

# Combustion of fossil fuels

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# Combustion of fossil fuels

- ◆ Historically coal has been the favoured fossil fuel for household and industrial combustion
- ◆ The Chinese used coal for metal smelting around 500 BC
- ◆ Romans used coal for residential heating

# Early combustion techniques

- ◆ Coal is burned on a simple bed or grate
- ◆ Much remains unburned
- ◆ Low efficiency
- ◆ Ash problems

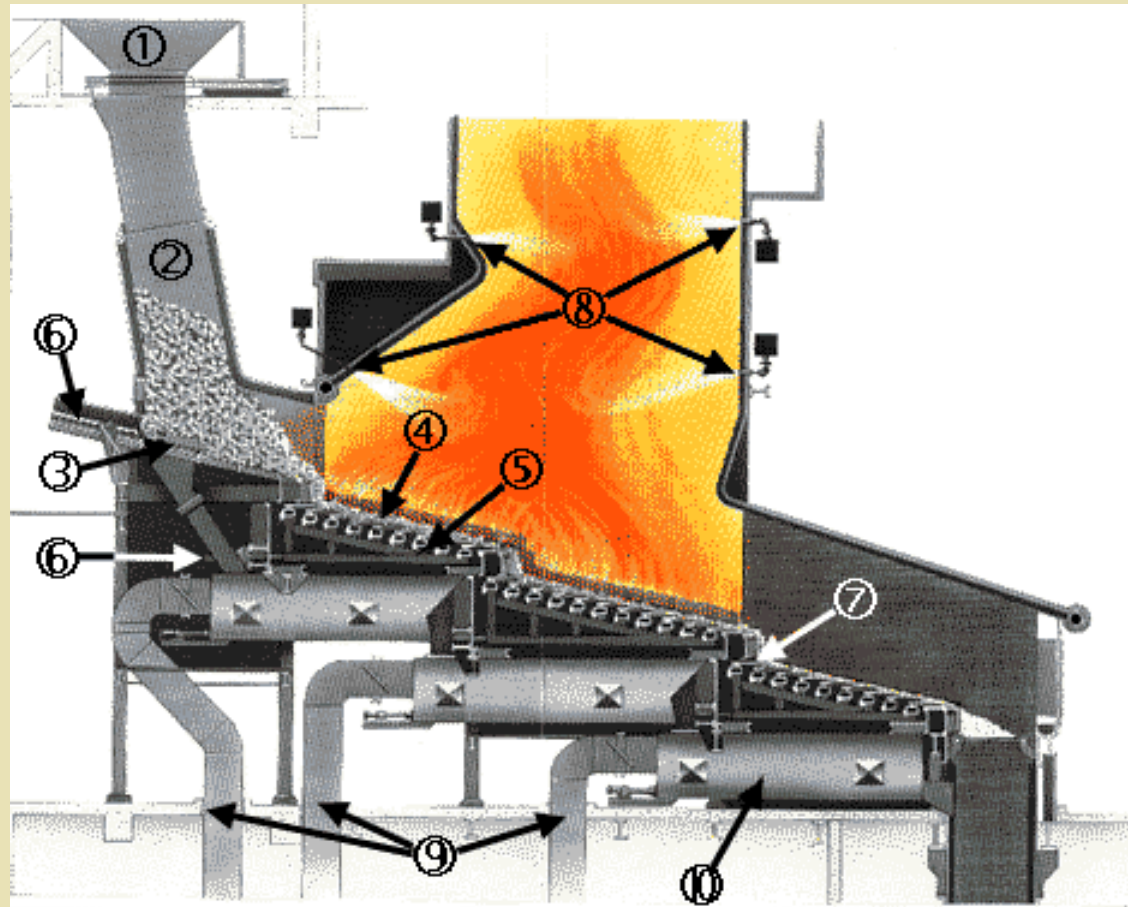




# Stoker combustion

- ◆ Small coal are placed on a travelling grate
- ◆ Air is introduced from below and above
- ◆ Suitable for burning high ash coals and large lumps, but also biomass and waste
- ◆ Uppsala Värmeverk

# Stoker combustion





# Pulverized Coal Combustion

- ◆ The dominating coal combustion technique
- ◆ Finely milled coal powder is blown into a furnace to resemble gaseous combustion
- ◆ Typical temperatures are 1300-1700° C
- ◆ Almost all (95-99%) coal is combusted
- ◆ High amounts of fly ash is created
- ◆ Base efficiency 40-45%, 50% in the future

# Pulverized Coal Combustion

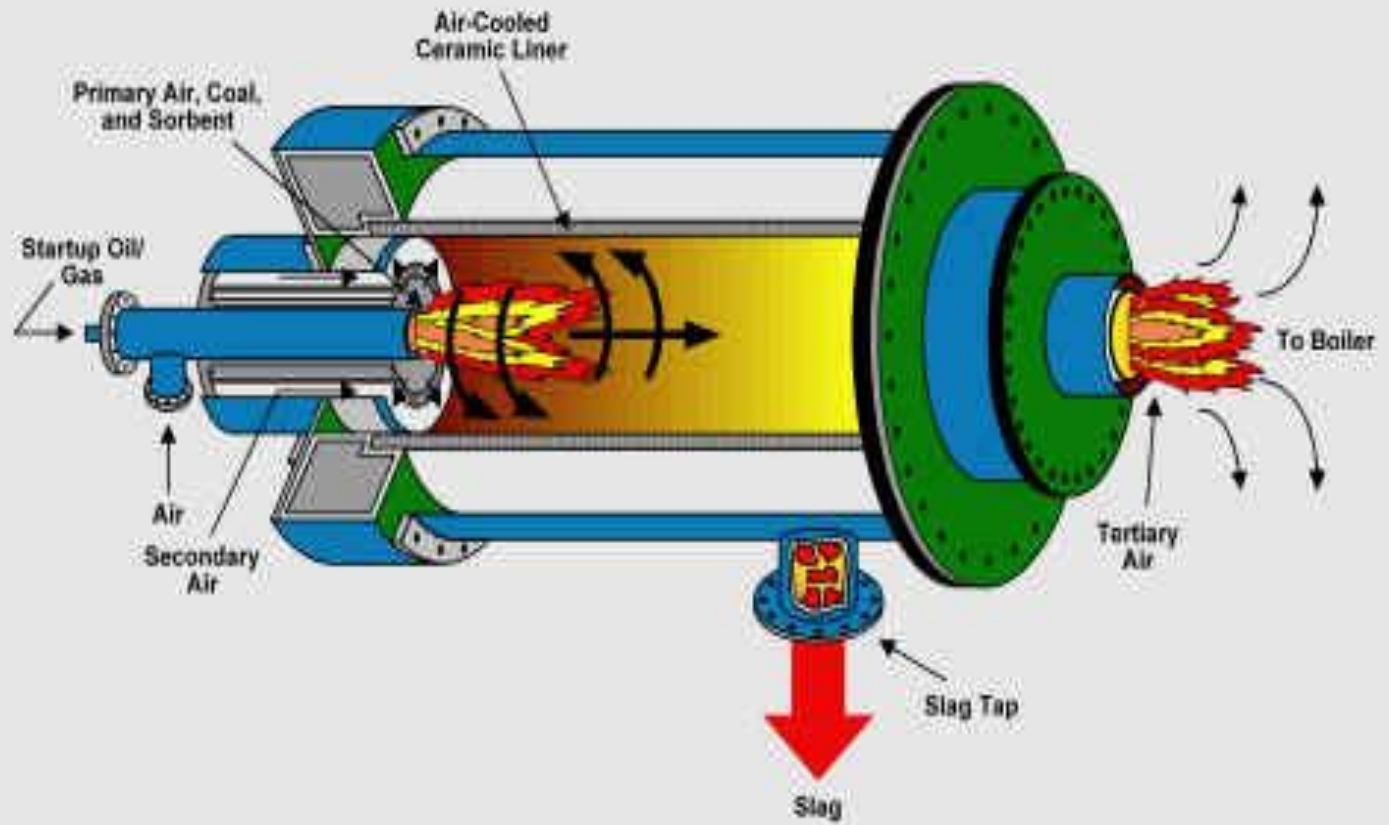




# Cyclone Combustion

- ◆ Similar to PCC but can burn a wider array of different coal types
- ◆ Crushed coal is blown into a large cylinder
- ◆ Injected air streams create a cyclone, that rapidly mixes fuel and air
- ◆ High temperature, 1650-2500° C
- ◆ Less fly ash and easier ash handling
- ◆ NO<sub>x</sub> problem

# Cyclone Combustion

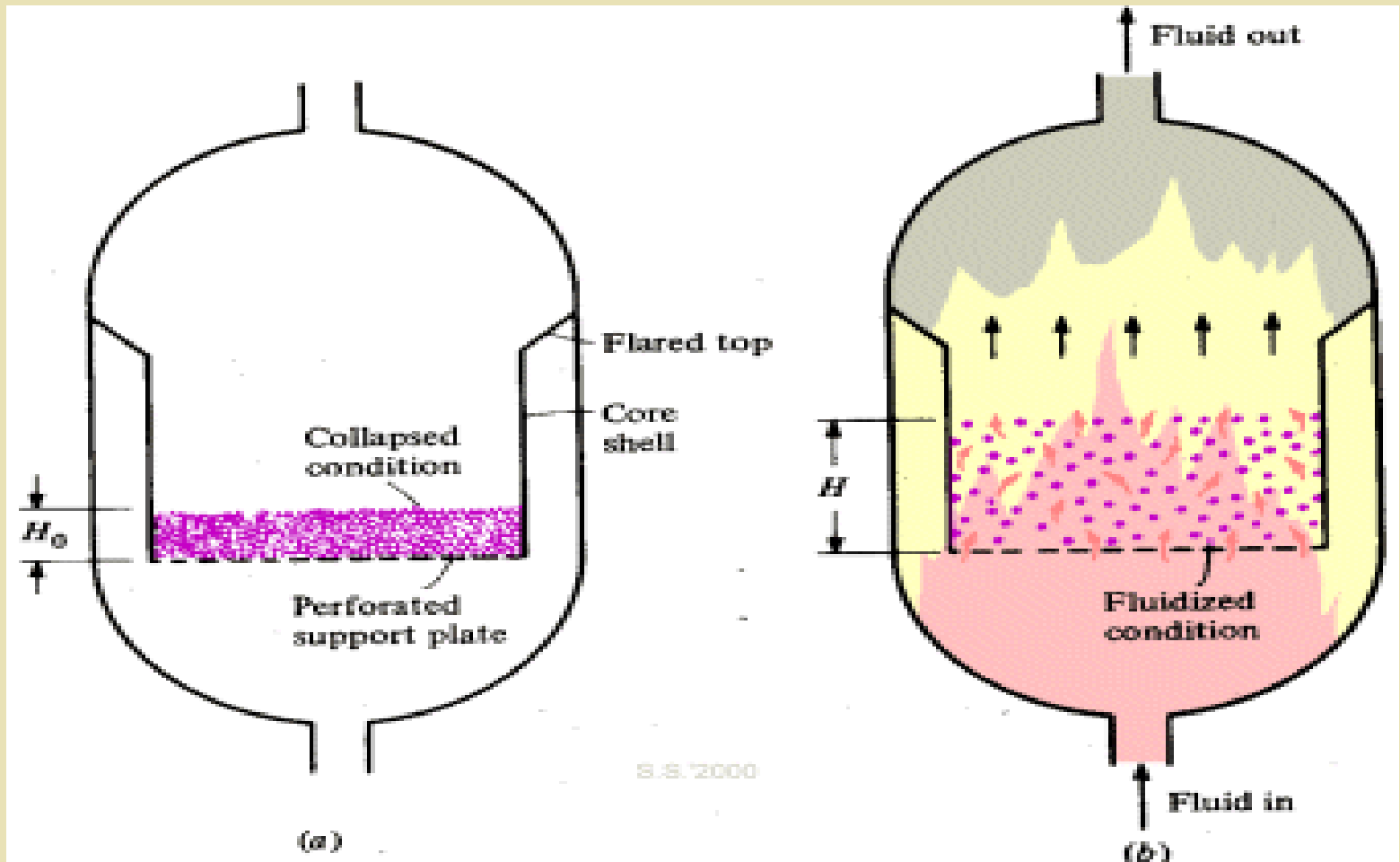





# Fluidized Bed Combustion

- ◆ Tries to achieve full combustion at lower temperatures, thus less NO<sub>x</sub> and SO<sub>x</sub>, and high fuel flexibility
- ◆ Upward air-jets create a bubbling fluid behaviour of the fuel with rapid mixing
- ◆ Complete combustion at 750-1000° C
- ◆ Environmental friendly

# Fluidized Bed Combustion





# Integrated Gasification Combined Cycle Combustion

- ◆ Coal is first gasified and transformed into a synthesis gas
- ◆ The syngas is combusted in a gas turbine and the waste heat is used in steam turbine
- ◆ NO<sub>x</sub>, SO<sub>x</sub> emission reduced by 95-99+%
- ◆ Ideal for CCS and hydrogen production
- ◆ Base efficiency 45%, 56% in the future

# IGCC

## COAL-FIRED Integrated Gasification-Combined Cycle/Cogeneration

