# 2A7. Advanced Pressurized Fluidized-bed Combustion Technology (A-PFBC)

Research and development: Japan Coal Energy Center; J-POWER; Chubu Electric Power Co., Inc.; and Mitsubishi Heavy Industries, Ltd.
Project type: Coal Production and Utilization Technology Promotion Grant
Period: 1996-2002

## Technology Overview

### 1. Overview

The development of high-efficiency power-generation technology utilizing coal is an urgent issue from the perspective of reducing greenhouse gas emissions and conserving resources. Advanced Pressurized Fluidized-bed Combustion (A-PFBC) technology is a further advancement of the Pressurized Fluidized-bed Combustion (PFBC) technology. The development aim is to increase the temperature at the inlet of the gas turbine from approximately 850°C to approximately 1,350°C, and to recover the high-temperature steam, thus attaining more efficient power generation (approximately 46% net efficiency; approximately 40% for existing coal-fired power plants) through combining PFBC technology with the fluidized-bed gasification technology.

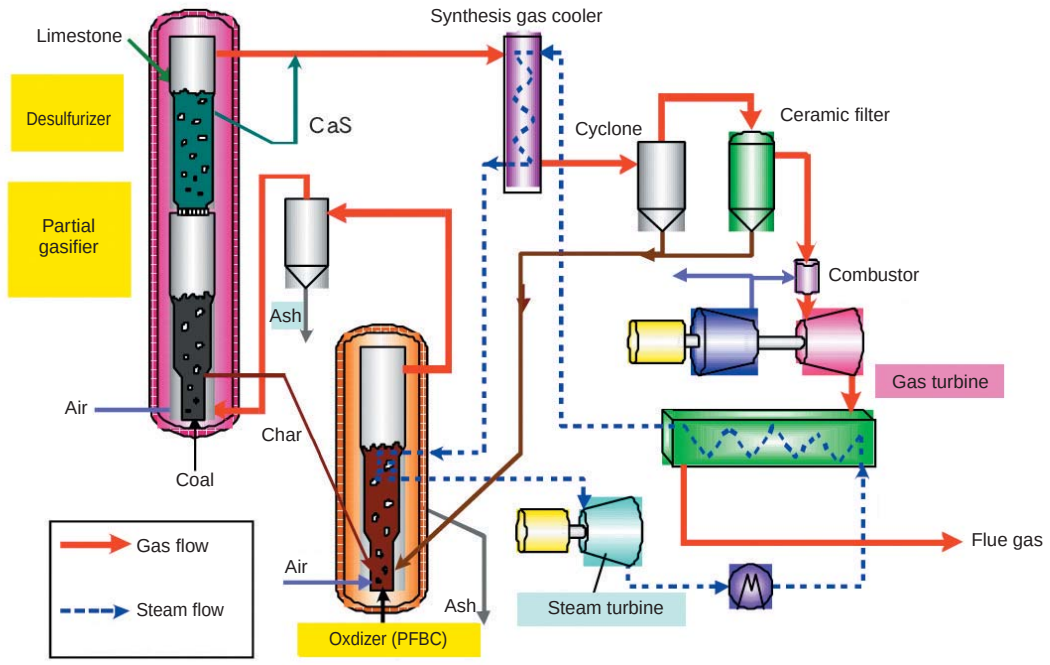


Fig. 1 Flowchart of A-PFBC combined power generation system

### 2. Development objective and technology to be developed

(1) High-efficiency power generation
Net efficiency: approximately 46%
- Increase of gas turbine inlet temperature (from approximately 850°C to approximately 1,350°C)
- Recovery of high-temperature steam (High-temperature steam recovery at the synthesis gas cooler applying the high-temperature desulfurizer)

(2) Moderation of gasification conditions
Carbon conversion: approximately 85%
- Gasification in the partial gasifier in combination with the oxidizer (perfect oxidizing atmosphere)

(3) Utilization of results of related technologies
- PFBC technology
- Various coal gasification technologies

### 3. Progress and development results

Aiming for the practical application of the above-described system, the study team installed a small-scale process development unit (Fig. 3) at J-POWER's Wakamatsu Research Institute (Kita Kyushu City). The PDU test operations began in July 2001. By the end of FY2002, the cumulative gasification operation time had reached 1,200 hours, and the continuous gasification operations had reached 190 hours. The PDU test confirmed the successful integration of the three-reactors, which was one of the objectives of the system validation, and the acquired characteristics of each reactor, thus confirming the data necessary for scaling-up.

Further development requires a validation of the total system, combined with a gas turbine in a pilot-scale plant.

(1) Overview of the process development unit (PDU) test

Objectives of the test

For the three-reactor combined system (oxidizer, partial gasifier, and desulfurizer), (Fig. 2), data is acquired on the reaction characteristics and operation characteristics, and the validation of the process is carried out in order to acquire information necessary for scaling-up the system.

- Validation of the three-reactor link process
- Confirmation of the performance of the individual systems (oxidation, gasification, desulfurization, etc.)
- Confirmation of basic operability
- Information on various characteristics, acquisition of data for scaling-up, etc.

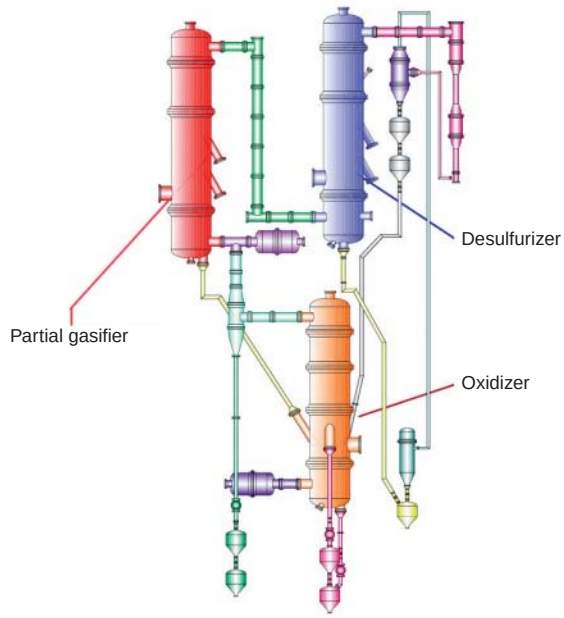


Fig. 2 PDU: Schematic layout of the three reactors

Fig. 3 PDU overview

A-PFBC development schedule

| Item \ Fiscal year | FY1996 | FY1997 | FY1998 | FY1999 | FY2000 | FY2001 | FY2002 |
|---|---|---|---|---|---|---|---|
| (1) Research plan, technology study | | | | | | | |
| (2) Elementary test and F/S | | | | | | | |
| (3) PDU test (15 t/d) | | | Design, manufacturing, and installation | | | Installation completed / Test operation | |
| (4) Process evaluation | | | | | | | |

Reference

Preprint for the 13th Coal Utilization Technology Congress, "A-PFBC"; sponsored by the Center for Coal Utilization (now known as JCOAL).