Environmental Innovative Technology
− Sustainable Use of Fossil Fuels and New Energy −

Brief Overview

To contribute to solution of global environmental problems, we promoted scientific assessment of global warming and high efficient utilization technology of biomass energy.

Among them, for scientific assessment of global warming, we carried out numerical simulations of paleoclimate using a global earth system model and clarified that the feedback of vegetation changes to clime was significant.

For high efficiency utilization of biomass energy, we assessed performances of biomass co-firing with coal and characteristics of spontaneous ignition for various biomass kinds, and we verified high practical use of our technologies for a carbonizing-gasification gas engine power generation and a dry gas purification by means of demonstration test using food processing residue.

In the technical development relating to environmental problems in the electric power industry, we developed soil purification material for arsenic and lead contamination using hydroxyapatite produced in reaction of phosphorus extracted from sewage sludge and desulfurized gypsum.

Achievements by Research Theme

Global warming measures research (Integral project)

●Warming projection and adaptive measures

- We confirmed that changes in vegetation greatly influenced on CO_2 absorption through calculation of paeloclimate using an earth system model.
- For research on adaptation to unavoidable climate change, we clarified relationship between air temperature rise and typhoon intensity change at the end of 20th century using re-analysis data from collaboration work with Japan Meteorological Agency.

○CO_2 underground storage

- We determined CO_2 underground behavior performance at the field tests and indoor tests to increase accuracy of CO_2 underground behavior simulation model.

●High efficiency utilization of biomass energy

- We assessed performances of biomass co-firing with coal and characteristics of spontaneous ignition.
- We demonstrated carbonizing-gasification gas engine power generation technology and dry gas purification technology using food-processing residue. (Fig.1)

Innovative environment technology

○Innovative environment measurement

- We developed an economical method to remove PCBs from PCBs contaminated transformer by changing transformer oil, followed by power operation. (Fig.2)
- We confirmed that simplified measurement method of selenium in wastewater developed by CRIEPI could be adapted for wastewater from power plants.

○Coal ash environment measures

- We developed soil purification material for arsenic and lead contamination using hydroxyapatite produced in reaction of phosphorus extracted from sewage sludge and desulfurized gypsum.

Next generation thermal plant technology

○Integrated operation and evaluation system for pulverized coal combustion power generation

- We developed the numerical simulation basis code to estimate pulverized coal combustion characteristics. (Fig.3)

○Coal gasified furnace

- To support IGCC demonstration plant operation, we predicted gasification performance by numerical simulation and clarified gasification characteristics by CRIEP's “coal gasifier for basic research” to actual tested coal.

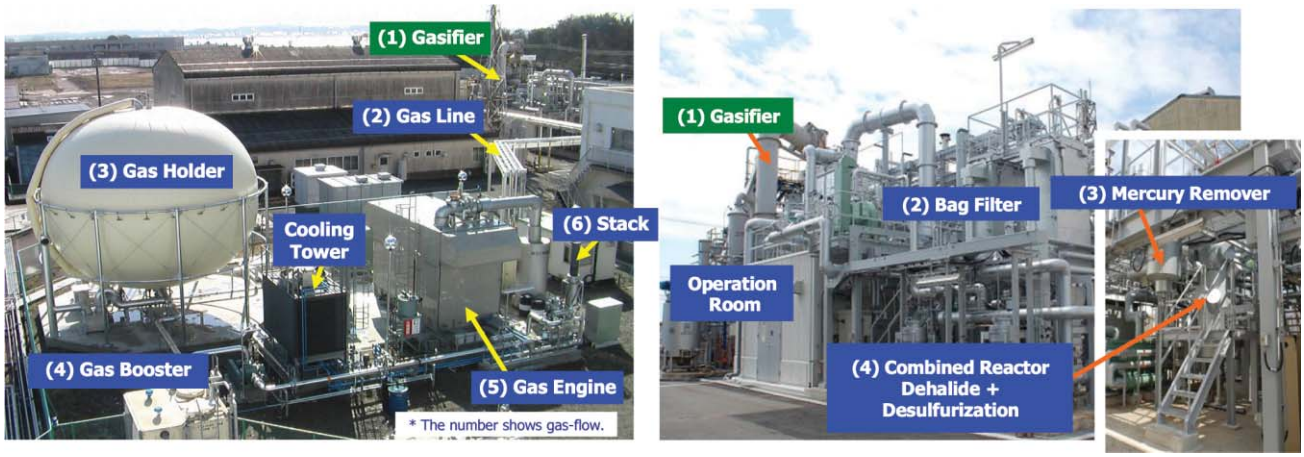
○Trace element control

- We developed prediction method for boron behavior in coal fired power plants.
- From coal properties and operating condition of exhaust gas processing facilities, we assessed quantitatively boron concentration in clinker, fly ash and desulfurization wastewater.

○Low cost MCFC power generating system

- We developed low cost separator technology and electrolyte pre-impregnation technology at a single cell to develop a low cost stack.

Global warming measures research (Integral project)



a) Gas Engine Power Generation
（Joint Research with The Kansai Electric Power Co., Inc.)

b) Hot Gas Cleanup

Fig.1 Demonstration Facility of Biomass Gasification Power Generation System

Innovative environment technology

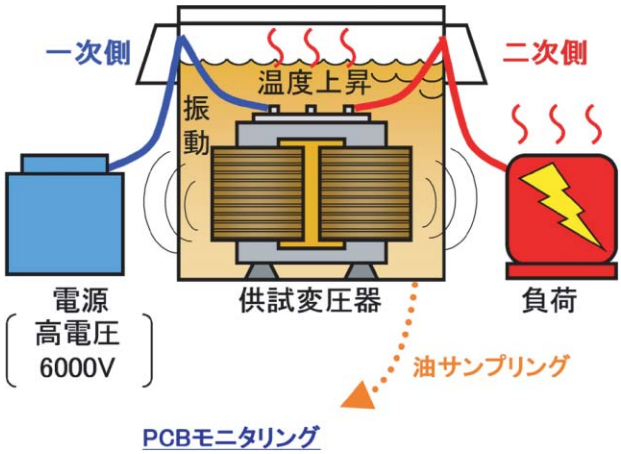


Fig.2 Transformer cleaning by electric connection

PCBs are leached from the transformer core with increase of oil temperature by electric connection after renewal of the insulating oil.

Next generation thermal plant technology

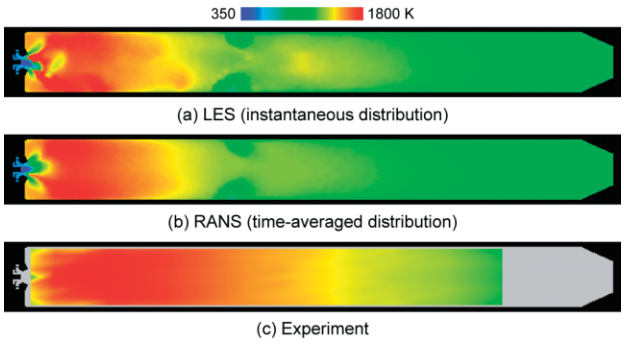


Fig.3 Comparison of gaseous temperature distribution in coal combustion furnace

The simulation code for the pulverized coal combustion which can compute the multiphase combustion field by means of a LES and RANS simulation has been developed. It is confirmed by comparing with the experiment that the basic combustion characteristics such as gaseous temperature distribution can be precisely predicted by the simulation code.