COGENERATION
POWER PACKS

TEKSAN

Since 1994

MILESTONES OF SUCCESS...

WHENEVER YOU NEED POWER, WE ARE ALWAYS WITH YOU... SINCE 1994!

Since 1994, Teksan has been delivering high quality tailormade solutions that are designed accordingly to your requirements with 24/7 expeditious after-sales technical support and maintenance services anytime and anywhere you need uninterrupted power supply. When your company is moving further ahead rapidly on the road to success, you always feel our continuous support as your reliable power solutions partner.

Because Teksan is a member of your family...

1994 1995 | 1996 1997 1998 1999 | 2000 2001 2002 | 2003 | 2004 | 2005 2006 | 2007 2008 2009

Established under the name of "Deniz Mühendislik Ltd. Şti." and began its activities.

Changed its name as Teksan Generator and moved to Sarıgazi Factory.

The upper limit of the range of products was increased from 880 kVA to 2250 kVA.

Moved to Sancaktepe Plant.

Power upper limit was increased from 2250 kVA to 3350 kVA.

Teksan Generator produced the biggest generator sets that were ever made in Turkey until today with its special project of 2x3.125 kVA -11 kV Alternator.

Teksan Generator was nominated as the "Best Distributor" By Doosan Infracore.

It produced the first national natural gas generator set of Turkey.

Research&Development studies of Cogeneration and Trigeneration systems were started.

Received "Appreciation Award" from Doosan Infracore.

It put first local Cogeneration System of Turkey into operation and assumed title of "the First Turkish Company that applied cogeneration systems".





2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017

Teksan Generator carried out one of the most comprehensive ERP projects of Turkey with the investment made into software system, and maximized its customer satisfaction.

First Trigeneration system, 4 x 500 kW Gas Engine, has been realized.

Teksan Generator was named among the first 1000 companies by Turkish Exporters Assembly within 55.000 companies in 2013.

Innovated the first national Hybrid Power System in Turkey and made a breakthrough on Research&Development field.

Teksan Generator logo and corporate identity were renewed as TEKSAN. It started to use TeksanMini sub-brand for portable generator sets.

Second factory started to operate in Kocaeli, Research and Development Center was opened, Ranked 419th in Istanbul Chamber of Industry's «Turkey's Top 500 Industrial Enterprises Survey-2016»,Ranked 406th in Turkish Exporters Assembly's «Top 1000 Exporters of Turkey Survey-2016» Ranked 469th in Fortune 500 Turkey list.

Teksan Generator started "TEKSAN Production System" (TUS) to increase efficiency on supply, production and delivery processes and to prevent losses.

Investment done for the second factory in Kocaeli Free Trade Zone.

Launch of Biogas Cogeneration Systems.

Number of export markets increased to 120 countries.

Chosen for the "TUBITAK Success Stories" booklet for its Hybrid Generator Set innovation, which is the first Turkish Hybrid Power System. Launched Hybrid Lighting Towers.

Not only ranked as 436th in "Turkey's Top 500 Industrial Enterprises" list announced by Istanbul Chamber of Industry, and 436th in the "Top 1000 Exporters of Turkey" survey published by Turkish Exporters Assembly, but also moved up to 97th place in "R&D Top 250 of Turkey" survey for its achievements in 2015.

COGENERATION SOLUTIONS

Absorption Chiller

Cooling Tower

Dry Cooler

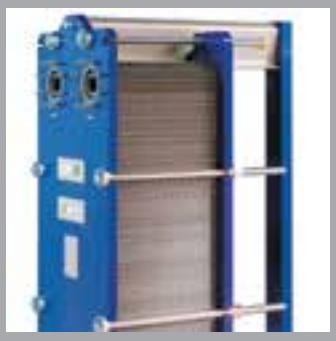


Plate Heat Exchanger

Exhaust Heat Boiler

STRONG SOLUTIONS FOR FUTURE

TEKSAN, thanks to its solid experience and know-how, delivers high performing natural gas and biogas-based cogeneration-trigeneration solutions with energy efficiency up to 90%.
You can get your investment back in a short period of 2-3 years.

Cogeneration Solutions

Today, it is the time to take action in the name of bequeathing a powerful heritage for the future…

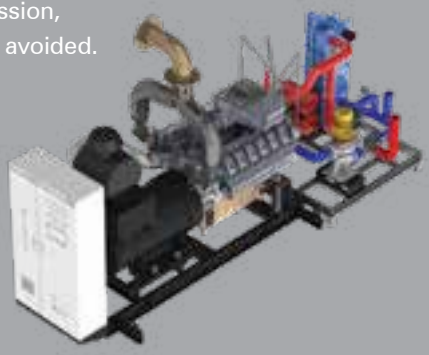
Cogeneration (Combined Heat and Power or CHP) is the simultaneous production of energy more than one form such as electricity and heat from fuel which is used. The basic and most fundamental principle of cogeneration is to benefit accumulated heat in the system to provide saving accordingly the electricity needs of the facilities.

Cogeneration optimizes the energy supply to all types of consumers, with increased efficiency of energy conversion and use, lowering emissions to the environment, saving costs significantly, providing additional competitiveness for industrial and commercial users, and offering affordable heat for domestic users.

Distributed combined heat and power generation is an obligation for cleaner environment. With Kyoto Protocol, many industrialized countries entered into an international agreement committing a reduction of 30% in CO_2 emissions as of 2010. If this objective is to be achieved, it is vital that significant savings be made on the primary energy side. The generation of power and heat that is close to the location of consumption, is energy-efficient hence the supply can optimally be adapted according to demand and transmission, distribution losses are also largely avoided.

Reduction in the CO_2 available with Teksan gas engine based cogeneration modules employed in CHP plants amount to more than 50% comparing to conventional oil-fired heating stations and coal-fired power stations. Teksan gas engines satisfy the twin requirements of low-emission and cost-efficient energy generation. Our CHP pack scan be used in municipal utilities and public authorities, power generating facilities, industrial, engineering and food processing companies as well as hotels. Operating as reliable electricity providers, they simultaneously serve to generate the heating energy for indoor swimming pools, sports centers, hospitals and clinics, schools and other public buildings.

According to system's thermal and electricity requirements, CHP plants can be designed as multimachine systems. System adaptation to the prevailing electrical and thermal demand profile is implemented by switching individual modules on and off. Multi-machine CHP plants also offer the benefit of exceptionally high availability.



TEKSAN POWER PACKS

You have the control...

Teksan Cogeneration modules are called as "Power Packs". They are high efficient, fully functional power units with all the auxiliaries and components that a power production unit requires. For industrial, commercial and domestic self generation, small utilities, which don't have major construction and project handling resources, a complete power production unit requiring minimum work on site, is the answer. The installation of a Power Pack is quick and easy like a "plug and play" system. Start up is so fast and also operation and maintenance require minimum staff on site and remote monitoring is possible. The standardized design of Power Packs also lifts the concept of "stepwise" investment to new heights.

Inspite of starting with a single Power Pack, you can easily expand the installation by adding new and interconnected packs as the demand for power grows in your plant.

Advantages of Teksan Cogeneration Systems:

- Durable to work for many years, design that make its dynamic and static analysis and calculations
- High efficiency due to its equipment designed specially for cogeneration system
- Convenience in layout and maintenance course due to its compact design,
- Investment return in short time thanks to feasibility calculations accurate analysis and suitable system design,
- Ease of augmentation of system capacity upon demand and simultaneous operation with diesel generators
- Low maintenance costs,
- In Teksan cogeneration systems, heat can be offered to the client in various ways. Along with standard hot air outlet, project based superheated steam and hot oil, cold water can be distributed too, in such projects which need cooling, via absorption chillers. Along with these, in greenhouses and projects that are demanding CO_2 usage, exhaust emissions are also utilisable.

TRIGENERATION POWER PACKS

Trigeneration is the process of procuring cooling in addition to the electrical and heat outlets of cogeneration systems. In trigeneration systems, hot water or exhaust, exhaust, that are gathered from the engine, are being used to obtain cold water via absorption chillers.

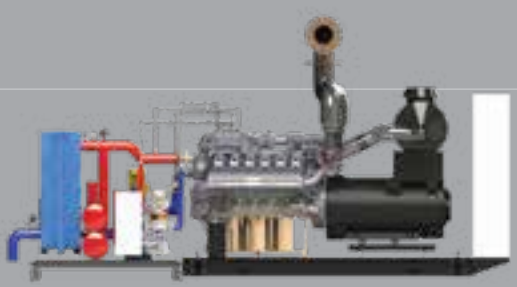
The trigeneration system is recommended in such implementations when the heat demand is used seasonally or in such implementations where cooling demand is higher than that of heating demand.

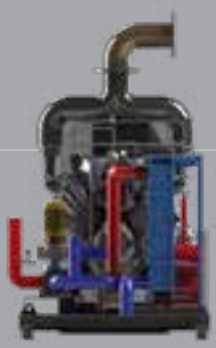
Sole or double effect absorption can be recommended depending on the cooling demand. In system absorption chillers provide cycle efficiency between 0,7 - 1,4 COP, depending on it's working principles.

In Teksan Trigeneration Systems, in addition to the cogeneration packs; absorption chiller, cooling tower and cooling pumps are also presented to the client.

Teksan Test Facilities:

- Low and high voltage testing
- Emission tests
- Fuel consumption test
- Thermal analysis
- Static and dynamic analysis
- Vibration tests





TEKSAN COGENENATION EQUIPMENTS

STANDARD EQUIPMENT

Engine Equiqment

- Electric coolant pumps for 1 T 8 HT circuits
- Ignition system
- Carburetor type combustion gas/air mixer
- Electronic speed controller with on – engine actuator
- Intake air filter with replaceable element
- Lubricating oil pressure , coolant temperature , speed sensors

System Equiqment

- The chassis which can include the engine, alternator and framework system
- Alternator, designed specifically for highly efficient cogeneration system
- Anti – vibration dempers
- Cable installations
- Emergency LT/HT radiator
- Output Swicht
- Oil cooler
- Intercooler

Heat Recovery

- Jacket heat exchangers, 3-way volves, expansion tanks and exhaust piping
- 316 L stainless exhaust heat exchangers
- Temperature and pressure sensors
- Overpressure safety valves
- The purge air discharge
- Analog pressure and temperature gauges
- Butterfly valves

Gas System

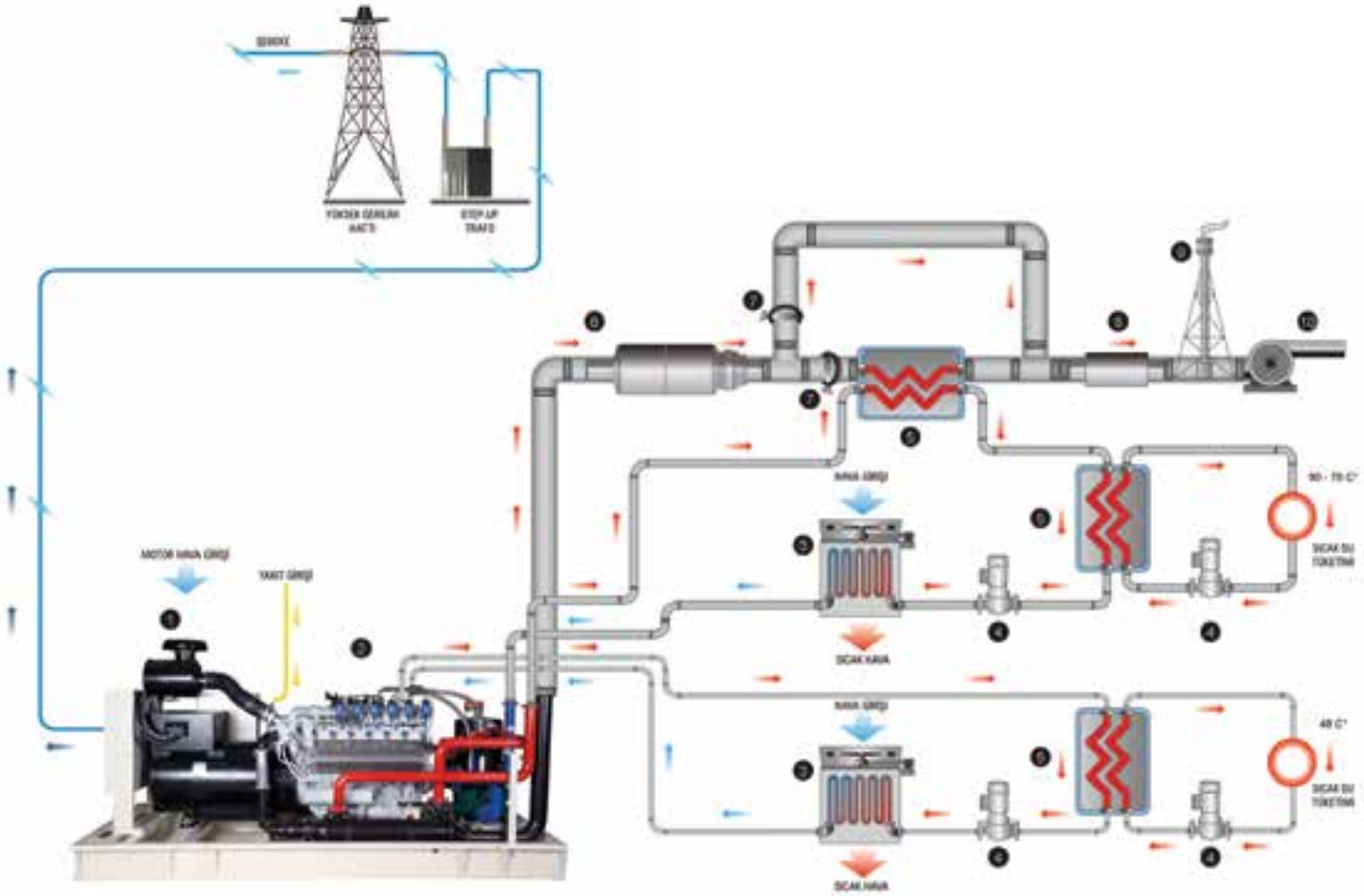
- Filter , double solenoid valve and gas regulator
- Preostats, globe valve, flexible connection

OPTIONAL EQUIPMENT

- PMG
- Alternator dehumidifiers
- Differential protection
- Alternator diode protection
- Sound isolation booths and containers
- Three- way catalysator converter
- Clinder knock control equipment
- Active AFR control
- Remote monitoring through internet
- Automatic oil discharge and completion
- Reverse Osmosis water purification system
- Medium voltage equipment
- Sprinkling tropical type heat mediator
- Seismic warning system
- Control panel heater
- Surge relay (ROCOF) and detonation system
- Availability Assurance

Documentation

- Operation and maintenance guide
- Spare parts catalogue
- System drawing and design



POWER PACKS

1. Alternator
2. Gas Engine
3. Emergency Remote Radiator
4. Electric Motor Pumps
5. Heat Exchanger
6. 3 Way Catalytic Converter
7. Butterfly Emergency bypass dampers
8. Silencer
9. Flare Stack
10. Blower

POWERFUL SOLUTIONS FOR DIFFERENT SECTORS

Tuzla State Hospital / Istanbul

2 x 400 kW
Trigeneration System

ACITY OUTLET CENTER / Ankara

4 x 500 kW
Trigeneration System

T.I.G.E.M. / Eskisehir

1 x 250 kW
Biogas Cogeneration System

A.S.K.I / Ankara
3 x 1000 kW
Biogas Cogeneration System

GATA Hospital / Ankara
2 x 600 kW
Trigeneration System
4 x 1650 kVA
Synchronized Diesel Generator Sets

Kepez State Hospital / Antalya
4 x 1650 kVA
Synchronized Diesel Generator Sets
2 x 400 kW Trigeneration System

M.Akif Ersoy State Hospital / Canakkale
2 x 500 kW
Trigeneration System
5 x 1130 kVA
Synchronized Diesel Generator Sets

Dicle University / Diyarbakır
1 x 7 kW
Biogas Cogeneration System

Edirne Sultan 1. Murat State Hospital / Edirne
2 x 430 kW
Trigeneration System

Bioarma Energy Biogas Plant / Gaziantep
2 x 499 kW
Biogas Cogeneration System

Gaziantep State Hospital / Gaziantep
2 x 800 kW
Trigeneration System
4 x 1900 kVA
Synchronized Diesel Generator Sets

Beylikduzu State Hospital / Istanbul
2 x 400 kW
Trigeneration System
3 x 1130 kVA
Synchronized Diesel Generator Sets

Buyukcekmece State Hospital / Istanbul
2 x 600 kW
Cogeneration System

T.P.A.O. Silivri / Istanbul

Izmir Bornova State Hospital / Izmir

TOO Shymkent Kus

2 x 400 kW
Trigeneration System

1 x 1240 kVA
Diesel Generator Set

1 x 1240 kVA
Diesel Generator Set

Istanbul Technical University / Istanbul
1 x 30 kW
Biogas Cogeneration System

Sariyer State Hospital / Istanbul
2 x 430 kW
Trigeneration System
5 x 1130 kVA
Synchronized Diesel Generator Sets

Izmir Torbalı State Hospital / Izmir
2 x 350 kW
Trigeneration System

Izmir Odemis State Hospital / Izmir
2 x 350 kW
Trigeneration System
3 x 826 kVA
Synchronized Diesel Generator Sets

Foca Criminal and Execution Institution / Izmir
1 x 350 kW
Biogas Cogeneration System

Kocaeli State Hospital / Kocaeli
3 x 1425 kVA
Synchronized Diesel Generator Sets
2 x 260 kW
Trigeneration System

Kiziltepe Wastewater Treatment Plant / Mardin
2 x 500 kW
Biogas Cogeneration System

Mugla State Hospital / Mugla
2 x 500 kW
Trigeneration System
5 x 1130 kVA
Synchronized Diesel Generator Sets

Nigeria Seplat Petroleum / Nijerya
1 x 375 kVA
Diesel Generator Set

Van Women's Diseases Hospital / Van
2 x 880 kW
Trigeneration System

TEKSAN

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COGENERATION AND TRIGENERATION SYSTEMS IN HOSPITALS

In hospitals, which offer 24/7 services and have an essential place in our lives, the service quality provided to patients, employees and visitors go parallel with their energy consumption. It is considerably important for hospitals to maintain uninterrupted supply of heating, cooling and electrical energy. In this scope, cogeneration and trigeneration systems bring significant advantages for hospitals.

Cogeneration and Trigeneration Systems

Cogeneration means converting a form of energy into a combined form of heat and electrical energy and producing them at the same place. Two of the most important advantages of producing heat and electrical energy in the same location instead of producing them in separate locations, are highly efficiency and economy. Natural gas, biogas, propane gas, coke-oven gas etc. can be used as energy input at these plants. While a gas turbine or gas engine producing only electricity transforms approximately 30-40 percent of the energy input into electricity, the efficiency in cogeneration systems go as high as 80-90 percent with heat production.

Trigeneration means adding a cooling property to cogeneration system which generates heat. In addition to supplying electricity and heat energy to the plant, trigeneration system also supplies cold water to the cooling line. This supply of cooling is enusred via an absorption chiller cooling unit. Absorption chiller unit containing lithium bromide supports 12-7°C line of the hospital by absorbing hot water from the engine. 12°C water line is covered by the absorption chiller group and this water is cooled in the unit and supplied back to the hospital at 7 °C.

NATURAL GAS — COGENERATION — TRIGENERATION

Since the use of natural gas has become widespread in our country and the government has facilitated the means for generating your own electricity , cogeneration and trigeneration applications have gained popularity. At Teksan, we have produced the first local cogeneration system in Turkey. With our know-how, we have been developed suitable solutions to respond to the needs.

Cogeneration and trigeneration facilities have carbon emission-reducing features in accordance with the Kyoto Protocol. Due to low emission values of gas engines used in these systems, environmental damage caused by the facility is minimized.

Why Should Hospitals Have Cogeneration or Trigeneration Systems?

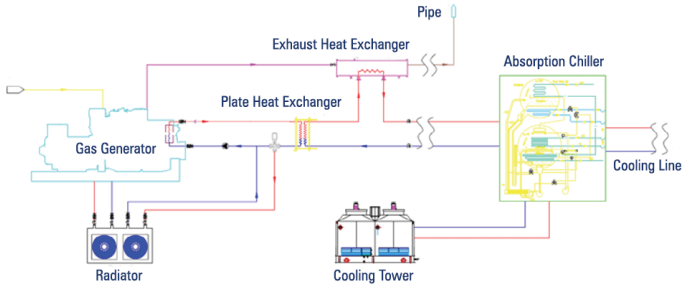
Hospitals need uninterrupted supply of electrical, heating and cooling energy for 24 hours. It is extremely important for hospitals to use cogeneration and trigeneration installations to heat the rooms, to sustain the operation of central heating boiler, to supply hot utility water, to ensure interrupted supply of vapor used in certain locations in hospitals, to operate the cooling line in designated locations in hospitals during summer and to maintain desired level of temperature in the rooms.

The advantages of cogeneration and trigeneration systems can be listed as follows;

- *High efficiency above 90%*
- *Low energy costs*
- *Uninterrupted energy*
- *Depreciating the investment in a short time*
- *Environment-friendly features*
- *Less burden on the national grid due to generating its own energy in thefacility, minimizing losses in transmission and distribution.*

Trigeneration System Applications in Hospitals

A single trigeneration circuit is indicated below.



Electric energy is produced by a gas engine running on natural gas and a coupled alternator. In addition, influent water of the hospital first absorbs the heat of the engine jacket water through a plate heat exchanger, and then the water goes to the exhaust heat exchanges to absorb the exhaust heat in order to use the heat of the jacket water and exhaust heat of the engine. Thus, it returns back to the hospital with a higher temperature. In addition, absorption chiller cooling unit supports the 12- 7°C cooling line by absorbing the hot water received from the engine through chemical reactions in order to support the cooling line of the hospital during summer.

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, supplyingenergy 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-conditioniers, 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 supplywould 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 thatthis 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.

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 preffered 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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