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ADVANTAGES AND DISADVANTAGES OF DIFFERENT TYPE OF TURBINES IN POWER PLANT

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Abstract

As a conversion system, most traditional power plants need a turbine from different operating fluids such as water, coal, steam and wind into mechanical power that would be used to produce electricity. In the future, energy consumption is expected to be higher and, thus, to prepare for this, the power plant requires a high turbine efficiency to produce the optimum amount of energy from the operating fluid. Therefore, numerous developments have been made and researched in the technology of turbines. The hydraulic turbine, gas turbine, wind turbine, and steam turbine are four different types of turbine that will be discussed in this article. Based on their working fluid, each turbine was distinguished and various kinds of turbine have their own efficiency. There are certain parameters that influence the performance of the turbine, such as the element of the turbine, the operating fluid feature, the materials used, the innovation of cooling, and many more. Any future research is also under way to boost the performance of the turbine and thus increase the amount of electricity generated. The goal of this review paper is to classify the typical type of turbine used in power plants, as different types of turbines need different types of power plants.

Keywords: *Gas, Steam, Turbines, Wind, Water.*

I. INTRODUCTION

Turbines are power generating devices they extract energy from the fluid (as water, steam, or air) and transfer most of that power to some form of mechanical strength output, normally inside the shape of a rotating shaft. The motive of turbine technology is to extract the most amount of energy from the running fluid, to convert it into beneficial work with maximum efficiency, by using a plant having most reliability, minimum value, minimum supervision and minimal starting time. By any method, turbine converts ability electricity of gasoline to mechanical energy. Generators were used for centuries to convert to be had mechanical power from rivers and wind into useful mechanical paintings, commonly thru a rotating shaft. Turbines can be categorised by means of many approaches together with primarily based on fluid, in the foundation of principle operation and course of float. As an instance, while the running fluid is water, the turbomachines are called hydraulic mills or hydro mills. While the running fluid is air, and electricity is extracted from the wind, the gadget is nicely known as a

wind turbine. In coal or nuclear energy plant life, the running fluid is commonly steam; therefore, the turbomachines that convert power from the steam into mechanical energy of a rotating shaft are called steam turbines. A more universal call for generators that hire a compressible gasoline as the running fluid is fuel turbine[1][2].

II. DISCUSSION

Gas Turbine

Gas Turbine is turbine that used gasoline and it is extensively used in electricity technology due to its capability to provide excessive performance, low pollutants and occasional operational value. A gasoline turbine may be defined as a combustion engine that converts natural gasoline or other liquid fuels to form a mechanical strength. Apart from electricity technology, it also may be used in several exclusive modes in essential industries such as oil and gas, procedure vegetation, aviation, as well domestic and smaller associated industries. For this overview paper, the principle consciousness is for the gas turbine power plant. The primary operation of gas turbine energy plant is straightforward. There are 3 primary issue associated which can be compressor, combustor and turbine. The sparkling atmospheric air will flow through compressors which are functionally to compress air to high pressure. Then, this high stress air will brought with energy that produce from spraying gasoline into the air and igniting it so the combustor will start the combustion and generates a high temperature drift. This high stress and temperature air will then input the turbine and convert the warmth into mechanical strength in which the gases are extended via a turbine and rotating the shaft this is used to power the compressor and other gadgets along with an electric generator that may be coupled to the shaft. The left over power will then exits in exhaust gases in high pressure or excessive velocity manner[3].

Closed-cycle gasoline turbine is one of the sizable hobbies of power plant because the functionality to produce high thermal efficiency that allows you to compensate the high power call for which are growing each day. A variety of benefits of this turbine were indexed in Table 1-4. But, all electricity vegetation has their own issue as no perfect gadget is practical in this global[4]. As a result, the challenge or disadvantages of fuel turbine additionally has been listed below:

Table 1: Advantages and Disadvantages of Gas Turbine

Advantages	**Disadvantages**
Higher thermal efficiency	Complexity
Reduced size	Large amount of cooling water is required. This limits its use of stationary installation or marine use
No contamination	
Improved heat transmission	
Improved part load η	Dependent system
Lesser fluid friction	

No loss of working medium	The wt of the system pre kW developed is high comparatively, thus it is not economical for moving vehicles
Greater output	
Inexpensive fuel	Requires the use of a very large air heater

Steam turbine

A steam turbine is a mechanical device that converts thermal power in pressurized steam into beneficial mechanical work. The steam turbine derives a good deal of its better thermodynamic efficiency because of the usage of more than one stages within the growth of the steam. This outcomes in a 32closer approach to the ideal reversible technique. Steam turbines are made in a spread of sizes ranging from small zero.seventy five kw units used as mechanical drives for pumps, compressors and other shaft driven gadget, to one hundred fifty MW mills used to generate electricity. Steam generators are widely used for marine applications for vessel propulsion systems. These days fuel turbines, as advanced for aerospace packages, are getting used increasingly more within the area of power technology as soon as ruled by steam mills[5][6].

Table 2: Advantages and Disadvantages of Steam Turbine

Advantages	**Disadvantages**
Thermal Efficiency of a Steam Turbine is higher than that of a Reciprocating Engine.	Steam turbines have a few drawbacks, although approx. 80 percent of the world's electricity is reliant on steam turbines.
The Steam Turbine develops power at a uniform rate and hence does not required Flywheel.	
No internal lubrication is required for Steam, Turbine as there is no rubbing parts inside.	Not profitable smaller turbines
No heavy foundation is required for Turbine because of the perfect balancing of the different parts.	Side Effect of low pressure steam turbine
If the Steam Turbine is properly designed and constructed then it is the most durable Prime Mover. Much higher speed may be developed and a far greater range of speed is possible than in the case of Reciprocating Engine.	
There are some frictional losses in Reciprocating Engine as some arrangements are required for conversion of Reciprocating Motion into circular motion. But in Steam Turbine no friction losses are there.	Possibilities of complete mechanical failure
Steam Turbine are quite suitable for large Thermal Power Plant as they can be built in size from few Horse Power to over 200000 HP in signal unit.	Load change behaviour

Water Turbine

Water turbine is used to make strength in hydroelectric energy vegetation. The overall concept of hydroelectric energy is that you dam a river to harness its electricity. You are making it fall through a top (called a head) so it picks up pace (in other words, so its potential power is converted to kinetic electricity) rather than the river flowing freely downhill from its hill or mountain supply towards the ocean, then channel it through a pipe referred to as a penstock past a turbine and generator. Hydroelectricity is efficaciously a three-step electricity conversion from river's capability power is develop into kinetic strength whilst water falls through a top, kinetic electricity in the transferring water is converted into mechanical strength through water turbine, the spinning water turbine force a generator that trade the mechanical power into electrical energy[7][8].

Table 3: Advantages and Disadvantages of Water Turbine

Advantages	Disadvantages
Can cover up to 90% of the energy of water into electric energy	Negative impacts that a large-scale dam and reservoir hydro system has on the environment. (Impact of hydropower on the environment)
With this high efficiency the cost of hydroelectricity has dropped with evolving technologies, and is estimated to be about 40% less expensive than using fossil fuels.	
Since hydro power is fueled by water, it has the advantage of being only used when needed, because it is easy to control the storage and allowable flow of water into a hydropower system.	very expensive to implement, so it takes a long amount of time before a hydropower system will begin to return profits on the original cost of the investment.
Hydro power has an advantage over wind power because water is more dense than air, so collecting the mechanical energy of wind requires a greater force of wind to rotate the turbine than it would for water in a hydropower system.	

Wind Turbine

Most researchers and engineers have proposed wind turbines as an opportunity to conventional power deliver systems so one can lessen greenhouse gas emissions. Large-scale wind generators have emerge as very popular within the market; they will play a totally critical role inside the strength deliver requirements within the near future. Wind turbine helps to transform kinetic electricity in wind into mechanical energy. Presently, various international locations are installing big scale wind farms both on shore and offshore so that you can meet their growing power call for. In 2014,China has hooked up ability of round 114,609 MW of wind energy contributing 32.0% of the whole wind energy observed with the aid of United States of America, Germany, Spain and India which produce 65,879 MW , 39,165 MW, 22,987 MW and 22,465 respectively[9][10].

Table 4: Advantages and Disadvantages of Wind Turbine

Advantage	Disadvantage
It's a clean fuel source. Wind energy doesn't pollute the air like power plants that rely on combustion of fossil fuels, such as coal or natural gas. Wind turbines don't produce atmospheric emissions that cause acid rain or greenhouse gases	Good wind sites are often located in remote locations, far from cities where the electricity is needed. Transmission lines must be built to bring the electricity from the wind farm to the city.
Wind is a domestic source of energy. The nation's wind supply is abundant. Over the past 10 years, cumulative wind power capacity in the United States increased an average of 30% per year, outpacing the 28% growth rate in worldwide capacity.	Wind resource development might not be the most profitable use of the land. Land suitable for wind-turbine installation must compete with alternative uses for the land, which might be more highly valued than electricity generation.
It's sustainable. Wind is actually a form of solar energy. Winds are caused by the heating of the atmosphere by the sun, the rotation of the Earth, and the Earth's surface irregularities. For as long as the sun shines and the wind blows, the energy produced can be harnessed to send power across the grid.	Turbine blades could damage local wildlife. Birds have been killed by flying into spinning turbine blades. Most of these problems have been resolved or greatly reduced through technological development or by properly siting wind plants
Wind turbines can be built on existing farms or ranches. This greatly benefits the economy in rural areas, where most of the best wind sites are found. Farmers and ranchers can continue to work the land because the wind turbines use only a fraction of the land. Wind power plant owners make rent payments to the farmer or rancher for the use of the land, providing landowners with additional income.	The installation of wind turbines in order to meet 10–15% of global energy demand might cause surface warming by increasing the temperature by 1 °C on land.

III. CONCLUSION

Knowledge concerning forms of turbine utilized in power plants and its associated data, wanted a good way to pick out the right sort of mills based on their using fluid were mentioned in element. This paper has tried to cover a number of the issues related to common kinds of turbines. It's far hoped that this evaluation enables students to have a higher perception into the various factors of the turbines used in energy plant, so that the associated troubles may be tackled with better information and self assurance.

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