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Commentary

Mechanism of Combine Cycle Power Plant

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DESCRIPTION

A combined cycle power plant is a set of heat engines that work in tandem from the same heat source and convert it into mechanical energy. On land, the most common type when used to generate electricity is called a Combined Cycle Power Plant (CCPP). The same principle is also used for ship propulsion, where it is called a combined gas and steam plant. The combination of two or more thermodynamic cycles improves overall efficiency, reducing fuel costs.

A combined cycle power plant is a very efficient electricity generating unit. They are the cleanest and most efficient. The co-generation process recovers the temperature of the exhaust gases and uses this heat to generate electricity. It is assumed that they produce around 50% more electricity with the same energy consumption. So combined cycle power plants are profitable as compared the conventional ones. The process of converting fuel energy into electric power involves in the creation of mechanical work, which is converted into electric power by a generator called "simple cycle", resulting in efficiency losses during the process. Depending on the type of fuel and thermodynamic process, the overall efficiency of this conversion is around 30-40 times. This states that the significant amount of the latent energy of the fuel ends up wasted. Much of this wasted energy remains as a thermal energy in the hot exhaust gases in the combustion process.

MECHANISM

The combined power plant, as its name suggests, combines existing gas and steam technologies into one unit, delivering significant improvements in thermal efficiency over conventional steam plants. However, the heat recovered in this process is sufficient to drive a steam turbine with an electrical output of approximately 50% of the gas turbine generator. The gas turbine and the steam turbine are coupled to a single generator. For start-up or open-loop operation of the gas turbine only, the steam turbine can be disconnected by means of a hydraulic coupling. In terms of total investment, a single-axis system is generally about 5% cheaper, while simplicity of operation typically leads to enhanced reliability.

An open-loop gas turbine has a compressor, a combustor and a turbine. For this type of cycle, the turbine inlet temperature is very high. The exhaust temperature of the exhaust gases is also very high. This is therefore high enough to provide heat for a second cycle using steam as the working medium, i.e. the thermal power plant.

Advantages of combined cycle power plant

There are many advantages of combined cycle power plant it increases overall plant efficiency: plant efficiency increases by 50% or more, its investment cost reduces by 30% as compared to a conventional steam power plant by using combined cycle power plant, it reduce the requirement of water in the plant, phase installation is possible in this cycle it causes less consumption of power, plant can be operated automatically with less use of workers, it creates less impact on environment; highly reliable and flexible, this plant can easily start-up and shut down easily and quickly in case of emergency, it needs less maintenance, construction time and installation costs; and it is global warming effect.

Disadvantages of combined cycle power plant

There are few disadvantages of installing combined cycle power plant as the technologies are complex and expensive which increases the initial investment, the efficiency of part-load demand is poor, during high temperature special metals are needed to operate the plant, and limited fuel switching capability. Crude oil requires an additional capital investment on handling fuel equipment; this operation requires additional operating costs for additives to counteract the contaminants present in the crude oil. Maintenance intervals and the extent of the maintenance work required are determined by the type of fuel used and the mode of operation.

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