The Flue Gas Cleaning System applied to Hitachinaka P.S.

2008.12.17

TEPCO

Thermal Power Engineering Center

Shigehiro Matsuda

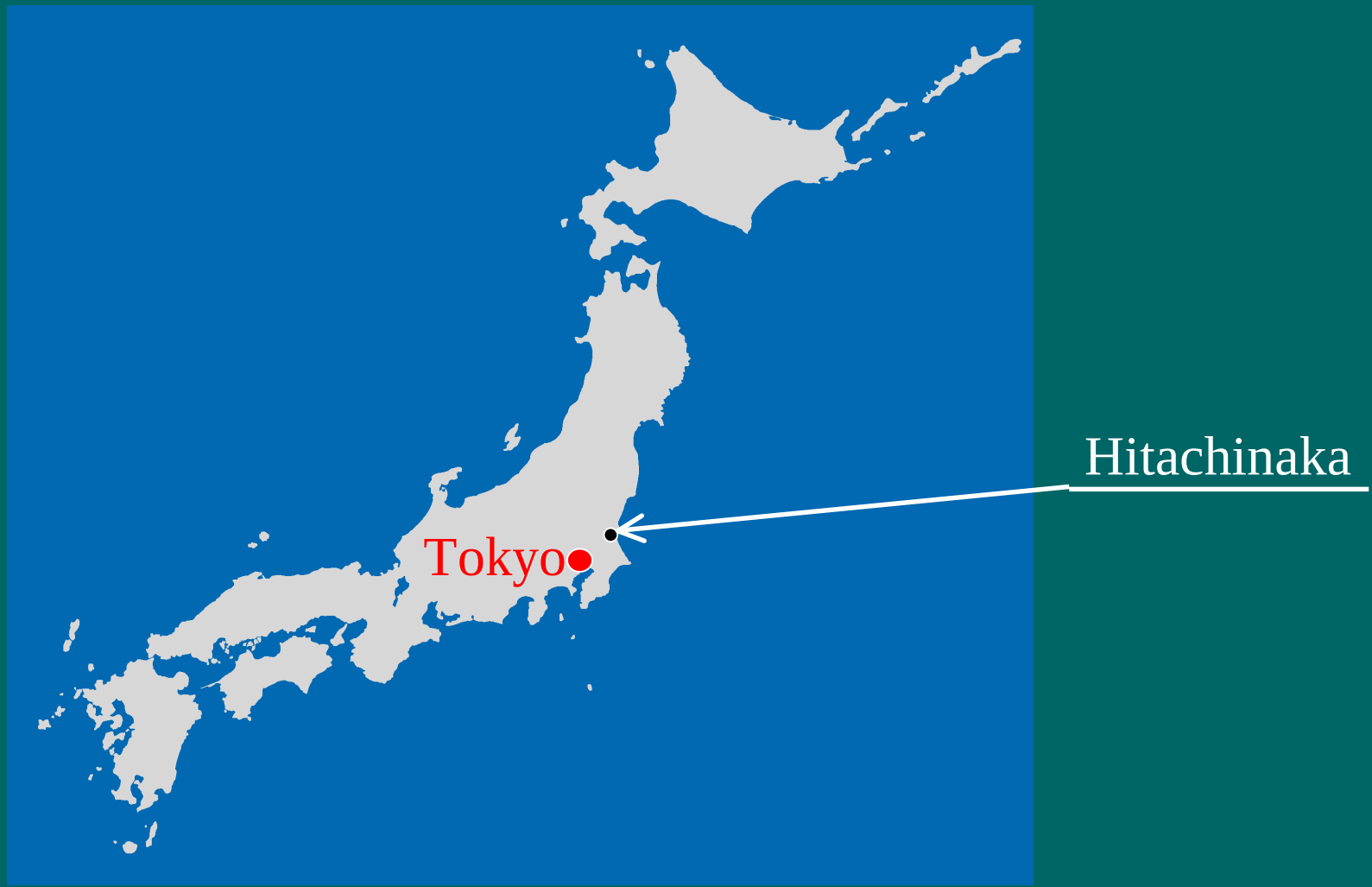
TOKYO ELECTRIC POWER COMPANY

Agenda

1. Introduction
2. The design of the Flue Gas Cleaning System applied to Hitachinaka
3. Denitrification Technology
4. Dust Removal Technology
5. Desulfurization Technology

1. Introduction

Hitachinaka P.S. Location



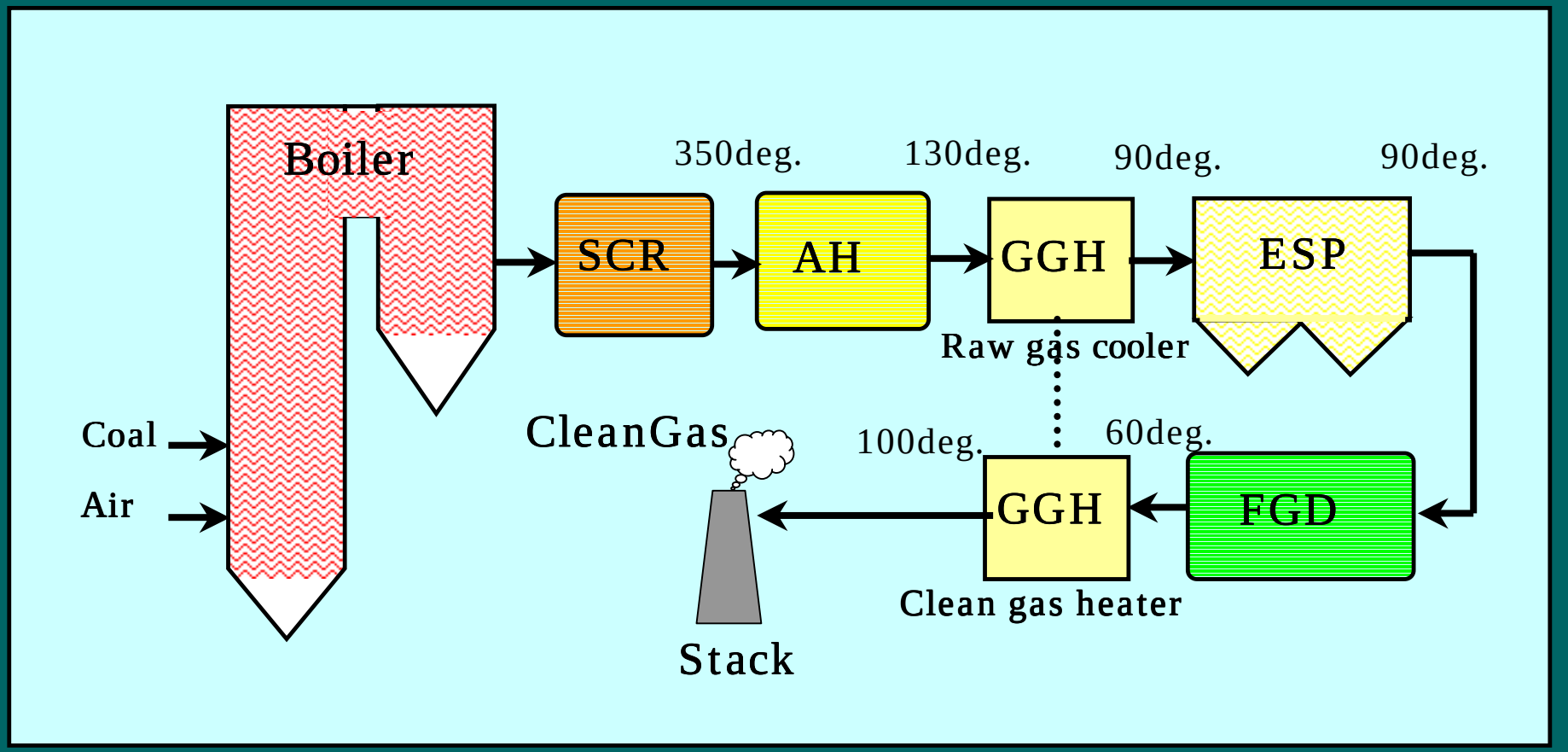
Hitachinaka P.S.

Hitachinaka P.S. Out line

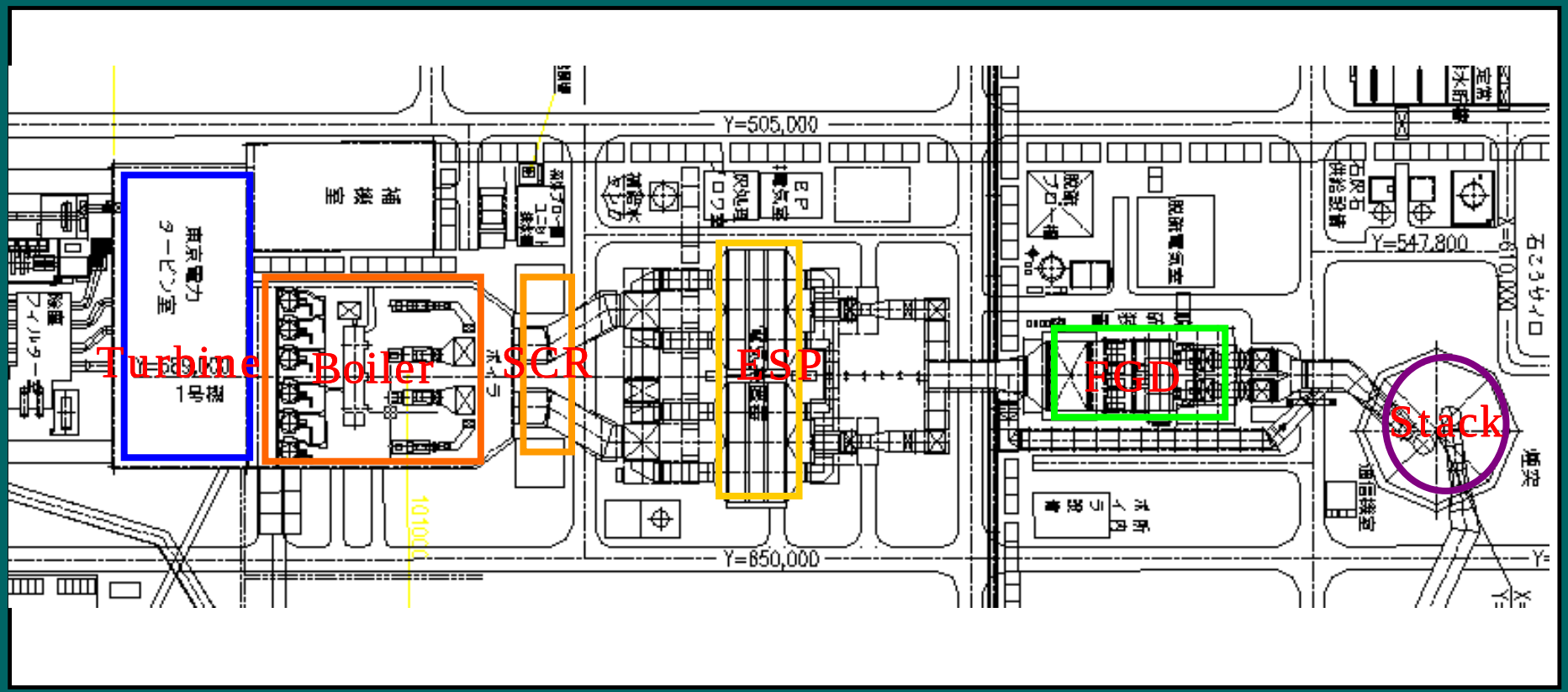
- Out Put: 1000MW
- Steam condition: USC24.5MPa, 600/600deg.C
- Efficiency: 44.9% (Gen. Terminal, LHV)
- Direct cool with sea water
- Coal Storage capacity: 400 K ton
- Environment measures: SCR, ESP, FGD

2. The design of the Flue Gas Cleaning System applied to Hitachinaka

The Flue Gas Cleaning System



Layout of the Flue Gas Cleaning System

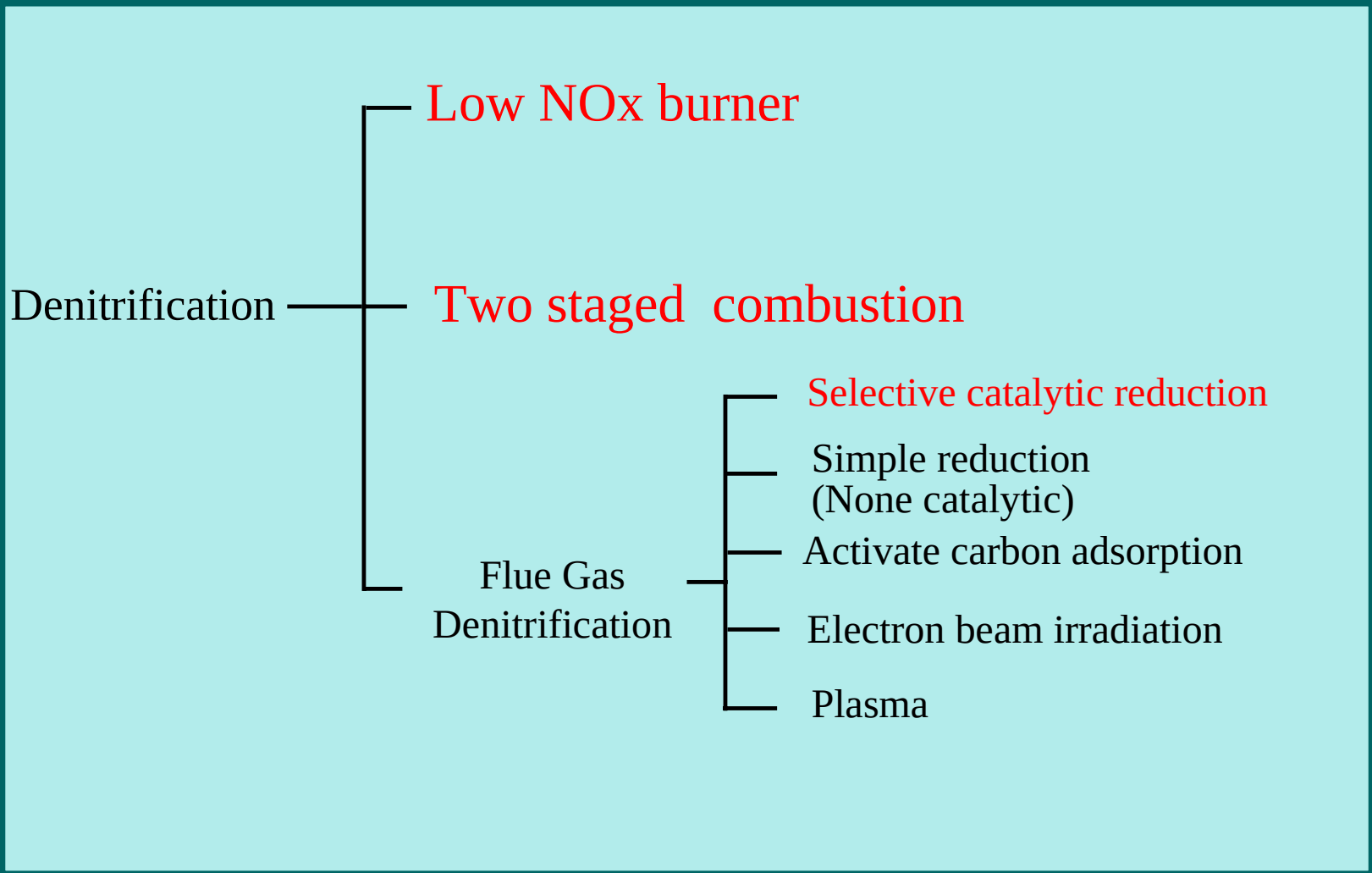


Specification of Air pollution

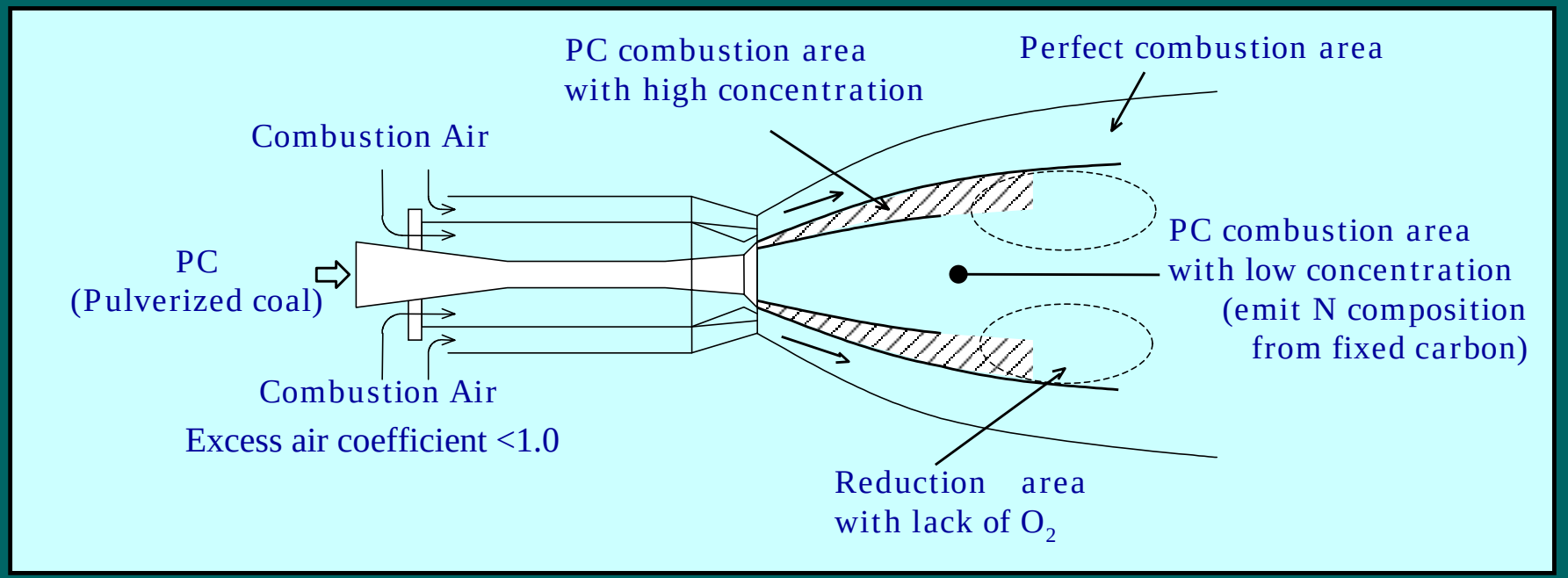
		Hitachinaka	Hirono
SOx	Rate	95%	96%
	Concentration	39ppm	24ppm
NOx	Rate	85%	87%
	Concentration	34ppm	24ppm
Dust	Rate	99.96%	99.96%
	Concentration	8mg/m^{3}N	7mg/m^{3}N

3. Denitrification Technology

A sort of Denitrification



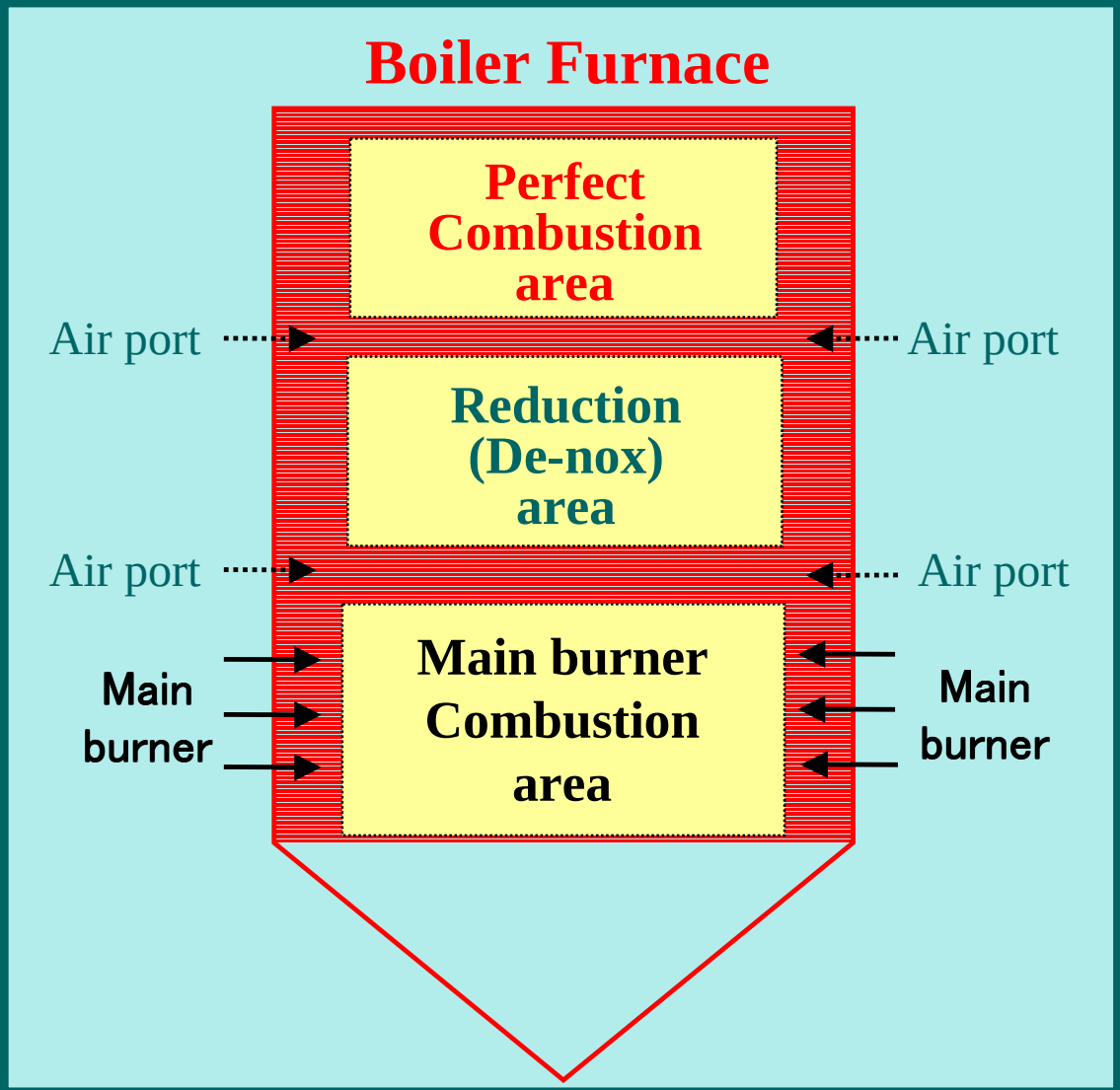
Low NOx Burner



- High PC concentration area: Volatile matter combustion
- Low PC concentration area: NOx Reduction

Reduce 35-40% of ordinary existing burner

Two staged Combustion



NOx combined at main burner

Reduced by CO, H

10-15% DOWN

Summery of De-NOx in Boiler

- These can reduce 40-50% at outlet of boiler comparing to the case without the system.
- Example for NOx of Boiler outlet
  Hitachinaka is about 200ppm

Process principle of SCR

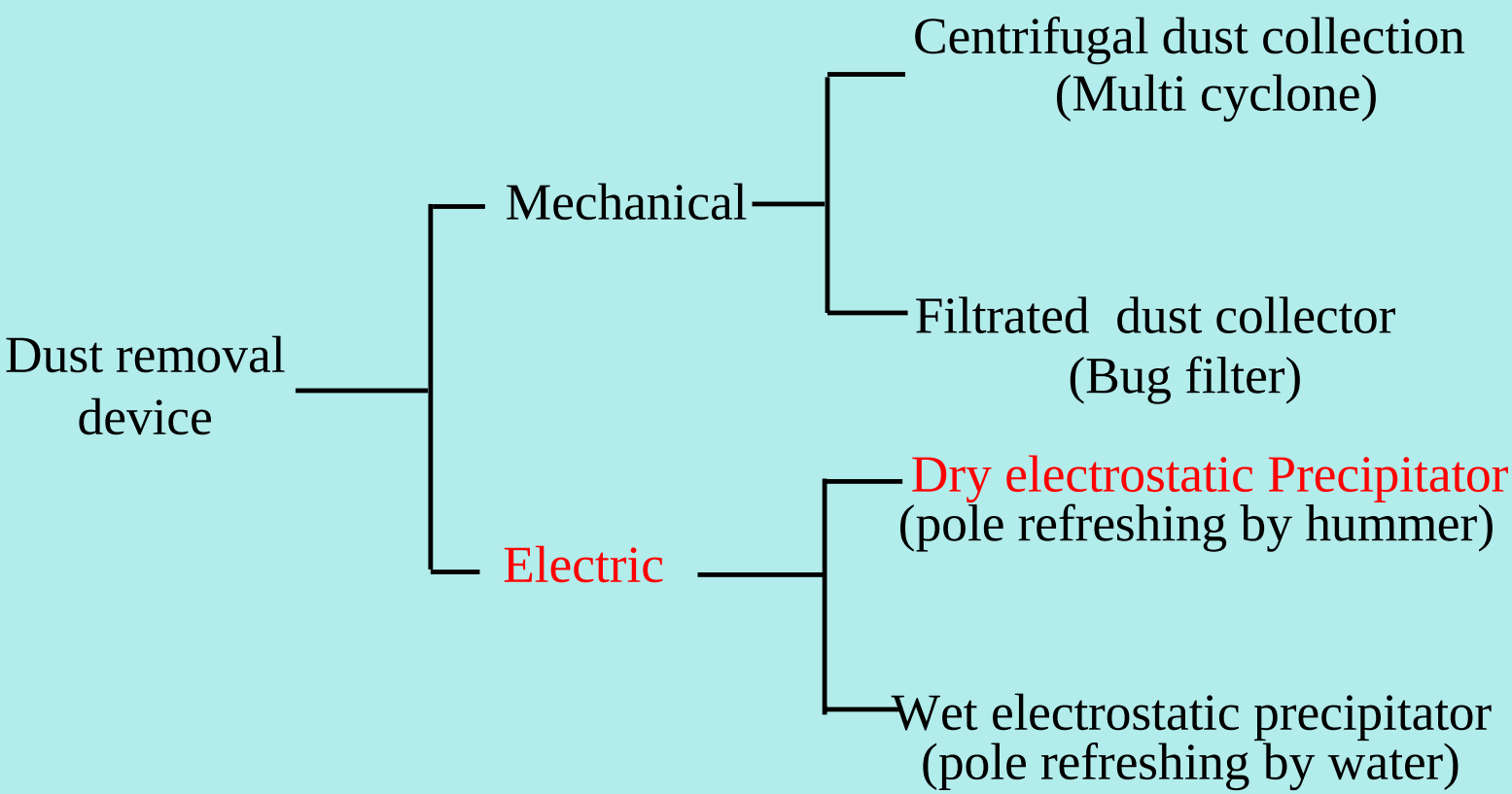
- By catalytic reduction with NH_4 injection, NOx is reduced to N_2 and water .
- Catalyst has the porus-shaped structure. Flue gas come into the hole and discomposed.
- Reactive temperature is 200-400 deg.C.
- $4NO+4NH_3+O_2 \rightarrow 4N_2+6H_2O$

Feature of SCR

- Denitrification rate: 85%
- NOx outlet concentration: 34ppm
- Temperature control is important to prevent the deterioration of performance.
- Controlling the volume of Ammonia and using the low-oxidation catalyst prevent acid ammonium sulfate from occurring.

4. Dust removal Technology

A sort of Dust Removal



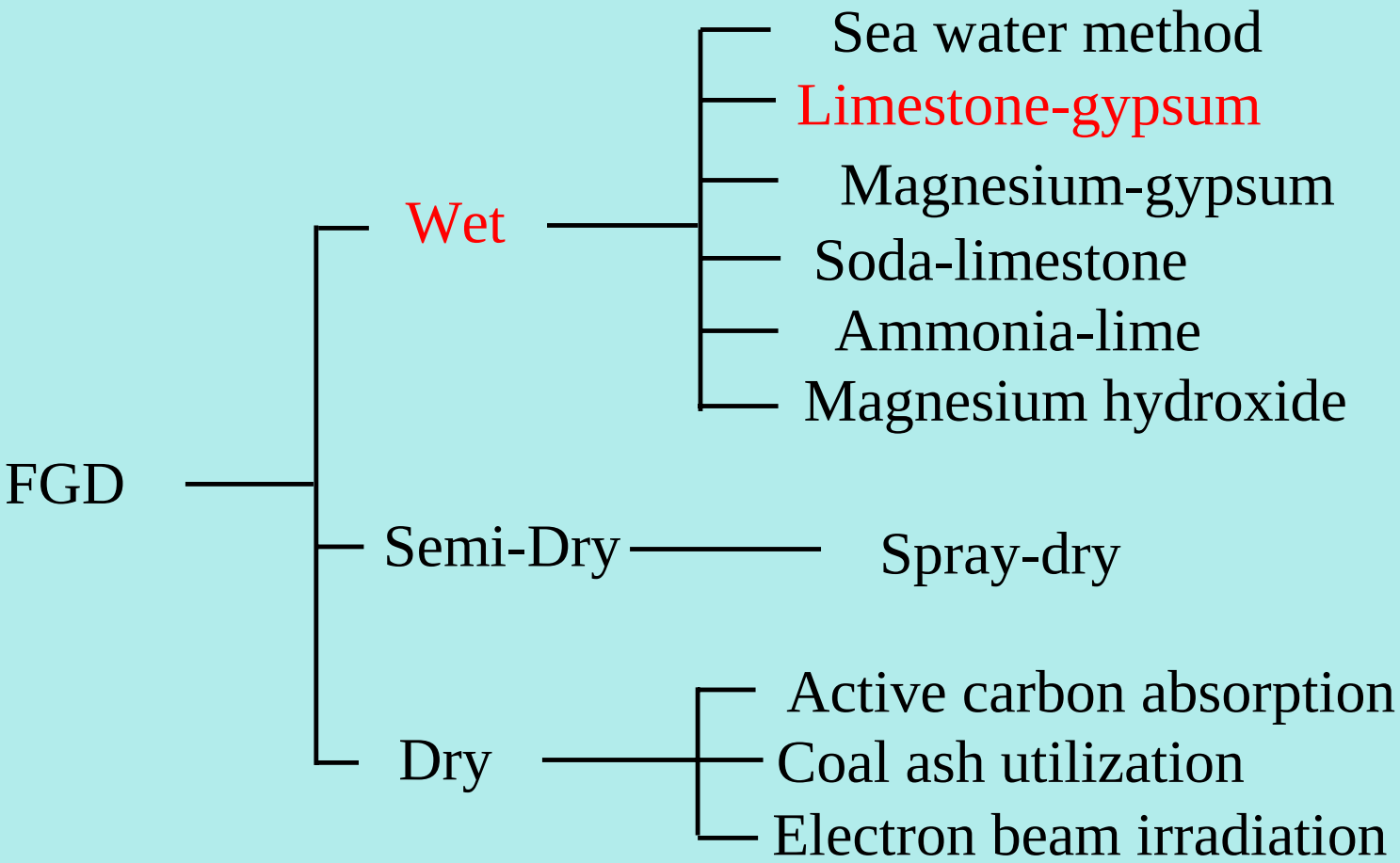
Feature of Dry ESP

- Removal rate is more than 99.9% and overall rate 99.96% with FGD.
- Dust concentration is 8mg/m^3N. (FGD outlet)
- Dust collecting performance is greatly influenced by characteristic of electric resistance, The influenced parameter are:

    1. Flue gas temperature.
    2. Coal and ash composition structure.

5. Desulfurization Technology

A Sort of FGD



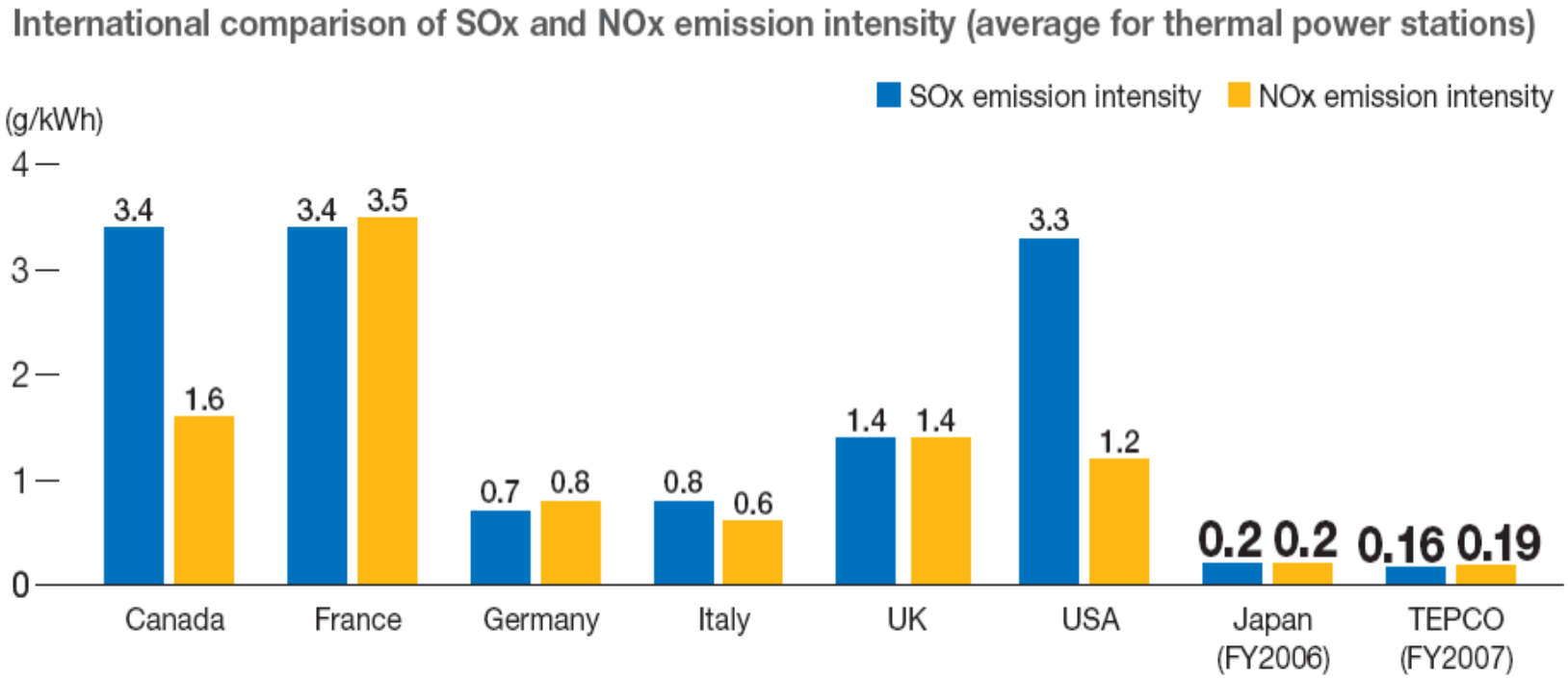
Limestone-gypsum method Basic Principle

- System consists of absorption (spray) tower including dust removal function and waste water treatment device
- Spray the slurry to flue gas, Absorption happens and sulfur dioxide is removed
- Lime stone reacts with sulfur dioxide, Gypsum is collected as by-product
- $CaCO_3+SO_2+1/2O_2+H_2O \rightarrow CaSO_4 \cdot 2H_2O+CO_2$

Feature of Lime stone-gypsum method

- Desulfurization rate: 95%
- SOx outlet concentration: 39ppm
- pH control is important to prevent the deterioration of performance.
- Lime stone is abundance and inexpensive in Japan.
- Gypsum is usefulness for Large space of land is required

The world's cleanest production of electrical power



Source:
Japan: Research by the Federation of Electric Power Companies of Japan
Other countries: Calculations based on "OECD Environmental Data Compendium 2006/2007" and "Energy Balances of OECD Countries 2004–2005"
* Data from FY2005 for other nations besides Japan and TEPCO