Gas turbine cogeneration system for energy conservation and better power supply security

Cogeneration is capable of contributing greatly to energy Reason for introduction

Site A Stable supply of electricity in summer and winter, and electricity conservation

Site B Reinforcement of power supply security for the plant in the wake of wako secuaEoer

Stable supply of electricity in summer and winter, and electricity conservation

Preface

Cogeneration has been introduced mainly for the purposes of energy conservation, energy cost reduction, and greenhouse gas reduction. However, power shortages and concerns over power service interruptions after the Great East Japan Earthquake have created new needs such as "the reinforcement of power supply security." Table 1 shows typical reasons for introducing cogeneration systems among our list of received orders.

① Reinforcement of power supply security
② Reduction in energy costs
③ Conservation of electric energy

Responding to such changes in market needs, we are constructively engaged in providing high efficiency, high reliability gas turbine cogeneration.

1 Market trend for cogeneration

(1) Japan

At present, the current basic energy plan is undergoing a radical review, following the impact of the Great East Japan Earthquake and the subsequent accident at a nuclear power plant in March 2011. In laying out a new basic energy plan, the Ministry of Economy, Trade and Industry released a plurality of "energy mix options." The release by the Ministry refers to the following matters as basic courses for an energy mix.

- Efficient utilization of fossil fuels as implemented by a shift to natural gas with the maximum possible consideration given to environmental load; (Clean use of fossil fuels)

- The importance of the expansion of clean use of fossil fuels as well as of the expansion of use of cogeneration systems (including fuel cells) that integrate the use of electricity and heat from the viewpoint of accelerating the effective use of waste heat and the widespread use of distributed power supplies; the necessity to this end of immediately materializing a policy aiming at the expansion of the introduction and development of a framework to efficiently use surplus power in grids.

3 Market needs for cogeneration and examples of cogeneration introduction

(1) Reinforcement of power supply security

Figure 3 shows the outline of the PUCS500 50 MW class and steam to four companies there. In addition, the utility company sells surplus power to bulk customers in the Greater Tokyo Metropolitan area via its subsidiary, Summit Energy Corporation.

One of the important features of the generator set is, instead of the common practice of the conventional combined heat and power supply business characterized by in-house consumption on a one-company-one-plant basis, the combination of a business supplying electricity and steam to two or more plants within an industrial complex via the electric power retail business, and the forming of an unprecedented new business structure as a 50 MW class power station. Distributed power generation can exert its full potential under such a business structure if it cannot make the most of its advantages in reducing costs and environmental load when introduced to a single plant.

During planned power service interruptions after the Great East Japan Earthquake, this generator set ensured a stable supply of electricity and steam to the companies in the food processing complex, thus helping those companies continue stable supply of their products. This in turn helped Kawasaki discover a different need for cogeneration than that of the past. A system that allows electric power and exhaust heat energy to be used efficiently on a regional basis can be said a small-scale example of a "smart energy network."

(2) Energy conservation and reduction in energy costs

Figure 4 shows an outline of the PUC180D gas turbine cogeneration unit, equipped with a reheating device and delivered to a factory in Shizuoka Prefecture. With the existing heavy-oil-fired boiler out of service and a natural-gas-fired gas turbine cogeneration unit working together with the customer's own waste heat reuse facility, a yearly reduction in crude oil consumption of about 19,000 kL was attained, contributing to a 34% energy-savings by the entire plant.

(3) Electric power conservation

The energy center of our Akashi Works is composed of a PUCS250 combined cycle generator set made up of a L20A gas turbine and a steam turbine, the PUC80D turbine cogeneration generator set, and a PUC17D mono-generation generator set. These are installed with the main objective of reducing plant electricity and steam costs, and conducting long-hour demonstration tests of model plants and newly developed gas turbine engines (Fig. 5).

Figure 7

(3) Power conservation by means of absorption chillers

Using steam generated by exhaust heat from a cogeneration system to make space-cooling cold water in an absorption chiller reduces electricity equivalent to that consumed by a turbo refrigerator.

Figure 8 shows the effect of the reduction in electricity achieved by an absorption chiller. To obtain a space-cooling capacity of about 500 USRT, an absorption chiller consumes about 2 t/h of steam, while a turbo refrigerator consumes about 260 kW of electricity.

For this reason, steam generated by 2 t/h of exhaust heat from a cogeneration system provides space-cooling equivalent to 500 USRT and simultaneously achieves about