AJLISI
GLOBAL RESEARCH NETWORK

Information Horizons: AMERICAN Journal of Library And Information Science Innovation
Volume 2, Issue 5, 2024 ISSN (E): 2993-2777

Thermal Power Plant Equipment and Environmental Impact

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Abstract. *Working principle of natural circulation drum steam boiler: Combustible mixture is fed to the combustion structure. The fuel combustion process does not take place here. The task of the combustion structure is to ensure good mixing of fuel and air. The combustible mixture is fed into the combustion chamber, where a high temperature (up to 2000 °C) is obtained as a result of the combustion process. Part of the heat is given to the evaporator tubes located on the inner walls by radiation. As a result, a water vapor mixture is formed inside the pipe. As a result of the density difference, the water-steam mixture moves towards the drum. Water and steam are separated here. Steam from the drum is fed to the steam heater and from there to the turbine. Feed water is supplied to the drum in the amount of this steam. This water, in turn, is heated to a certain temperature in the economizer.*

Keywords: *Steam boiler, steam turbine, electric generator, water basin, greenouse effect.*

Introduction.

In thermal power plants, steam boilers are the main heating equipment and convert the feed water into superheated steam with a certain pressure and tempe-rature.

The steam boilers installed in the plant to produce electricity are called power steam boilers, and the steam boilers used for technological and heating purposes are called industrial or heating steam boilers.

The movement of the water-steam mixture in the evaporator tubes is organized in two ways: natural and forced.(Nuraliyeva R.N. Baku-2010)

For this reason, steam boilers are divided into the following classes: natural circu-lation drum steam boilers, forced circulation drum steam boilers, straight flow ste-am boilers, combined circulation boilers.

In the energy system of our republic, drum steam boilers with natural circulation and straight flow steam boilers are used.

Working principle of natural circulation drum steam boiler: Combustible mixture is fed to the combustion structure. The fuel combustion process does not take place here. The task of the combustion structure is to ensure good mixing of fuel and air. The combustible mixture is fed into the combustion chamber, where a high tempe-rature (up to 2000 °C) is obtained as a result of the combustion process. Part of the heat is given to the evaporator tubes located on the inner walls by radiation. As a result, a water vapor mixture is formed inside the pipe. As a result of the density difference, the water-steam mixture moves towards the drum._[23] Water and steam are separated here. Steam from the drum is fed to the steam heater and from there to the turbine. Feed water is

supplied to the drum in the amount of this steam. This water, in turn, is heated to a certain temperature in the economizer. An air heater is placed after the economizer. Here, combustion products release their heat into the air. This air is used to prepare a combustible mixture. After all these processes, the temperature of the air discharged into the atmosphere drops to 140 °C-160 °C. (1)

Steam turbine

Turbine means "turning" in Latin. Steam turbines are heat engines. The steam first flows into the low-pressure medium in the channel called the nozzle, as a result, the speed of the steam in the nozzle increases sharply. The stream of ste-am coming out of the nozzle at high speed flows on the blades placed along the rim of the disk, which is immovably connected to the shaft. As the direction of movement of the steam flowing through the inter-blade medium changes, it gi-ves part of its kinetic energy to the blades (pushing the blades), as a result of which the disk and the shaft connected to it are rotating.[19]

According to the direction of steam flow, turbines are divided into axial and radial turbines, active and reactive turbines according to the effect of steam, medium pressure, high pressure and critical pressure turbines according to the parameters of the initial steam, throttle steam distribution, nozzle steam distri-bution and indirect steam distribution according to the steam distribution. .[20]

Electric generator

An electric generator is an electric machine that converts mechanical energy into electrical energy and is similar in structure to an electric motor.

Generators consist of 2 parts: the rotating part, the rotor, and the stationary part, the stator.

The winding of the stator consists of three phases, and in general it can be m-phase. The loop located in the rotor of the generator is called the induction loop.

The working principle of the generator is as follows: it is based on the conver-sion of mechanical energy into electrical energy. The Lorentz force describes the force acting on an electric charge when it moves in a magnetic field. If a conductor moves transversely in a magnetic field, the Lorentz force moves the charges on the conductor along the conductor.(Babayev Elman Bakı 2017)The movement of the load crea-tes a voltage difference across the ends of the conductor. To increase the vol-tage, they use conductors in the form of loops. In the generator, the rotor rotates relative to the body. When a stator with a magnet on it rotates in a magnetic fi-eld, the Lorentz force creates an electric current.

Impact of thermal power plants on the environment depending on the type of fuel burned

Impact of TPPs on the environmentTPPs are one of the main industrial enterprises that pollute the environment. The impact of NPPs on the environment can be clas-sified as follows: Impact of NPPs on the atmosphere

Flue gases emitted from the thermal power plant when the combustion process go-es properly .The following substances are released into the atmosphere from the smoke pipes of the thermal power plant: complete combustion products (CO_2,H_2O, SO_2, SO_3), incomplete combustion products (CO, CH_4, C_2H_4, $C_{20}H_{12}$), nitrogen oxides (N_2O, NO, N_2O_3, NO_2, N_2O_4, N_2O_5), ash particles, sodium salts, vanadium compounds, soot, etc.[20]

Flue gases emitted from the thermal power plant when the combustion process does not proceed properly.

As a result of the activity of both TPPs and other industrial enterprises, a large amount of SO_2 is released into the atmosphere.

The main feature of carbon dio-xide that causes environmental problems is that it creates a "Greenhouse effect" in the atmosphere. According to research conduc-ted in recent years, the amount of carbon dioxide in the atmosphere increases by 15 billion tons every year. About 22% of this growth is accounted for by IES. In our country, about 9 million tons of SO_2 are emitted from thermal power plants every year. [24]

Sulfur compounds are one of the constituents of combustion products released into the atmosphere. Sulfur compounds are SO_2 and SO_3, which are formed when fuels containing sulfur and sulfur compounds are burned. 95–99% of the sulfur compo-unds contained in combustion products are SO_2, and 1–5% are SO_3. In the convec-tive gas path of the boiler, part of the SO_2 is converted into SO_3. SO_2 is not that dangerous for the boiler plant and the environment. But SO_3 is considered dange-rous.

One of the other substances released into the atmosphere from nuclear power plants is benz-a-pyrene ($C_{20}H_{12}$), which is considered the most active of polycyclic aromatic hydrocarbons. $C_{20}H_{12}$ is formed when air does not reach the combustion process. It has been proven that $C_{20}H_{12}$ takes a maximum value at the temperature of 700-800 °C during the incomplete combustion process. In recent years, the pro-perties of benz-a-pyrene and its reduction methods have been studied by studying the effects of carcinogenic incomplete combustion products.

Nitrogen oxides (NOx) are present in combustion products emitted into the atmosphere, and in order to reduce their amount, first of all, the temperature in the furnace of the boiler should be lowered.

Ash is produced only when solid fuel is burned. The amount of ash in liquid fuels is very small, and it is practically absent in gas fuel. In modern times, solid fuel-fired NPPs use highly efficient ash removal devices to separate ash particles from the combustion products, and very small amounts of ash particles are released into the atmosphere.

Impact of NPPs on water bodies

NPPs pollute water bodies as well as the atmosphere. The pollution of water bodies means the generation of a large amount of waste water during the technological process in NPPs and the discharge of these waters into water bodies. When we say waste water in thermal power plants, first of all, additional water, condensate, fee-der, etc. Waste water obtained during water treatment and washing of heat exchan-ge surfaces and contaminated with various salts, alkali, acid, metal, oil and other mixtures is meant. This waste water is discharged into water bodies and water qua-lity deteriorates drastically. In addition to restoring the general average value of water quality indicators in water basins, there are continuous processes aimed at balancing and changing the composition of mixtures in water, and this is primarily due to the introduction of sewage into the water basin.

Several ecosystems exist in the same water basin, and each of them has its own dif-ferent processes. Wastewater has a certain influence on the course of these natural processes. Thus, as a result of waste water discharged from the NPP, the existing balance of the ecosystem is disturbed and sometimes it can reach such a level that all the animal and plant life in the water basin is completely destroyed. However, at this time, opposite processes are carried out in ecosystems to maintain their ba-lance in an optimal state. In other words, self-cleaning processes of water are ta-king place in the basin. However, the last-mentioned self-purification process is possible only when the wastewater contains a small amount of harmful substances and when the wastewater is purified to a certain extent. Otherwise, water bodies may face a serious environmental problem.

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Impact of NPPs on the living world. [25]

In addition to the impact of NPPs on the atmosphere and water bodies, they also have some impact on the soil. The absorption of a certain amount of waste water from the station into the soil, soil contamination during acid rains, and contami-nation of the upper part of the soil with ash particles are the main damage caused by NPPs to the soil. Due to the influence of sewage and acid rain, the process of soil salinization can also occur. Soil pollution by nuclear power plants indirectly reduces soil productivity. This, in turn, lowers the quality of the plants planted in that land. In addition, the productivity of plants directly decreases. Impact of TPPs on the living world When we say the impact of TPPs on the living world, it basi-cally means the effect of SO_2 and NOx gases on people, animal and plant life.

Effects of SO_2 on humans: During the effects of SO_2 on humans, special diseases occur in humans. These types of diseases primarily include atherosclerosis and related heart disease, chronic bronchitis, emphysema, bronchial asthma, etc. belongs to. The growth of these diseases is related to the number of people in large industrial cities and the level of atmospheric air pollution. If the average annual amount of SO2 or suspended particles in atmospheric air is 0.08-0.10 mg/m^3, then people's eyesight deteriorates, they experience some discomfort and breathing deterioration. If the average daily amount of SO_2 or suspended particles in the air is 0.08-0.10 mg/m^3, the health of people with lung disease deteriorates, their cases of seeking medical help increase, and sometimes death occurs.

Effect of SO_2 on plant life: Due to the effect of SO_2, the surface of the leaves is damaged and the leaves are exposed to the disintegration of chlorophyll. Coniferous plants in particular are more adversely affected because they are ever-green. When the amount of SO_2 in the air is 0.23–0.32 mg/m^3, the drying process of conifers occurs due to both photosynthesis and respiration, and the tree is com-pletely destroyed within 2–3 years. When the amount of SO_2 is between 0.08-0.23 mg/m^3, the speed of the drying process decreases as the speed of the photosynthe-sis process decreases.

Effects of NOx on humans: The first symptoms of NOx effects on humans are skin irritation and watery eyes. Nitrogen oxides are very poorly soluble in liquids, they penetrate deep into the lungs of people and destroy the epithelium of the alveoli and bronchi. In residential areas where the concentration of NOx in the air exceeds the norm, people's breathing worsens, respiratory diseases increase, and changes in methemoglobin in the blood are observed. [**23**]

Effects of NOx on plants: Plants suffer severe damage when the concentration of NOx in the air is 4-6 mg/m^3. When the concentration of nitrogen oxides in the air is 2 mg/m^3 for a long time, plants are exposed to chlorosis due to the effect of NOx. If the concentration of nitrogen oxides in the air is less than 2 mg/m^3, then the negative effect is not felt and only the growth rate of plants decreases.

CONCLUSION

In thermal power plants, steam boilers are the main heating equipment and convert the feed water into superheated steam with a certain pressure and temperature.

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Reference list

1. References Law of the Republic of Azerbaijan on efficient use of energy resources and energy efficiency
2. National action plan on energy efficiency for 2020-2025. Funded under the EU4Energy Initiative of the European Union
3. Nuraliyeva R.N. Economic and ecological problems of the development of Azerbaijan's fuel energy complex Baku-2010
4. Ch. M. Chuvarli, V. I. Jesman – Wind and solar energy, its conversion and use. Baku - 2003
5. Yusifbeyli N.A., Guliyev H.B. "Automation of electrical systems" Baku-2017, p. 458
6. Babayev Elman Alasgar oglu MASTER'S DISSERTATION BAKU-2017 on "Alternative and renewable energy sources, ecological and economic consequences of their use"
7. Aliyev H.S. "Electrical transmission theory" Baku-1970, p. 92
8. Efendizade A. "Automatic management of electrical transmissions" Baku-1964, p. 332
9. Kostenko M.P., Piotrovsky L.M. "Electric machines part 1" Baku-1969, p. 588
10. Kazimov Sh.K., Hajiyeva V.I., Novruzova S.Y. "Nakhchivan MR electric power system" Nakhchivan, NDU-2017, p. 244
11. Mammadov H.M., Abdinov A.S. "Solid State Electronics" Baku - 2004, p. 136
12. Mehdiyev R.F., Abdinov A.S., Huseynov T.Kh. "History and Methodology of Physical Electronics" Baku-2008, page 165
13. Poyarkov K.M. "Power plants, substations, lines and networks" Baku-1980, p. 325
14. Guliyev H.M., Taghizadeh S.M. "Fundamentals of the theory of electric circuits" Baku-1997, p. 280
15. Rustamzade P.B. "Electrical part of power stations and substations, part 1" Baku-1958, p. 664
16. Vazirov O.Y "Calculation of electric energy" Baku-1987, p. 128
17. Yusifbeyli N.A "Transition processes in electrical systems" Baku-2008, p. 336
18. https://policy.asiapacificenergy.org/sites/default/files/Law%20No.%20784-IQ%20of%201999%20%28AZ%29
19. http://rabite.nmr.az/metbuat/x%C9%99b%C9%99rl%C9%99r/gunes.html
20. https://minenergy.gov.az/az/alternativ-ve-berpa-olunan-enerji/azerbaycanda-berpa-olunan-enerji-menbelerinden-istifade
21. https://naxcivanxeberleri.com/cemiyyet/78737-culfa-kulk-guns-hybrid-electric-stationasi-rayonun-enerji-tahluksizliyin-muhum-tohfdir.html
22. https://www.energy-pool.com.tr/post/hibrit-elektrik-santrali
23. https://kontekenerji.com.tr/hibritenerjisantralleri/