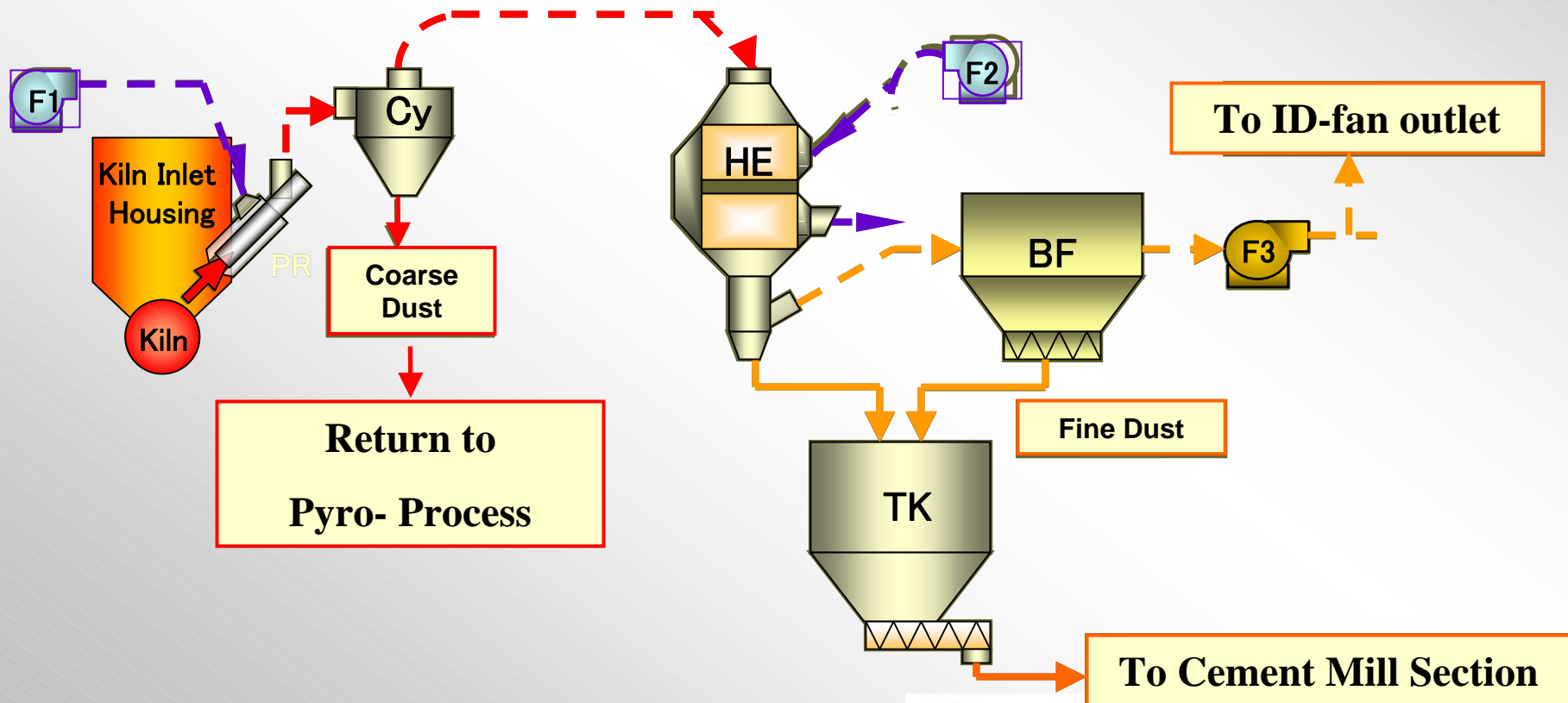


Countermeasures for more Co-Processing

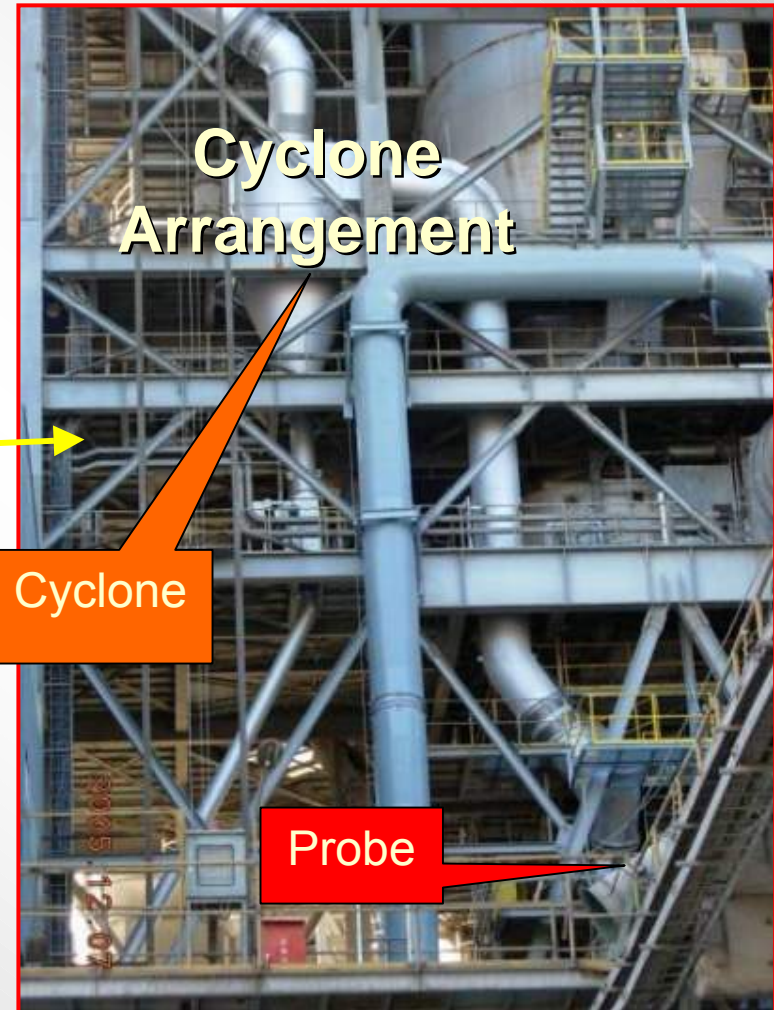
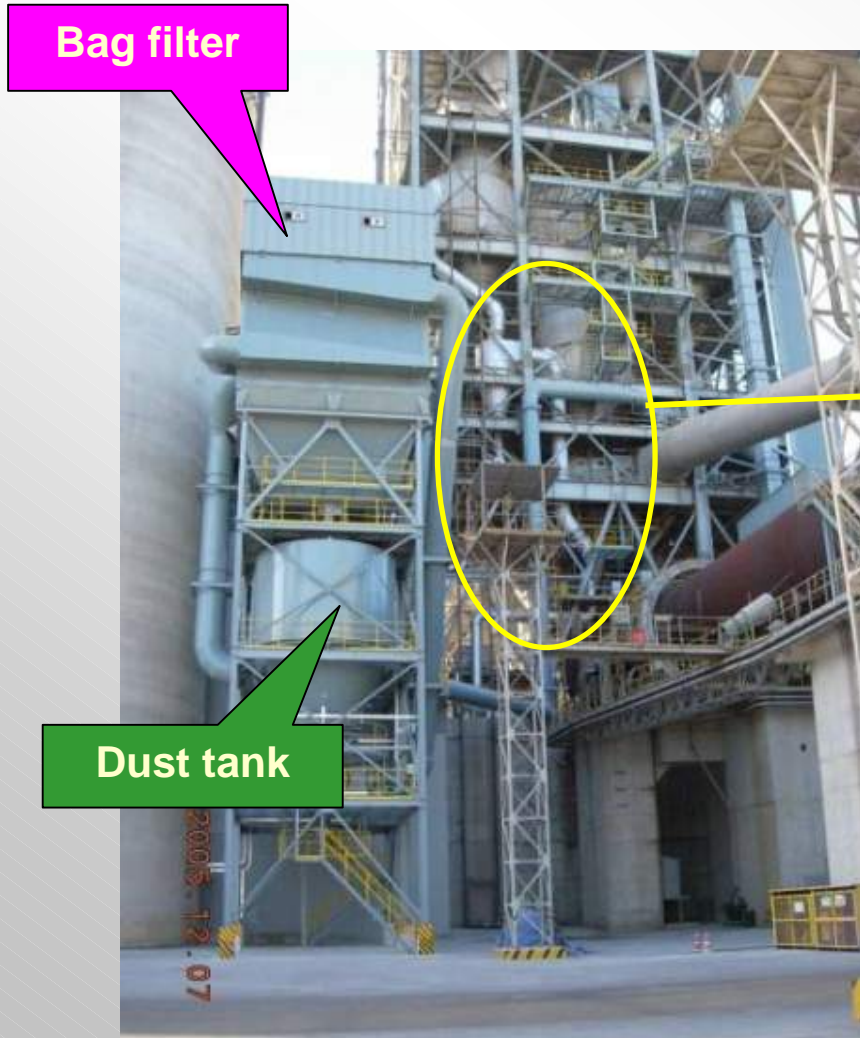
1. Taiheiyo Chlorine Bypass System
→ To prevent coating trouble by removing chloride contained in kiln exhaust gas
2. TCS: Taiheiyo Coating Solution System
→ To prevent coating by absorbing SO_2 gas and sulfur compound with dispersed raw meal at Kiln end.
3. Kiln Control Programs
→ Raw Mix Control, Preheater Control
→ Auto adjustment for stable Kiln operation by Model Predictive Control

Taiheiyo Chlorine By-Pass System

To prevent coating at Kiln inlet caused by low melting point chloride substance



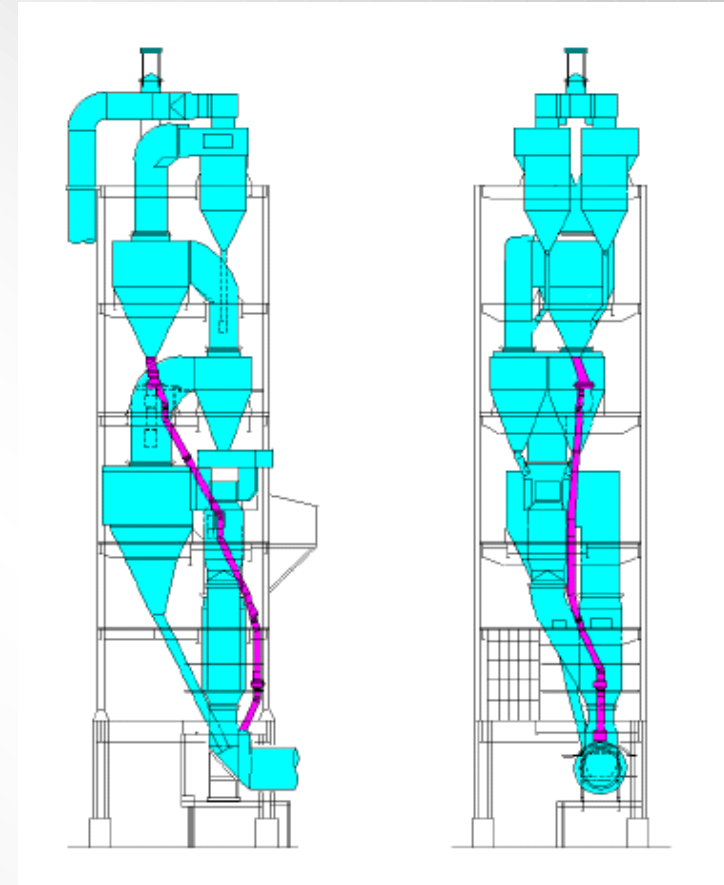
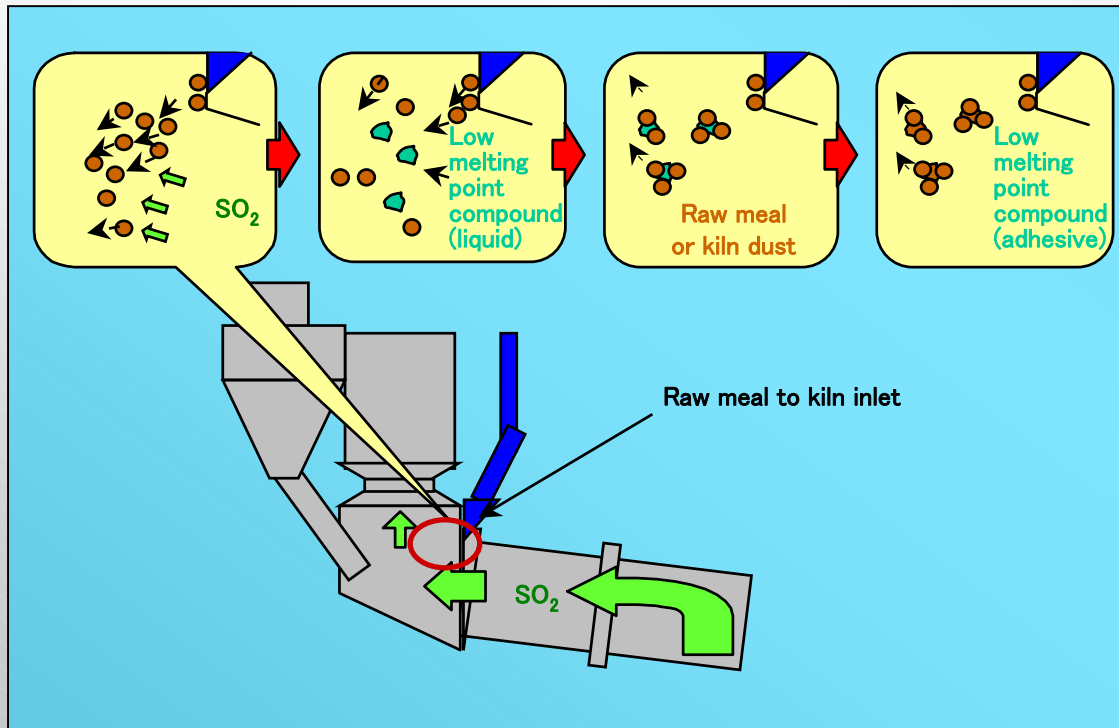
Actual Installation of Taiheiyo Chlorine bypass system





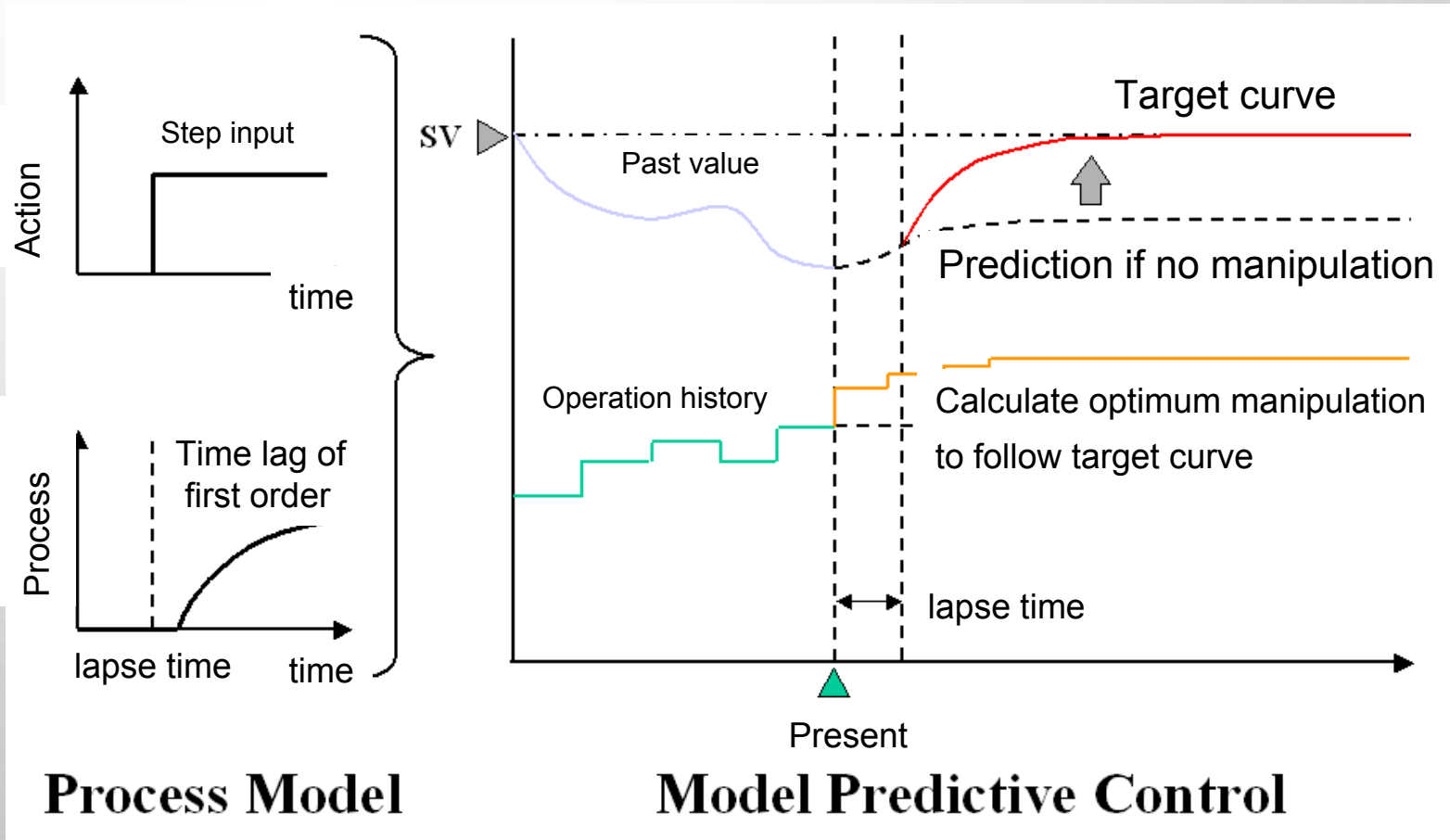
TCS (Taiheiyo Coating Solution) System

Raw meal feeding from upper stage cyclone to avoid coating formation



Automatic Control (adjustment) Programs for maximum Co-Processing

Raw Mix Control Program



4. Decomposing of CFC and PFC

- Advantages of decomposing CFC and PFCs in Cement kiln
 - Stable decomposition (CFCs decompose at 900°C)
 - No additional equipment required
 - No additional energy required
 - No big investment required

CFC and PFC Decomposition system

