

COGENERATION AND TRIGENERATION SYSTEMS IN HOSPITALS

An Example of Feasibility of Trigeneration in Numbers

Assume that a 2x400 kW natural gas trigeneration installation in a hospital has the following values.

Electric Production	:2 x 400 kWe
Heat Production	:2 x 539 kWt
Abs Chiller Cooling Capacity	:675 kWt

This trigeneration facility supplies 800 kW electrical energy and 1078 kW thermal energy per hour to the hospital, as well as supplying 675 kW cooling to the cooling line of the hospital in summer. While conducting a feasibility study and choosing a trigeneration installation, it is highly important to determine operating hours and to operate during targeted times. In general, trigeneration installations provide energy during most of the year, except for the maintenance periods, supplying energy for approximately 7-8 months of the year and supporting the cooling system for 3-4 months in summer. These periods may vary depending on the geographic location of the facility.

Without a trigeneration facility installation;

- Electrical energy would be purchased from national grid on unit price of electricity,
- Thermal energy would be purchased on unit price for natural gas to operate boilers,
- Cooling energy would be purchased on unit price for electricity to operate air-conditioners, electrical chillers and air-cooled cooling groups.

If we make a calculation, assuming that unit price for electricity is 0.34 TRY/kWh, and unit price for natural gas unit is 0,85 TRY/m³;

Without a trigeneration installation;

- Costs of production of electrical energy would be 2.176.000,000 ₺
- Costs of production of thermal energy would be 557.281,00 ₺
- Costs of production of electricity for cooling water supply would be 160.550,000 ₺ in a facility with the same capacity as the trigeneration.

If we add these values, the sum is 2.893.831,00 ₺, which would be the total amount to be paid for electricity, heating and cooling production per year in the absence of a trigeneration installation in a hospital. In addition, the hospital would operate heat boilers, electrical cooling groups etc. in order to reach these energy values, which would be subject to maintenance costs. With a trigeneration installation, only natural gas costs for operation of gas engines and operation expenses would have to be paid. Natural gas consumption values of natural gas generator group may vary depending on gas engine used in the trigeneration installation.

When there is a trigeneration installation, the natural gas expenses of the hospital with the facility values and operation hours specified above would be 1.468.800,00 ₺.

In addition, when we add maintenance costs, internal electricity consumption, spare parts and oil consumption to the management

expenses, the annual cost of the facility amounts to 1.8000.00,00 ₺. Annual profit by trigeneration installation for the hospital can be calculated by subtracting the amount to be paid for electricity, heating and cooling in the absence of a trigeneration installation from the total annual cost of trigeneration facility. When we calculate the difference, the approximate amount is 1.093.831 ₺, which means that this 2x400 system will generate approximately 1.000.000 ₺ annual net profit for the hospital. Thus, the hospital will ensure savings on natural gas by operating heating boilers less when trigeneration system is functional, and as well as savings on electricity by disabling electrical chiller group when absorption chiller group operates during summer.

Electricity Cost
Heating Cost
Cooling Cost



In conclusion, cogeneration and trigeneration systems contribute to energy efficiency of hospitals and reduce energy costs considerably. Using the energy efficiently is valuable for facilities which require uninterrupted supply of energy. Cogeneration and trigeneration facilities can also be preferred in hospitals due to increasing energy demand, reduced external dependence in terms of electric energy, environment-friendly system and user-friendliness.



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