

Fig. 10.12.

Advantages and Disadvantages of various Cogeneration Systems.

Name of Cogeneration System	Advantages	Disadvantages
1. Steam turbine	1. Fuel flexibility is high	1. Increases the pollution 2. Suitable where continuous energy demand is required due to system inertia 3. High capital investment.
2. Gas turbine	1. Due to short start up time, suitable for intermittent operation 2. Simple plant 3. Low capital investment, low civil construction 4. Low pollution 5. Good fuel efficiency.	1. Need more maintenance than steam turbine 2. Limited suitability for low quality fuels 3. Moderate part-load efficiency.
3. Combined cycle system	1. High efficiency 2. Low capital investment 3. Less gestation period 4. Quick start up and stoppage 5. Low pollution 6. Fuel flexibility is high.	1. Need more maintenance 2. Limited suitability for low quality fuels.

Name of Cogeneration System	Advantages	Disadvantages
4. Reciprocating engine system	<ol style="list-style-type: none"> 1. Minimal pollution 2. Higher electricity to thermal ratio 3. Low civil construction is required 4. Suitable for stand by power source use. 	<ol style="list-style-type: none"> 1. Higher cost of generation per kWh than the other systems 2. Need more maintenance 3. Low overall efficiency 4. Limited suitability for low quality fuels 5. Produces low temperature steam.

10.6. IMPORTANT TECHNICAL PARAMETERS FOR CO-GENERATION

Technical parameters are very important while selecting the cogeneration systems to understand operating mode, type etc.

1. Heat-to-power ratio : It is ratio of thermal energy to electricity required by the energy consuming system. Heat-to-power ratio are different for different co-generation systems. That is why it is one of the most important technical parameters influencing the selection of the type of cogeneration system. It should match according to requirement of the energy consuming facility or site loads. The ratio of heat to power required by site may vary during different times of the day and seasons of the whole year or due to other reasons. So, cogeneration system should be designed to balance or manage the variation of demand.

2. Quality of thermal energy needed : Temperature and pressure define the quality of thermal energy. The quality of thermal energy required by an industry determines the type of cogeneration. So, topping cycle or bottoming cycle is required to satisfy industry demand. For example, sugar mill requires a topping cycle and thermal energy at approx. 120°C whereas a cement plant requires bottoming cycle because it needs thermal energy at approx. 1450°C.

3. Load patterns : Load pattern means, pattern of heat and power demand for a given time schedule of different factories. Load pattern decides the suitable cogeneration system for any particular type of industry. For example two patterns are shown below.

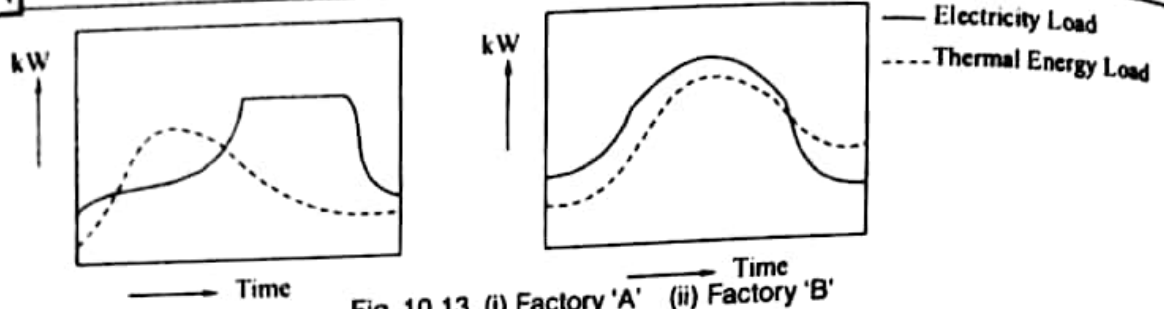


Fig. 10.13. (i) Factory 'A' (ii) Factory 'B'

4. Fuels available : Rate and availability of fuel also decide the cogeneration system. Some waste products, by products can also be used as fuel at site. Availability of fuel may be a major factor for shortage, rate, competitiveness and continuous production in any industry.

5. System reliability : Many industries, service centres require very reliable power and heat due to their emergency process requirement. For reliability factor co-generation system should consist of more than one unit so that any break down of specific unit can not seriously affect the uninterrupted energy supply.

6. Grid dependent system versus independent system. Both have different concept, grid-independent system has to manage all energy requirements and all load variations on the other side, grid dependent system can buy or sale power to grid as per requirement of energy.

7. New installation versus modification in existing system: Technical and economic analysis decide which proposal should be adopted or rejected for a given specific energy consumption pattern.

8. Local conditions : There are so many rules and regulations for fuel availability, pollution control, buy and sale of power to grid, which decide the choice of co-generation system.

SOLVED QUESTIONS

Q. 1. What is cogeneration ? What is the meaning of term CHP ?

[RGPV Bhopal, June, Dec., 2006 2007, Dec., 2008]

OR

What is cogeneration ? What are its benefits ? Discuss in short various co-generation techniques.

Ans. Cogeneration is an energy efficient technology. It reduces the primary energy use thereby reducing the energy cost and provide two different forms of energy i.e., heat and electricity, that is why it is known as combined heat and power (CHP). Heat or mechanical energy is used to drive an alternator for generating electricity, or rotating equipment such as motor, compressor, pump or fan for providing various services.

Thermal energy is used for producing steam, hot water, hot air for dryer. Co-generation is nothing but conversion of fuel's energy into two or more useful form.