

# Research status and evaluation system of heat source evaluation method for central heating

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**Abstract.** The central heating boiler room is a regional heat source heating center. It is also a kind of the urban environment pollution, it is an important section of building energy efficiency. This article through to the evaluation method of central heating boiler room and overviews of the researches during domestic and overseas, summarized the main influence factors affecting energy consumption of industrial boiler under the condition of stable operation. According to the principle of establishing evaluation index system. We can find that is great significance in energy saving and environmental protection for the content of the evaluation index system of the centralized heating system .

## 1. Introduction

This topic put forward ten important indicators and established the system of central heating heat source energy saving index evaluation system. According to the analysis of central heating heat source evaluation methods both at home and abroad, respectively from the perspectives of social factors, environmental factors and also together with the present situation of central heating in Jilin province.

Now cold concentrated heat input rate of Jilin province area already amounted to 90%, in which large and medium-sized regional boiler rooms heating accounts for about 50% of central heating.

So the benefit of central heating is very important, we use a layered approach to establish heat source evaluation index and method to establish the heat source of heat the weight of evaluation index system and the structure of the system

## 2. The research status and analysis of the evaluation method of the central heating boiler room

### 2.1. Summary of evaluation methods both at home and abroad

Along with society's progress, the development of the Times, people have been aggressively explore the earth's resources from steel era, gradually formed the consciousness of environmental protection and the sustainable development of society and resource brought about widespread attention. Abroad on evaluation system of urban central heating index research began with technology evaluation, the development of energy utilization evaluation gradually to satisfy both social and economic development and national benefit comprehensive evaluation theory. It is necessary to continue to enrich the domestic urban heat index. To make evaluation more standardized According to the different perspectives of evaluation theory, it can be divided into three categories: First, the evaluation theory about economic perspective; Second, about social perspective evaluation theory; Third, the evaluation theory about sustainable development perspective.



## 2.2. Overview. AHP

AHP (Analytic Hierarchy Process (AHP) was put forward by a famous American professor at the University of Pittsburgh in the 1970 s. It is a kind of important decision method .This method make the complex problem can be simplified, classified summarised according to has the characteristics of the project, and then will be able to influence the nature of the problem in all aspects for further analysis, and judgment to build a basic hierarchy model, then according to its content further build the second level model. So that we can find the inner link between the things it and the influencing factors. An embodiment of the content of the complex detailed, so as to provide simple decision method is clearer. It is the human thinking process hierarchical, quantification, and mathematics for analysis, decision making, forecasting provide quantitative data or control. It is especially suitable for the qualitative judgment plays an important role, is difficult to accurately measuring directly the result of the decision situation.[1]

## 3. The central heating boiler evaluation index

As the evaluation index of the central heating boiler room, the first part is divided into two categories: qualitative and quantitative. Respectively from the boiler room economy benefit, safety performance, the national standard, and energy conservation and environmental protection four aspects: determine the content of each index, according to the content of the data acquisition found each internal connection between formula is determined, it is concluded that the numerical after with national standard and combining the reality of indexes. Can be intuitively found problems of boiler efficiency in one area, but on the other hand , it not necessarily can improve the energy saving effect of the boiler.

### 3.1. The boiler running qualitative indicators

**3.1.1. Boiler type selection.** Industrial boiler plant boiler main types including chain furnace, reciprocating furnace and circulating fluidity bed boiler, boiler type directly affect the efficiency of the boiler. Chain furnace is the main type of furnace, accounting for about 70%. But the chain furnace boiler operation efficiency is low, at about 65% on average, than the low efficiency of boiler design and 10 ~ 15% [2]. First, observe the scene boiler stations, measured the capacity of a single pot boiler. Furnace room number of the boiler should be controlled by 2-4 sets;single capacity should be between 7 and 14 MW, is greater than or less than this range will affect the boiler room of the temperature of the heating area and resource loss. Second, the fuel type to design appropriate to the types of coal and boiler. Burning boiler design and types of coal are a far cry from what would have been to a certain extent of damage swirl burner of a boiler or other components. Coal type and should satisfy matching with type boiler and its calorific value in severe cold and cold area residential building energy efficiency design standard [3] minimum design efficiency of the boiler.

**3.1.2. Smoke wind system.** In the fan and induced draft fan smoke wind system configuration parameters and frequency conversion system configuration is perfect, will affect the operational efficiency of the fan and energy loss. In boiler concentration system, the system resistance increased dramatically, induced draft fan doesn't adapt to the change of the system, will be difficult to meet the boiler continuous heavy load operation.

**3.1.3. Automatic adjustment control device.** Currently, the district heating boiler with a low degree of automation, the existing automatic control system for the main role is to ensure the safety of operation, such as relief valve, the over pressure alarm, etc. To fire workers do not understand the best working condition of the boiler, boiler combustion operation often bad, HTM run under low parameters. Boiler room should be set in the process of combustion automatic control device [4]; heating parameters control device and linkage and climate compensator, heat meter device, etc.

Replace without automatic adjust completely relies on experience stoker state, more precise adjustment boiler state, the greatest degree of the motor running.

*3.1.4. Insulation.* The central heating heat source of centralized mode and transportation mode mainly by boiler equipment and piping hot water, and the temperature of the pipe and equipment loss besides non-quantifiable will consume more energy, according to the outdoor temperature to reduce dramatically dissipate more heat transfer heat to the individual. So, heating equipment and pipe line corresponding heat preservation measures should be taken, with or without thermal insulation layer to a certain extent can reduce heat loss in the conveying process, improving the efficiency of the boiler.

*3.1.5. Operation and management.* Stoker personnel and professional management personnel have become a boiler room now must face the problem.

- 1. Operating personnel should be the regular and accurate record of heating parameters; the main monitoring data and real-time uploaded to the monitoring center when the equipment is running status.
- 2. The heating load curve of heating system adjustment parameters, the efficiency of boiler running sets according to the load and load should be adjusted.
- 3. Boiler after a new installation, overhaul and technical transformation should be thermal efficiency test, the thermal efficiency of the running time interval should not be more than three years.
- 4. The boiler should be checked regularly, and the heating surface of the solid should be removed and slagging, dust, scale and corrosion of pipes and boiler.
- 5. Coal should be according to the batch tests and coal quality analysis, and according to the features of the coal series of preconditioning.
- 6. Water quality standards should be consistent with existing national system.
- 7. Management personnel should receive training on a regular basis.
- 8. Stoker personnel should be stable and strong professional knowledge.
- Due to the heating equipment records and feedback often does not reach the designated position. Operators don't get professional trained .They don't have basic knowledge, good foundation and experience in emergency, so they can't take care of the boiler in science. Through simple experience neither energy conservation and environmental protection, nor the best condition of the boiler and play their efficiency. Evaluation of artificial factor occupies a considerable proportion. We must attach much importance to the display status of boiler equipment monitor log . Whether the running of the boiler regular maintenance and cleaning. Contrast boiler efficiency before and after testing whether there is a problem is an important factor cannot be ignored.

### *3.2. Quantitative indicators and evaluation system of grading rules*

*3.2.1. Boiler efficiency.* Boiler type, the return water temperature of water supply capacity and coal is the main factor affecting the boiler efficiency, the average for the return water temperature directly determine the thermal efficiency of boiler. At the same time, low calorific value coal unit mass of coal combustion heat release can determine the efficiency of the boiler load rated. The use and design types of coal do not match, the quality is not stable. In today's society, a single boiler coal consumption is estimated numbers ,it can not reach an accurate numbers for coal to give supply. We can only use coal in the chain furnace travel distance  $L$  , time  $T$ ,  $H$ , coal mass thickness  $G$ ,  $M$ , bulk density  $P$  derived Formula B to get consumption of coal. That is to say, it will be a problem for future industrial boilers how to accurately grasp the central heating system of coal consumption of number. Determine the value of Industrial boiler thermal efficiency calculation is better, that can determine the level of industrial boiler thermal efficiency[5] . The value of Industrial boiler thermal efficiency calculation shouldn't be lower than the national standard.

**3.2.2. Power unit load ratio.** Studies have shown that there is a lot of equipment and working procedure in the boiler room, the whole boiler station use the same electric meter. So we can't have accurate understanding of electricity consumption of boiler in the accessory equipment, induced draft fan, dust collector, coal equipment, crushed coal equipment and desulfurization equipment. We can only according to the fan, induced draft fan the rated power and the actual power to control boiler room of electric power and heat load ratio.

**3.2.3. Exhaust temperature.** A large amount of smoke and exhaust temperature too high have become main factors of industrial boiler exhaust heat loss. Among them, the furnace exit should maintain optimum excess air coefficient and the optimal amount of smoke. It is a scientific method to record exhaust temperature control, collect regularly smoke exhaust temperature and calculate a number of their average in every hour. According to the specified conditions under the specified value, the industrial boiler exhaust smoke temperature and exhaust gas temperature of the boiler heating surface of the maximum temperature should not exceed 180 degrees, when the industrial boiler is operating.

**3.2.4. Ash content of the fuel.** In the burning process of coal, only a small part of the coal is completely burned, cause that the combustible ash content is too large, waste resources and pollute the air, and cannot use secondary heating temperature, so choose the appropriate and rank of coal is important for energy saving and emission reduction of a task. But first layer furnace under rated load the run time should not be the choice of purchasing low-quality coal of coal. Second, for industrial circulating fluidized bed boiler, the removal of anthracite coal ash can is achieved combustible content. Standard to the national standard coal-fired industrial boiler ash combustible content in the specified value shall prevail.

**3.2.5. Smoke excess air coefficient.** In the actual, operation of the pulverized coal fired boiler, excess air coefficient is reaction with an important indicator of pulverized coal and air. Excess air coefficient is too big, not only reduce the furnace temperature but also affect the combustion, it still can make smoke volume increase, that cause the boiler exhaust heat loss and the fan's power consumption is too large. Instead of smoke in excess air coefficient is too small will cause the chemical and mechanical incomplete combustion of coal, heat loss increased. Boiler room should use zirconium oxygen meter oxygen determination of measuring the many times, after selecting the effective value, fill out oxygen.

#### 4. Conclusions

Central heating heat source energy saving index evaluation system is conducive to the heating enterprise energy-saving operation, market guidance as well as the government's macro guidance of heat-supply enterprise. Use evaluation and scientific evaluation system of the effective method could analyze the central heating energy-saving operation conditions and energy saving operation of potential. That is to develop new energy saving regulations, policies, standards and related policy are one of the important basis. In actually improve the economic benefit of heating, energy conservation and emissions reduction and environmental protection as the center, we could find the effective ways to improve the efficiency of the boiler is the goal of the evaluation system.

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