Fuel cells employ the electrochemical reaction between hydrogen and oxygen to directly generate power. With their high-efficiency and excellent environmental features, fuel cells are now in the limelight. They can be classified by electrolyte material into phosphoric acid fuel cells (PAFC), molten carbonate fuel cells (MCFC), solid oxide fuel cells (SOFC), and solid polymer electrolyte fuel cells (PEFC).

Among the fuel cells above, MCFC and SOFC operate at high temperatures and are expected to be highly-efficient technologies for next-generation large-scale power plants due to the following features: (1) they can be used in combination with gas turbines, and (2) they can accept coal gas.

SOFC produce power through an electrochemical reaction between hydrogen, which has been derived from gasified fuel, and oxygen in the air. This mechanism is the reverse process of the electrolysis of water. The traditional power generation system burns fuel to generate heat and converts the heat into electrical energy. Unlike this system, fuel cells derive electrical energy directly with lower energy losses and higher generation efficiency.

SOFC, consisting of ion-conducting ceramics, generate heat at temperatures as high as 900°C to 1,000°C during the chemical reaction. Combined with gas turbine generation, SOFC can provide higher generation efficiency than other types of fuel cells. Besides coal-gasified gas, LNG, methanol or biogas can also be used as fuel.