7A2. Co-production Systems

Technology overview

1. Feasibility of fuel co-production power generation systems

Conventional attempts to develop innovative processes within a single industry face limitations. To continue the reduction of CO_2 emissions, it is necessary to comprehensively review existing energy and material production systems and to develop technologies that optimize the individual processes and the interface between processes. This will not only improve the conversion efficiency and conserve energy, but will also fundamentally and systematically change energy and material production systems.

The "fuel co-production power generation system," which produces power, fuel, and chemicals from coal, improves the total energy use efficiency through the unification of industries through the construction of an industrial coal complex.

In the power, iron and steel, and chemical industries, where large amounts of coal are consumed to produce energy, structuring a core plant that produces energy and chemicals simultaneously, and assembling peripheral plants to produce various products, enhances the unification of industries centered on a core plant, thus forming an industrial coal complex based on a new material and energy production system. This unification of industries would advance existing industrial systems to a next-generation, hybrid industrial system.

The core technology for that type of fuel co-production power generation system is coal gasification technology. By combining a high-efficiency power generation system, such as IGFC, with a process to co-produce storable fuel, the normalization of the load to the gasification reactor and a significant reduction of CO_2 emissions are attained.

Furthermore, the waste heat in the industrial coal complex is utilized to recover chemicals from coal through endothermic reactions, thus further improving energy efficiency and enhancing the industrial coal complex.

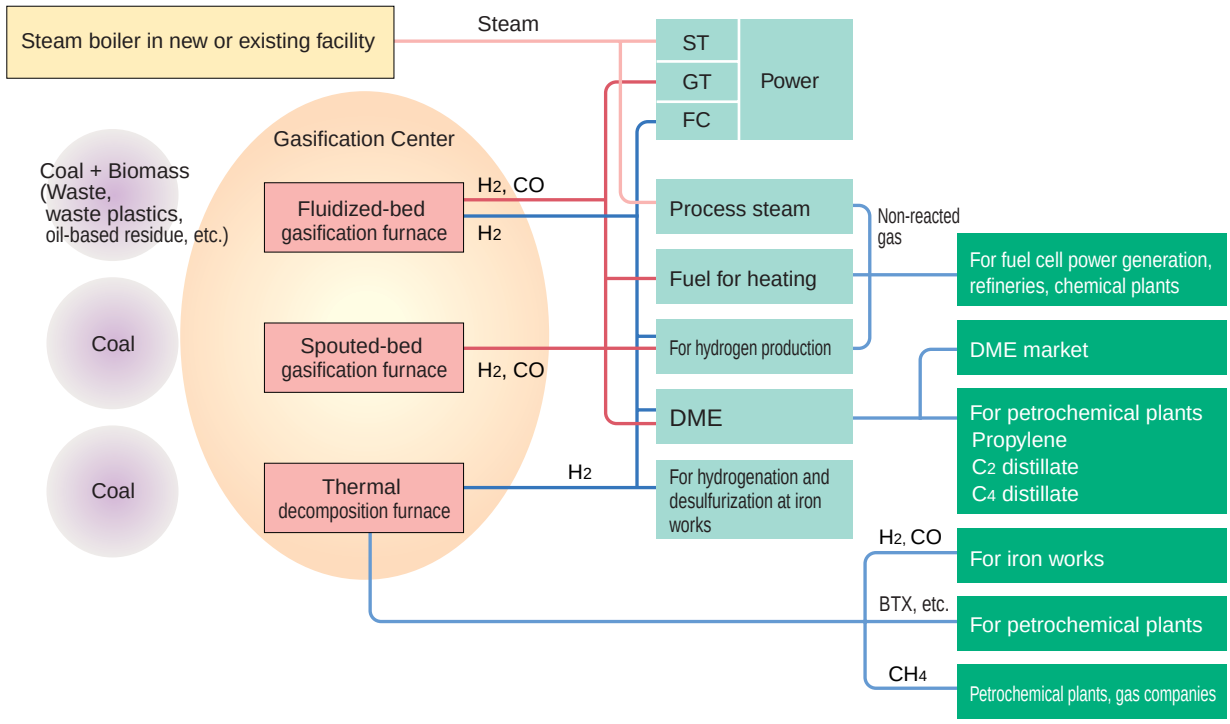

Fig. 1 Energy flow

2. Co-produced fuel and raw materials for chemicals

There are overseas examples of fuel and chemicals being co-produced along with power through coal gasification, with production varying depending on the needs of the related companies, like Sasol's production of synthetic fuel (GTL) in South Africa and Eastman Chemical Company's production of acetyl chemicals in the U.S. Other examples of chemical synthesis with coal gasification include the production of methanol and methane in China, Europe, and the U.S. It is anticipated that DME, which has applications as a raw material for clean fuel and for propylene production, will be produced as will hydrogen, for which demand is expected to increase for use as a fuel for fuel cells and for the coming hydrogen-oriented society.

Clean gas for iron works is also expected to be produced to respond to changes in the energy balance at iron works of the future.

3. Co-production systems

The co-production system produces both materials and energy to significantly reduce the exergy loss that occurs mainly in the combustion stage, and achieves an innovative and effective use of energy.

The co-production system is a new production system that combines aspects of the conventional system, which aims to improve energy conversion efficiencies, and the cogeneration system, which effectively uses the generated thermal energy to the maximum extent possible, but goes one step further by producing both energy and materials in order to significantly reduce their consumption. The co-production system, which should stimulate the economy, is also clean, thereby solving both energy issues and environmental concerns simultaneously. Consequently, co-production systems that produce energy, such as power and fuel, while also producing materials shall be encouraged from the perspectives of creating new energy markets and also creating new industries.

Coal co-production systems focused on coal gasification will be able to solve environmental issues through a significant reduction in CO_2 emissions by realizing the development of high grade and comprehensive coal utilization technology. That type of system technology development would trigger strong technological innovation in the coal utilization field, and vigorous innovation is expected to increase international competitiveness and encourage the structuring of a recycling-oriented society. Internationally, the development of co-production systems should be an important technological issue that addresses global environmental issues.

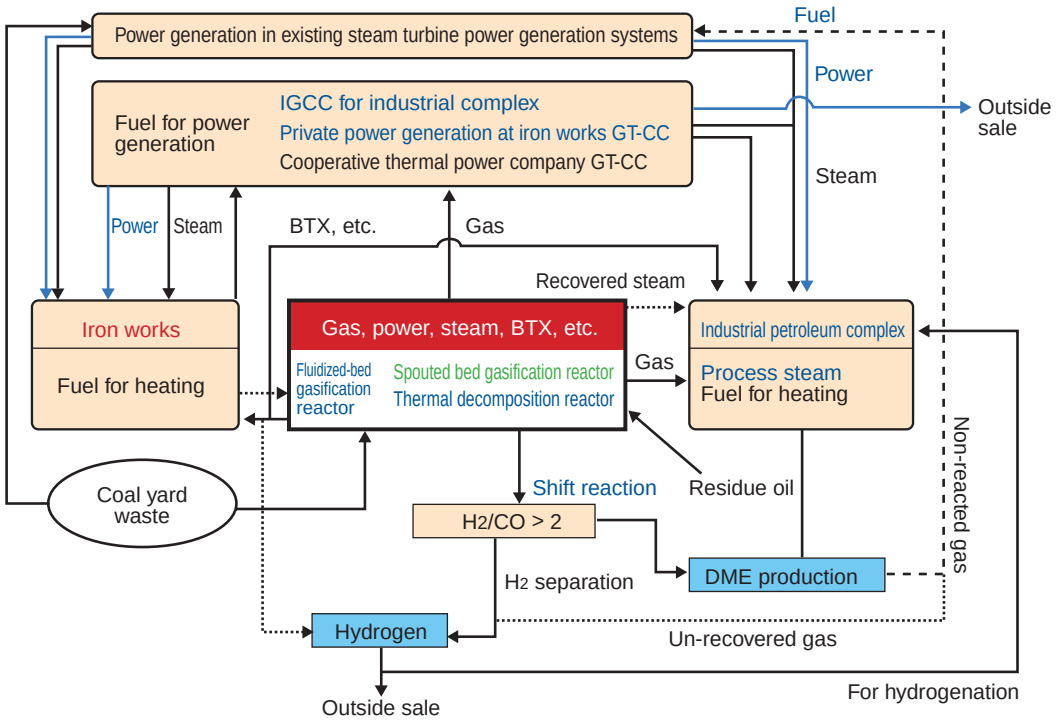

Fig. 2 Power generation, steam, fuel for process heating, hydrogen, and DME energy supply system in an iron works facility