American Journal of Interdisciplinary Research and Development
ISSN Online: 2771-8948
Website: www.ajird.journalspark.org
Volume 16, May, 2023

# REUSE OF FLUE GAS ENERGY OF WATER BOILERS IN DISTRICT BOILER HOUSES

Sobirov Tolibjon, a student
Department of Energy Saving and Energy Audit
Tashkent State Technical University named after Islam Karimov, Uzbekistan
sabirovtalib6@gmail.com

Ph.D. Jakhongir Normuminov
Head of the Department of Energy Saving and Energy Audit,
Tashkent State Technical University.
normuminovjakhongir@gmail.com

Dildora Badalova,
Head Teacher in the Department of Energy Saving and Energy Audit
Tashkent State Technical University named after Islam Karimov, Uzbekistan
abdumalikovna1987@gmail.com

**Abstract**
The production of heat and power in many countries in the world is mainly based on the burning of fuels, especially water boilers, and gas-fired boilers. Therefore, practical developments in reusing the flue gas energy of water boilers in district boiler houses have been increasing all around the world. Why? Overall, the temperature of released gases from water boilers to the atmosphere is over the dew point of water in waste gases. And it is obvious that recovery of the thermal energy of flue gases increases the efficiency of boilers and supplies energy-saving. Although examination of energy utilization is the search for the minimum consumption of energy. This paper deals with the potential of recovering waste heat emitted by the hot water boiler in district boiler houses. As water boilers are the major component in these industries, it makes it sensible to evaluate the technical features and measure the energy efficiency of boilers.

**Keywords**: water boilers, energy utilization, reusing the flue gas, system energy-saving.

## Introduction

Energy is at the heart of development and vital for computerization and innovation. Computerization and Innovation are increasing rapidly in the manufacturing sphere. With the rise of the energy consumption rate, requests for establishing new energy sources and modernizing existing ones are becoming relevant. In many countries, gas-fired boilers are sufficiently demanded and popular

sources of heat supply. As the heart of the system, a boiler is a closed container that enables thermal energy from combustion to be transferred into water until it turns into heated water or steam. In the process of transferring theory into practice, confronting natural energy losses is undoubtedly general. In order to optimize the combustion processes and provide high thermal efficiencies by reusing the energy of flue gas of water boilers in district boilers houses.

**Description of the Central Heating Plant**

The use of gas boilers for residential areas or industrial enterprises as sources of heat supply has a number of advantages over district heating. And what is the reason for many ongoing projects and attempts to optimization of water boilers in district boiler houses? Firstly, it is economically advantageous to use gas-fired boilers. The thermal energy produced by such boiler houses costs significantly less than the energy generated at a thermal power plant, which operates on other types of fuel. Secondly, gas boilers are high efficiency (up to 95%). From an environmental point of view, gas boilers are considered the least harmful to the environment. When gas is burned, the amount emitted harmful emissions are much lower than the maximum allowable Russian and European norms.

**Working principle of water boilers:**

The boiler is the largest and most important part of a thermal power plant. The function of the boiler is to convert the energy contained in the coals' high-temperature steam. Large power plants usually use the type boiler called a water hard boiler which is through pipes surrounded by flames. Flowing water tube boilers are perfectly suitable for high-pressure installations there are also gas tube boilers but they are used for small burner settings in the boiler to convert chemical energy. The first node moves the coal dust in thermally generated hot gas moves throughout the boiler. a boiler that absorbs heat is called an economizer water enters here under high pressure supplied by the feed water pump. Economizer absorbs energy from flue gas, thereby increasing liquid temperature from their water through the steam. Drum enters downpipes, then it passes through a section of narrow pipes which is called the furnace screen. Phase transition of water occurs in the furnace screen the resulting steam with water droplets again enters the steam drum home. The function of the steam drum is to the separation of water droplets from steam. The result of steam coming out of the steam drum becomes rich and clear. Now let's remember some facts about thermodynamics according to the second law of thermodynamics the higher the temperature of the heat source the more efficient the cycle is thus the higher the steam temperature reached a power plant would be more efficient it. The steam temperature can only rise up to certain limits, the material from which steam blades are made turbine cannot withstand temperatures over 600 degrees Celsius. Therefore, after the steam drum then the steam is fed to the turbine inlet after passing the first stage. Cake steam temperature drops a good idea for raising jealousy and power plants is the complete removal of steam after the first stage and transferring additional heat. This process is called secondary superheated steam for this purpose used heat exchanger known as secondary superheater reheat and overheating also increases power. The power plant, in addition, to its efficiency now let's discuss the important misconception about boilers

we know that passing through the boiler raises the temperature of the water, but what about pressure consider this drop of water suppose that she is surrounded by a shell. If she converted to steam it is obvious that the pressure will increase now considering the same drop but without shells. In this case, if the liquid turns into steam pressure remains the former because the liquid is not here and has a fixed volume. It can freely expand the inside of the cauldron and also looks like a drop of water without a shell. This system is free to flow water can expand freely when the liquid turns into vapor which means what is the water pressure. An ideal boiler should remain unchanged in practice due to friction and other imperfections in the boiler experiencing a slight drop in pressure. (**Fig. 1.)**

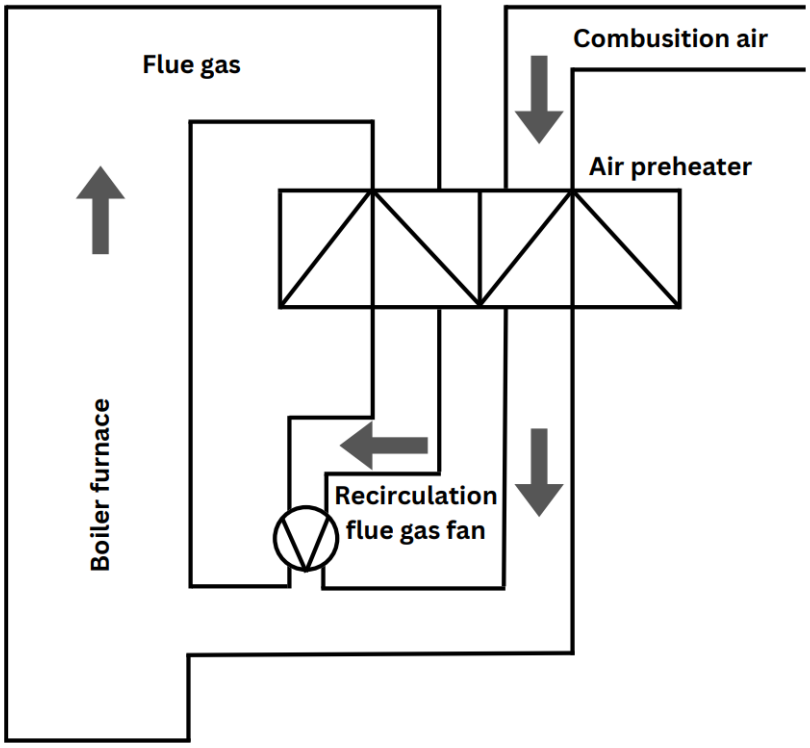


**Fig. 1.** Principal view of inner system of water-tube boilers

**Benefits of Reusing Flue Gas Energy:**

There are several benefits to reusing flue gas energy in district heating systems. Firstly, it can significantly improve the energy efficiency of the system. By preheating the water that is fed into the boilers, less fuel is required to generate the same amount of heat. This not only reduces energy costs but also reduces emissions of greenhouse gases and other pollutants.

Secondly, reusing flue gas energy can help to reduce the strain on natural resources. By using less fuel to generate the same amount of heat, less oil, gas, or coal needs to be extracted and processed, reducing the environmental impact of the energy generation process.

Thirdly, reusing flue gas energy can help to improve the reliability and stability of the district heating system. By preheating the water that is fed into the boilers, the system is better able to handle sudden changes in demand for heat or steam. This can help to prevent disruptions to the heating supply and ensure that buildings and facilities remain warm and comfortable.

**Challenges of Reusing Flue Gas Energy:**

While there are many benefits to reusing flue gas energy, there are also several challenges that need to be addressed. Firstly, capturing and reusing the energy from flue gases can be technically complex and require specialized equipment. This can be expensive to install and maintain and may require significant modifications to the existing boiler house infrastructure.

Secondly, the quality of the flue gas energy can vary significantly depending on the type of fuel being burned and the efficiency of the combustion process. This can make it difficult to design a system that is optimized for the specific characteristics of the flue gas energy being captured.

Finally, the reuse of flue gas energy can be subject to regulatory and legal constraints. For example, in some jurisdictions, there may be strict limits on the number of emissions that can be released from a given facility. This can make installing equipment that captures flue gas energy difficult without violating these limits.

**Conclusion:**

The reuse of flue gas energy from water boilers in district boiler houses is a promising approach to improving the energy efficiency and sustainability of district heating systems. While there are several challenges that need to be addressed, the potential benefits are significant, including reduced energy costs, lower emissions, and improved reliability and stability of the heating supply. As such, it is likely that we will continue to see increased investment and innovation in this area in the years to come.

**References:**

1. Nikola Tanasić, Mirjana Stamenic, “Effects of Flue Gas Recirculation on NOx Emissions from Gas-Fired Utility Boilers”, Beograd, January 2022.
2. Elie Tawil, P.E., LEED AP, **“**Boiler Basics, Operation and Maintenance”.
3. “Boilers” by Carl D. Shields, McGraw Hill Book Company, U.S, 1961.
4. “Analysis of Using Exhaust Flue Gas For Power Generation In Thermal Power Plant”,
5. M. Hariprabhu, K. Sundararaju, K. Arnold Wilson Department of Electrical and Electronics Engineering, M. Kumarasamy College of Engineering, Karur- 639113, India.
6. **“**Influence of Flue Gas and Feed Water Temperatures on Boiler Efficiency – An Analysis”, Hari A. Bhaskaran Scientist ‘C’, Ministry of New and Renewable Energy, Government of India.
7. **“**Application of Recuperator for Waste Heat Recovery from Exhaust Flue Gas in Hot Water Boiler in the Central Heating Plant”, Gamze Karanfil Kaçmaz, Mehmet Ali Topçu, Selmin Ener Ruşen, Seyit Alperen Celtek, Article-March 2019.