

Energy analysis and exergy analysis method

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Abstract

We mounted the thermodynamic evaluation model by means of the use of the actual dimension parameters of six hundred MW direct dry cooling strength plant in Wuxiang, China. The overall performance, particularly the exergy losses of the unit in addition to its subsystems in particular along with seven parts were acquired no longer most effective at one particular load however additionally at specific masses. We've determined that the exergy loss inside the boiler is generally greater than 70% of the whole exergy lack of the gadget, while the exergy loss of the combustion occupies more than 50% of that of the boiler. therefore, it's far critical to lessen the losses inside the boiler for electricity saving capability development, in particular that of the combustion and warmth switch. on the same time, the cold stop optimization has fairly huge capacity for power saving due to that the exergy efficiency of the air cooling device is pretty low being approximately 5.7% or so. in addition, we've got gotten the primary converting traits of gadget performances in conjunction with the weight alternate, together with exergy loss, exergy efficiency and coal consumption, which were derived from the real-time system performance records according to a massive quantity of measured records in actual time. if you want to make the complete device run greater effectively, it's far cautioned that the unit need to run at the load higher than 350 MW.

Keywords: *Exergy analysis, Exergy Loss, Exergy efficiency, unique operating condition, Load Variation I.*

INTRODUCTION

Thermal power plant combining the coal-burned boiler and steam turbine has been growing toward splendid power, high parameters, electricity saving and surroundings-pleasant. The operation of the energy plant is a complicated procedure with characteristics of nonlinearity, time-variation, multi-loop coupling. moreover, the evaluation of the version regulation of the thermodynamic process and the loss distribution is the important thing to the correlational researchers, such as the operation optimization, manage evaluation, fault diagnosis and analog simulation [1] [2] [3]. Therefore, the observe of the entire approaches of the thermal electricity plant approximately electricity input, release, transmission, and conversion can have

very essential importance for the studies on the gadget optimization operation. lately, a lot of students have completed associated research on coal-fired energy plant from extraordinary aspects. That allows you to improve the overall performance of coal-fired strength plant life, together with manipulate of pollutants, numerous research had been performed. Advanced self-mastering controller has been evolved and the effects of advanced manipulate concept on combustion process were analyzed the usage of artificial neural-network based totally parameter prediction model; however they have now not analyzed the effects throughout actual time thermal power plant operation [4]. Bastian Hoffmann, etc. have evolved the best method to analyze impacts of climate

alternate on cooling systems and energy plant performance by modeling selected German thermal electricity plant devices and their respective cooling systems via dynamic simulation taking into consideration legal thresholds for warmth discharges to river water together with climate records projections. And the offered modeling approach can provide high temporal resolution and the precise illustration of website particular plant homes to support the planning of manufacturing and optimization of plant revisions [5]. so that it will compare the electricity plant from a more complete perspective, a multi-standards assessment of the six specific electricity flora is carried out through Analytic network method (ANP) with respect to technical and sustainability, financial applicability, pleasant of life and society economic impact. [6] .if you want to sell preventive renovation as well as failure analysis at the same time as making sure a degree of compliance with statutory policies, a brand new technique for short- and long-term assessment of the operation of a thermal energy plant became proposed. It became focused on a new manner for detection over exceptional thermodynamic variables involved, without discussing thermal overall performance of the machine, e.g., thermal performance, exergy performance as well as exergy destruction, and coal intake, and many others. [7] .An method based on statistics envelopment evaluation (DEA) and game theory has been delivered. They described two classes of inputs (operational and non-operational) to measure performance of power plants located in Iran so one can evaluate choice making units (DMUs) irrespective of their wide variety through a huge scale of measures inside the aggressive surroundings [8] . In allusion to a 50MWe sun thermal power plant, two distinctive cooling technologies for it are in comparison from the exergetic standpoint, especially focusing at the exergy

destruction, without considering the effect of various hundreds on the gadgets' performances [9]. Taking coal-fired power plant as the studies item, the relevant students also have performed a number of research concerning CHP, CO₂ capture and pollutants controlling, and many others., the purpose is to as a way to make this long-term used primary energy era systems extra quite green and extra environmentally friendly [10][11] [12][13] [14].The above investigations are particularly for the overall assessment of power plant overall performance, such as multi-criteria complete evaluation methods, on-web page detection strategies, network analysis and blended with environmental and monetary factors of complete assessment strategies. Similarly, we additionally want to investigate the specific vicinity and length of the power loss that allows you to make clear the distribution and lack of energy in the electricity plant. Analysis of strength generation structures are of medical interest and also essential for the green utilization of energy resources. The maximum conventional approach of building mathematics fashions primarily based on the primary regulation of thermodynamics is widely used to evaluate the overall performance of strength systems [15][16][17][18] .the primary law method does no longer account for the degradation or irreversibility of electricity in the system. While the technique of exergy evaluation based totally on the second one regulation of thermodynamics perfects the technique of power stability and gets down to research at the entire machine from the better stage of the conservation and degradation of electricity first-rate. Exergy evaluation is a useful technique to layout, evaluate, optimize and improve thermal electricity vegetation, no longer only to decide the scale, area and purpose of plant irreversibility, but also to assess the overall performance of everything of the plant meaningfully. This

analysis permits one to quantify the loss of performance in a technique because of the loss in power pleasant. lately, there is growing interest within the mixed utilization of the first and second legal guidelines of thermodynamics, the usage of such concepts as exergy and exergy destruction so one can examine the efficiency of which the available energy is consumed. It is able to be stated that appearing exergetic and energetic analyses collectively can provide a whole depiction of machine traits. The sort of comprehensive analysis may be a extra convenient method for the performance assessment and determination of the steps in the direction of development [19][20][21][22][23]. For these reasons, the strength usage analysis offers a real degree of electricity era device performance. in the literature, there exist a number of papers regarding energetic and exergetic performances of coal-fired thermal strength plants. In allusion to coal fired electricity flora, specifically such as regenerative-reheat Rankine cycle power flowers, the usage of subcritical, supercritical, and ultra-supercritical steam conditions, in addition to nuclear steam power plant life, the exergy evaluation approach was applied to decide the exergy losses and the exergy efficiency of the power plant as well as character components [24] - [32] . Inside the published literature, now not a great deal is reported at the power and exergy evaluation of huge-scale generator structures through combining stay real-time size parameters. Exergy evaluation can be used to go greater into information of the plant to localize and quantify the exergy losses. undoubtedly, new green strength cycle structures and technologies will retain to seem, but, the traditional

thermal electricity vegetation using coal as the principle fuels will keep to play an essential role in electric powered strength production field, especially in China, where the coal occupies the dominant role inside the power structure. The essential research of the traditional ruled thermal power gadget especially with the in-depth technique has very essential importance for complete understanding of the operational mechanism of the strength gadget, for this reason, providing beneficial guidance for the efficient operation of the actual unit. On this paper, the complete electricity utilization analysis of the 600 MW strength plant is finished mainly by using the usage of the actual going for walks dimension statistics, specifically below the precise and variable working conditions, which exhibits the concrete energy loss and erergy performance of the system and its additives. As a result the take a look at can lay a stable foundation for the development of strength plant overall performance.

Description of the device and analysis Methods

Description of the System

As shown in figure 1, the float sheet of the thermodynamic machine is set up according to the practically walking six hundred MW thermal strength plant with the direct air cooling condenser in Wuxiang, China. From the perspective of studies, the entire machine is specially divided into seven subsystems, inclusive of the boiler system, coal pulverizing system, fuel air machine, steam turbine machine, regenerative gadget, air cooling device and energy era device, which have different capabilities respectively.

Steady-flow Engineering Devices

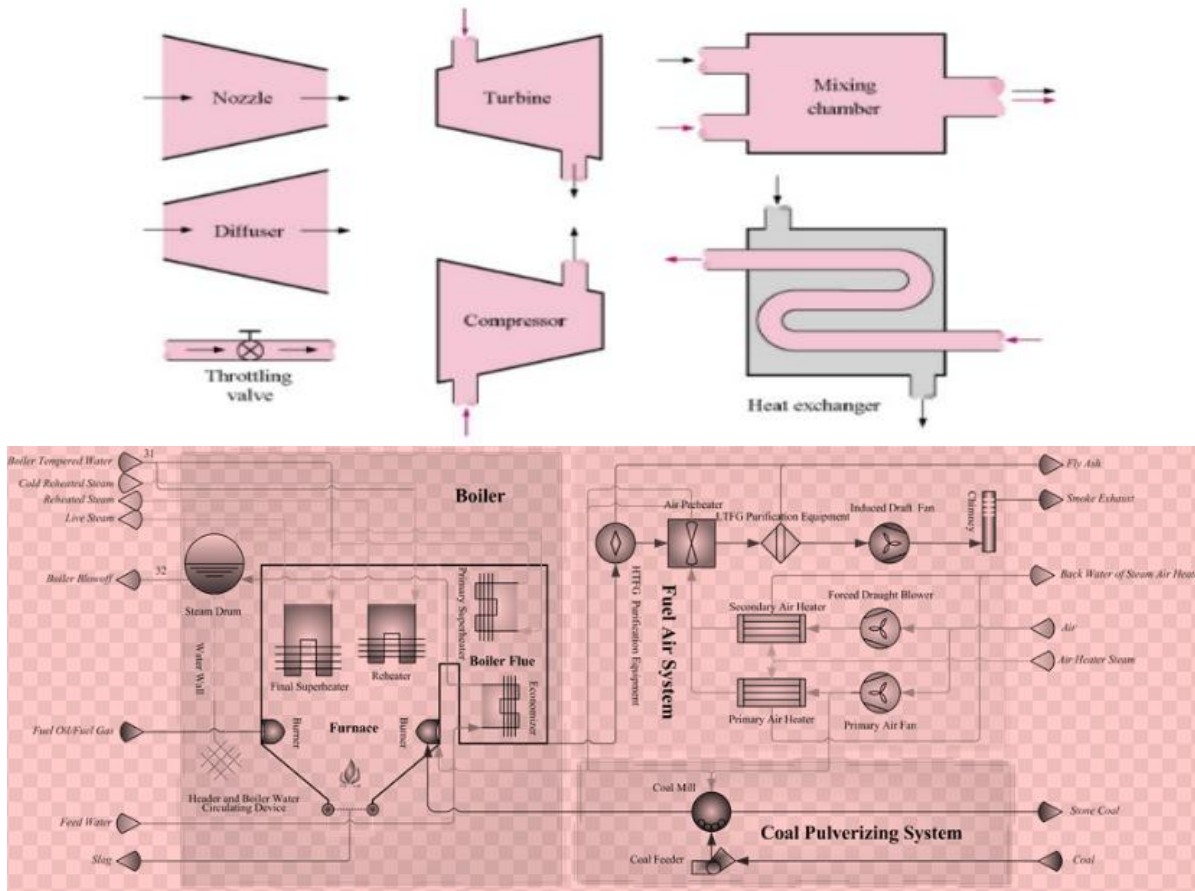


Fig 1 sheet of the thermodynamic machine

Electricity and Exergy analysis Methods

The technique of strength evaluation based totally on the primary regulation of thermodynamics is commonly used to investigate strength gadget overall performance. even as the exergy analysis combining the primary and the second one regulation of thermodynamics is to probe the essence of the power loss and the distribution of the available power from the point of view of energy quantity and energy best, which well-known shows things: the destruction of exergy within a system component in addition to the exegetic performance showing how efficiently the exegetic assets provided to a

issue were used. in this paper, as a way to evaluate the performance of the system synthetically, this paper uses the power analysis technique and the evaluation technique and evaluates them with special assessment indexes, consisting of thermal efficiency, efficiency, loss fee, loss rate and dissipation warmth and net coal consumption. The exergy float is proven in figure 2.1, wherein the red arrows constitute the input and the output exergy of the system, black arrows the trade exergy among the subsystems, and blue arrows the exergy losses for a one of a kind manner.

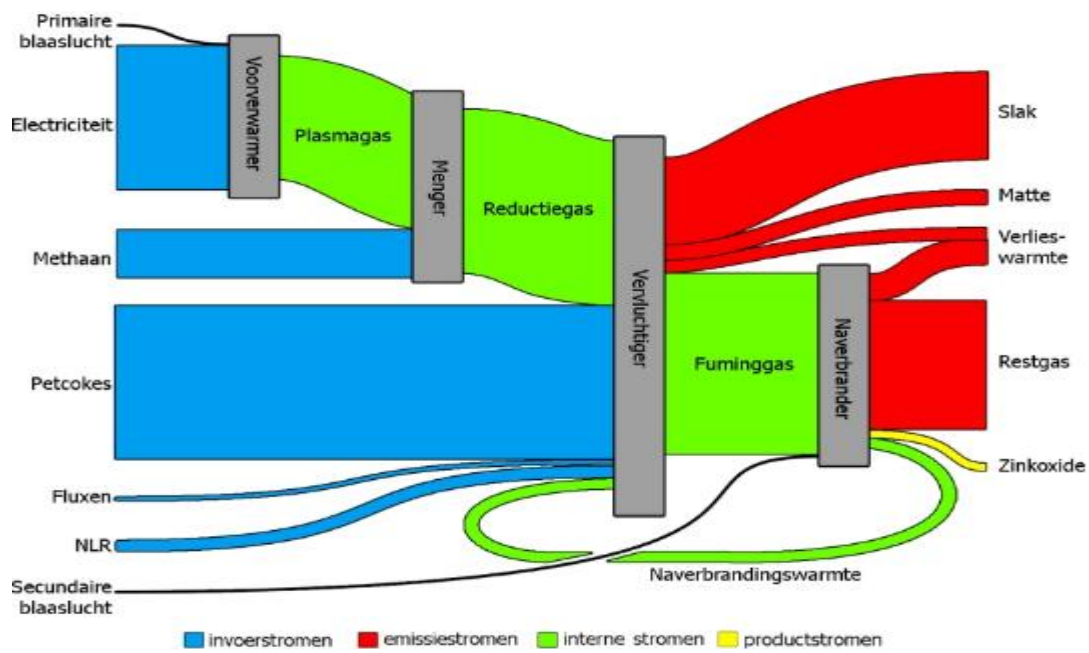


Fig. 2.1 Exergy

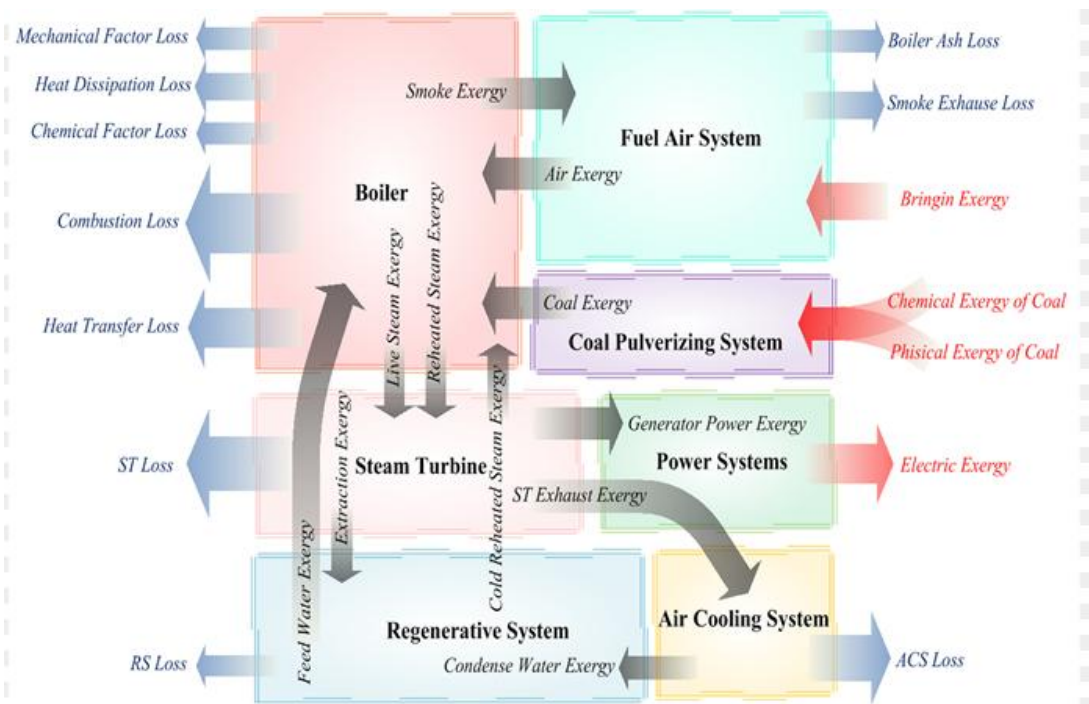


Fig- 2.2 Exergy flow

Exergy analysis Model3.1.

Assumptions In order to research the overall performance of the gadget through exergy analysis, some hypotheses are made as follows: a) Ignoring the diffusion exergy loss of working medium in the pipelines and small leakage of running

medium at equipment joints or connections.b) waft charges of liquid and stable mediums are from the measured records and that of the gasoline medium from exceptional equilibrium calculation of system.c) The working medium mixes uniformly at the condition of regular

flow.d) To make sure the reliability of the measured parameters, they have to be examined and filtered earlier than into model for calculation.

CONCLUSIONS

Electricity evaluation and exergy evaluation method had been used in this paper, mixed with the most extensively uses in the actual operation of 600 MW direct dry cooling power device, a complete monitoring of the method of the operation condition with the entire load has been achieved. The precise calculation, evaluation, and dialogue of the assessment index of the strength utilization were given through the status quo of the whole thermal system primarily based at the logistics system, the exergy drift techniques, and thermal evaluation model. And we get the subsequent primary conclusions. 1) The main a part of the exergy loss in the entire gadget is the boiler amongst which the ratio of the exergy loss is more than 70% at every running load. The exergy losses of the combustion with the ratio of the exergy loss extra than 50% are the primary parts of the boiler machine. Consequently, the decrease of the combustion and the heat switch loss is the important thing to the power saving for the thermal strength plant. 2) The exergy of the steam turbine and the air cooling gadget is almost similar to the ratio of the exergy loss inside the overall device is ready 10% both. The exergy performance of the steam turbine is eighty% or so. Nevertheless, the exergy performance of the air cooling device is pretty low which pretty much 5.7% at the load price 85%. So the ability for electricity saving of the air cooling machine is great. Three) the heat and internet coal intake have a similar lowering fashion with load increment. while the load is much less than 350 MW, both the warmth and internet coal intake indicates the pointy boom with the burden decreasing. And whilst the burden is more

than 350 MW, the heat and the internet coal intake boom linearly and lightly with the burden lowering. Meanwhile, the exergy performance of the complete gadget decreases with the consistent pace with the weight lowering. Therefore, so that you can enhance the performance of the entire machine, its miles recommended that the unit should run at the load better than 350 MW. in step with the traits of thermal electricity technology and the electricity consumption regulation of the real thermal operation, we are able to retain doing the following work that includes the studies at the unreasonable links and the high exergy intake techniques primarily based at the outcomes of this paper, so as to research the lifecycle of the thermal energy gadget and evaluation the complete process of strength device from the proposed thermal economics factor of view.

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