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To Study on Co-Generation Plant Simulation, Oil Extraction & Power Generation by Steam using Boiler

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Peer Review Information	Abstract
<i>Submission: 20 Jan 2025</i> <i>Revision: 24 Feb 2025</i> <i>Acceptance: 27 March 2025</i> Keywords <i>Bio-Mass</i> <i>Coal Fired</i> <i>Co- Generation</i> <i>Energy</i> <i>Gas-Fired</i>	The overview of the manufactured Cogeneration plant ,there are many advantages for the user and our society such as increased efficiency, lower efficiency, reduced energy costs, supporting renewable energy as well as empowered business and citizens. Cogeneration plants are becoming increasingly popular as a sustainable energy solution that allows for efficient utilization of resources. In this scenario, co-generation plant is used for boil extraction as well as power generation using a boiler to produce steam.

INTRODUCTION

This document is a template Cogeneration systems apply less fuel to developed the same amount of energy as well as altered depending upon the needs of the energy user.

Cogeneration plants are becoming increasingly popular as a sustainable energy solution that allows for efficient utilization of resources. In this scenario, co-generation plant is used for boil extraction as well as power generation using a boiler to produce steam. Simulating a cogeneration plant can be done using computer software that models the behaviour of the plant under different conditions. This simulation can be used to optimize the plant's performance, identify potential issues and test different scenarios before implementation. In term of

future scopes, the use of cogeneration plants is expected to increase as the dictate for lasting energy sources increases. As technology continues to advance, there will likely to enhancement in the efficiency and the amount effectiveness of co- generation plants, making them even more fetching option for energy production.

Problem Statement

There could be several user based problems that could arise with a various manufactured products which are improper installation, failure to maintain, low water pressure, clogged filter, low efficiency

Objectives

The objectives of co-generation power generation system are as follows-

- To improve the installation of Co-generation system
- To improve the system maintenance
- To maintain water pressure

METHODOLOGY

When electricity and usable heat are produced simultaneously from a only one fuel inception, a cogeneration plant methodology—also called the "combined heat and power (CHP)"—essentially captures the low grade heat is developed while power production to provide additional thermal energy for heating purposes, leading to a significantly improved system wide efficiency when compared to separate electricity and heat production.

Key factors to take into account while designing a cogeneration plant:

Aligning power generation with heat demand: The design ought to guarantee that the quantity of heat generated corresponds with the necessary thermal load.

Selecting the best fuel depends on a number of factors, including cost, availability, and environmental impact.

System control: Putting in place cutting-edge control systems to regulate heat distribution and maximize energy production

WORKING OF CO-GENERATION SYSTEM

In traditional power plants, the kinetic energy required to develop power is produced by warming water to the boiling point, which produces steam that powers a turbine. Usually, fossil fuels like coal, oil, or natural gas are used to heat the water. Every step of this process wastes energy, particularly since the heat generated to create steam is only released into the atmosphere. Approximately 65% of energy can be wasted by conventional electricity generation. Energy efficiency is about 35% because some energy dissipates during transmission. Alternatively, a cogeneration plant uses this heat by, for instance, using pipes to deliver hot water to a customer (like a factory or a complex of buildings).

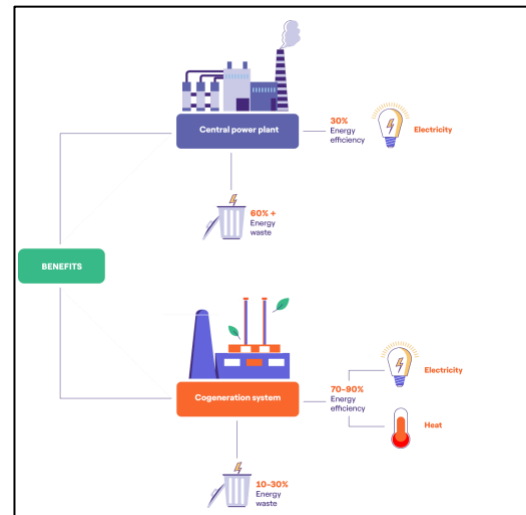


Fig.1 Co-generation System

Different types of co-generation system are as follows-

Gas turbine powered: these systems normally use natural gas as fuel and harness the waste heat in the gas turbines' flue gas to produce electricity

Gas engine powered: For this cogeneration method, a reciprocating gas engine is employed. Usually produced as completely assembled units, these CHP cogeneration plants are simple to connect to the site's electrical and heating systems and can be placed either outdoors or inside a designated plant room

Biofuel engine: these systems are fairly similar to the earlier ones in that they employ a diesel or reciprocating gas engine that has been modified to run on biofuel. Carbon emissions are decreased when biofuels are used instead of fossil fuels. Additionally, these plants typically come in pre- assembled modules that are simple to connect to the electrical and heating infrastructure already in place

Steam turbine CHP: with this system, the heating system serves as the steam turbine's condenser. Scope in co-generation plant simulation, oil extraction & power generation of steam is vast and exciting.

Here are some potential areas for growth and innovation

Integration with renewable energy sources: Cogeneration facilities can be combined with renewable energy sources like wind and solar to improve energy efficiency and lessen their environmental effect.

Use of advanced technologies: Co-generation plants can benefit from the use of advanced technologies for predictive maintenance, optimization, and control. These technologies can improve plant performance, reduce downtime, and increase safety.

Modular design: Modular design can enable the construction of co-generation plants that are scalable, flexible, and easy to maintain. This approach can reduce capital costs, shorten construction time, and provide greater

operational flexibility.

Power storage: Power storage cache can be used to store extra power produced by co-generation plants. This approach can increase the efficiency of power developed, reduced energy costs, and improve grid stability.

Remote monitoring and control: Remote monitoring and control systems can enable plant operators to monitor and control plant operations from a centralized location, reducing the need for on-site personnel and improving safety.

Overall, the future of co-generation plants looks bright as well as advanced technologies, non conventional energy medium, and modular design can help to make these plants even more efficient, cost-effective and sustainable.

The International Energy Agency projects that by 2016, power develop from non-aqueous renewable sources, such as solar, wind, and bioenergy, will surpass that from gas and nuclear, and that renewable energy will rise by 40% over the following five years.

"Combined heat and power (CHP), also known as cogeneration, is the simultaneous production of electricity and heat from a single fuel source, such as: natural gas, biomass, biogas, coal, waste heat, or oil," the US Environmental Protection Agency reports (EPA).

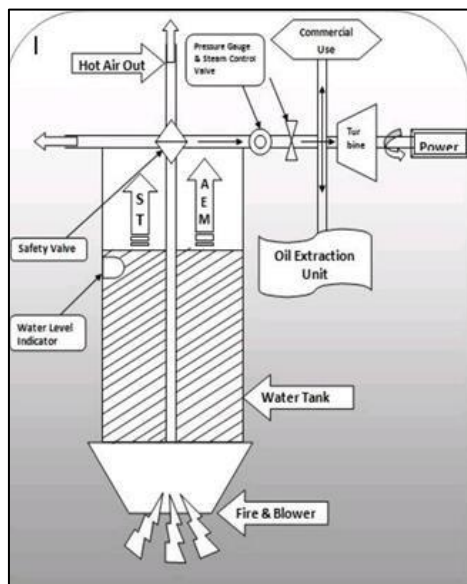
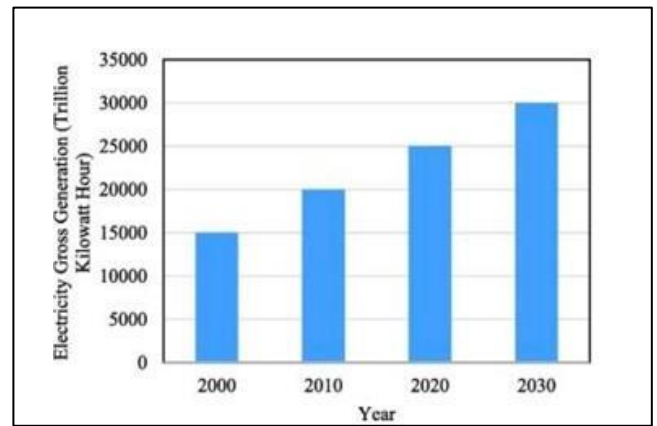


Fig.2 General layout of boiler

Recently, the prominent method to the development of base load electricity globally is traditional gas or coal-fired power plants. The source of energy has attracted much due to the issues associated with its energy-generation process, such problems is the associated pollution and carbon emission. The increase in the world market comes with increases in non-renewable energy prices.



Graph No. 1 Year vs Electrical Gross Generation

CALCULATION

We know ,

$$t=1/2 \text{ cm \& } d=0.3 \text{ m}$$

Material Ultimate Strength=400MPa Considered, factor of safety (FOS) Design strength = $400/3 = 133.33 \text{ N/MM}^2$ Now calculating Hoop stress of the boiler For 2 bar pressure

$$\text{Hoop Stress} = Pd/2t$$

$$= (2 \times 10^5 \times 0.03) / (2 \times 0.005)$$

$$= 6 \text{ N/MM}^2$$

Suitable for boiler For 50 bar pressure Hoop

$$\text{Stress} = Pd/2t$$

$$= (50 \times 10^5 \times 0.03) / (2 \times 0.005)$$

$$= 150 \text{ N/MM}^2$$

Not Suitable for boiler For 40 bar pressure Hoop

$$\text{Stress} = Pd/2t$$

$$= (40 \times 10^5 \times 0.03) / (2 \times 0.005)$$

$$= 120 \text{ N/MM}^2$$

The boiler can Suitable pressure up to 120 N/MM^2 for boiler

BENIFITS OF CO-GENERATION PLANT

Energy efficiency increased: Cogeneration is up to 40% maximum efficient than the distinct development of heat and power

Less emissions: Co-generation consume every year 200 million tons of carbon dioxide to being very powerful. This equals the total emission of 42.5 million passenger cars or 2.6 million trucks.

Energy costs reduced: Cogeneration benefit from higher effective and this demand less fuel to cover their heating and power demand.

Support renewable energy: Cogeneration can develop on any non-conventional fuel and is the much cost-effective way of using non-conventional fuels. Currently, 27% of fuels used in cogeneration in Europe are renewable, such as biogas as well as biomass.

Empowered business and citizens: Cogeneration produces in all design, from 1KW to nearly 1GW. It is fit to pass heat and power to all types of users, from a single domestic to a large industrial complex or entire.

FUTURE SCOPE

"Combined heat and power (CHP), also known as cogeneration, is the simultaneous production of electricity and heat from a single fuel source, such as: natural gas, biomass, biogas, coal, waste heat, or oil," the US Environmental Protection Agency reports (EPA).

Cogeneration is more a principle than a one technology, with the benefits of CHP system being optimal effectiveness. Conventional power develop discards up to 60% of power potential as dissipated heat, the cogeneration system have a conversion efficiency of 72-89%, and are particularly needful in chilled climates where the heat can be used for heating buildings and industrial processes. Another benefit lies in the proximity of the average Co- generation facility, compared to the 5-10% drop in transmission of power from typically remote traditional power plants.

The main part of recently the large industrial and commercial CHP applications are in the pulp and paper, chemical, purify, agro processing, ethanol and production unit, which require large amount of power and heat. and the natural gas - generally believed to be the cleanest as well as low emission fossil fuel and in great supply over NA country. Cogeneration systems use low fuel level to produce the same amount of energy, and may be altered depending upon the needs of the energy demand.

CONCLUSION

Hence from this we conclude To improve the installation of Co-generation system , to improve the system maintenance as well as to maintain water pressure and from the calculation we calculate the mass of water in our boiler is 442.022 kg and time taken was 120 min.

The Latent Heat of our boiler was 245.41 KJ/min and the Sensible Heat was 1289.255 KJ/min.

The steam flow rate of boiler was 4.038Kg/min. the boiler capacity in terms of steam production in tones/hours.

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