Innovative Application of Air Conditioning Energy Saving Technology in Commercial Complex Building

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Abstract: Energy saving measures, such as air conditioning heat source system, air conditioning, air conditioning external air system, air conditioning terminal system, air conditioning terminal system, etc., are applied in directional international office and commercial facilities. The building won the annotation of "2-star green building design logo" in China and "LEED Gold Award" issued by American Green Association.

1. Introduction

The national business center is located in the north of Shanghai Century Park, connecting the Pudong main road between the Central Park and the land AZ financial center. The project covers an area of about 100 meters from north to south[1], 210 meters from east to west and 19.83 square meters. The building is a large savings building with two East-West towers and two benchmarking towers. The total construction area is about 150427.4 square meters. The ground area is 82505.4 square meters, and the underground area is 6792 square meters. The total height of the building is 99.5m. There are 20 underground floors and 4 underground floors. The building is a commercial office.

2. Air Conditioning Cold and Heat Source System

Using Smad design software to calculate the time, the cooling load of air conditioner is 15432 kW in summer and 6240 kW in winter. The load index of air conditioning in summer is 145 w / m2, and the heat index of air conditioning in winter is 59 w / m2[2].

2.1. Strategies for Air Conditioning Cooling Heat Source Layout

In this project, the air conditioning and air conditioning heat sources of the four major 3517kw (1000rt) and 21110kw (600RT) York water chillers are deployed in the refrigeration room for the aviation group B4. Business facilities, function diversification and movement mode change. In order to respond to other cooling actions, high efficiency actions can be maintained[3].

Cop price of 100rt is higher than that of 600RT. In the partial load rate, the load rate of four 1000rt reflectors is 40% ~ 60%, and the frequency conversion operation is controlled, and the priority is given to the later.

2.2. Heat Source Configuration

This project provides gas-fired boilers with 6240kw of air conditioning heat and 1600kw of available hot water with three major evaporation capacities of 2800KW / unit. 95% and 110 ° C of the boiler have exhaust temperature. The remaining two traditional boilers have 92% and 170% of cigarette gas respectively. According to statistics, the total consumption of building boilers in 2016 was 189571 m3 / h. If the boiler is equipped with gas recovery device, the gas consumption is 295 Nm3 / h. The gas consumption of ordinary boiler is 304nm3 / h, and the gas cost is 4.17 won / m3.

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At the same time, the boiler installed with the heating recovery device is first opened, the annual operation time of the boiler is 4380h / A, and the calculated annual saving is about 39420m / A. Conversion of standard coal saves 39420 × 1.2143 = 47867.7kce/a. The operating cost was saved 16431.4 yuan[4].

2.3. Free Cooling

According to the construction scale of the commercial building (the functional characteristics with a precision depth of more than 8 meters), the internal area of the building should be cooled especially the commendation desk area. Therefore, a plate heat exchanger with a heat exchange capacity of 1200 kW is set up in the cold and heat source system, and indirect free cooling is provided in the cooling water in a specific field environment. During this event, the part of indoor humidity is usually negative, so the temperature of cold water supply is adjusted to 11 ° C, return to 5 ° C, and the indoor temperature and humidity can continue to meet the requirements can be appropriately adjusted. As shown in Fig. 2, the temperature of indoor humid area is 8 ° C[5]. when using, according to Fig. 2, "statistics of special analysis meteorological data of China Building", the economy and recovery temperature are 11 / 16 ° C. Now it can use 2514 hours of cooling time for free in a year.

2.4. Air Conditioning Water System

The air conditioning water system adopts 4-pipe closed mechanical circulation system. The static pressure device of the trunk is set for cooling, heating and free cooling respectively. The water tank is located on the roof of the Dongyang tower. Cooling system, variable flow of secondary pump, fixed frequency of 1 group, frequency conversion of 2 pump. The speed of the pump is the choice of the cold water pump of the air conditioner. The most ideal is to control it according to the fantasy pressure difference detector.

The primary elevator of the combined ladder is relatively neat (9mh2o), but due to different large-scale functions, the second time in terms of overall lower pump rise between other areas is quite different. In addition, in order to reduce the energy supply of the pump and recover the air conditioning temperature is 7 ℃ ℃to C ℃ and the supply of small trends. Due to the third power relationship between power consumption and process, the energy saving rate is 1 - (g T7 / g delta T5) 3 = 63.5%. The heating system is the 90 ℃ / 70 ℃ hot water which is produced by the high temperature plate heat exchanger 60 ℃ / 50 ℃ / 50 ℃ twice. The air conditioning temperature uses the primary pump system, and the pump frequency is variable[6].

3. Air Conditioning System

In the above ground commercial and office areas, the VAV system is used in a single public way, and the internal and external areas are limited by meters. Commercial outdoor VAVBOX with reheating lines. The area outside the office is divided into two outer fields AHU in Northeast and southwest directions, with four controls. The AHU is set to the inside area of both controllers. The variable air volume system adopts the positive pressure control method to measure the temperature and compare with the indoor temperature setting value, forming a feedback class, and the development of VAVBOX (pressure) adjusting shock absorber is also independent. At the same time, the frequency regulation of the electric fan is returned after comparing the Zheng seizure value and the setting value. The minimum frequency of the fan is set to 30 Hz, which is influenced by the indoor ventilation time (6-8 times in the shopping center, 3-6 times in the transaction area) and the frequency conversion of the fans themselves. The amount of fresh air does not change with the situation, it can make people feel comfortable.

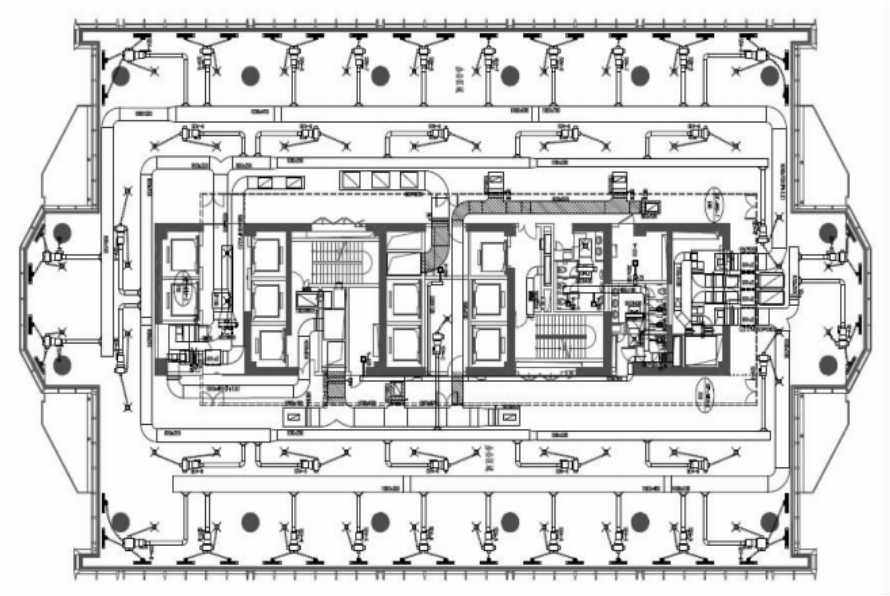

Figure 1 Air conditioning and ventilation plan at the top of standard tower

4. Energy Saving Measures for Fresh Air

Fresh air plays an important role in people's comfort. For the fresh air system, the project will implement fresh air saving measures according to the connection mode of various places and fresh air in the commercial office.

4.1. Energy Saving Measures for Aboveground Commercial Fresh Air

The air conditioning unit rooms in this area are all installed on the outer wall, and the fresh air is directly connected to the rainproof. This advantage is that during the transition period (mainly dehumidification in summer in Shanghai, lower than the risk of indoor air conditioning), fresh air is used as a natural cooling Park, reducing the cooling capacity[7], reducing the mechanical cooling capacity, and adopting a natural gas ratio of 50% to 80%. The external air duct and rubber shall be set according to the maximum external force. In order to ensure the balance of air volume, the exhaust fan must keep the fresh air speed consistent with the variable speed or manual control.

4.2. Fresh Air Saving Measures in Tower Office Area

The air conditioning room in this area is in the furnace tube. If considering the construction cost of the area, the natural cooling in the transition period can not increase the fresh air volume, but 8 heat recovery units (side roads) are set. During the non transitional period (the outdoor entertainment summit in summer is 76kj / kg, which is not suitable for the outdoor temperature of 14 ℃ in winter, and the indoor fresh air and exhaust runners handle the complete / heat recovery in advance. The candidate's heat recovery efficiency is more than 60%. The mechanical freezing capacity and boiler heating capacity will be reduced, and the remittance will be made through the air conditioning box of each mechanical room in the vertical axis. The rest of the outside air under the outdoor parameters will be connected directly to the hot water side. The towers in the East and West are divided into high-rise and low-rise. The 5-12 floors are low area, and the heating device is set on a wide tree. The 13th to 20th floors are high-rise buildings with equipment on the roof of the tower.

5. Inner Circulation Breathing Curtain Wall

To ensure the long-term stability of the indoor environment, the office rental area uses the internal circulation type breathing curtain. As shown in the rescue section in Figure 4. The fourth picture is divided into interior wall and exterior wall. The curtain wall outside is a closed curtain

wall. The wall is made of glass. The inner curtain wall can be a single-layer glass window, which can be opened for cleaning and repair. The width of the inside and outside passage of the curtain wall is 200 mm (curtain wall). At the same time, the entrance and exit of the curtain wall are open, and the exit is connected with the air conditioning and ventilation system[8].

Using this type of curtain wall can not only save energy, but also install electric shutter in the internal channel. This summer, the sun shading function is used to reduce the cooling load of the encoger. In addition, in order to avoid the changes of indoor temperature and humidity caused by outdoor environmental factors, the frequent actions of the air conditioning control system are reduced by the blower. On the whole, it reflects the pursuit of high-end comfortable buildings in the office area.

6. Air Conditioning Pressure System

In particular, the air conditioning system and automatic control system of the building adopt large-scale and multiple systems. In the case of multiple building functions, the working hours and the buildings with time difference between the air conditioning Department complement each other. All main equipment of building refrigeration equipment (chiller, air conditioning circulating pump, water treatment equipment, etc.), water and water temperature, worst pressure difference, flow of cold and heat source system will be connected to PLC programming first. BA system coefficient through communication interface[9]. Terminal equipment (VAVBOX, electric fan, air conditioning box, etc.), temperature and humidity and pressure detector, DDC connected to the floor first, connected with BA system. Finally, the real-time monitoring of air-conditioning room parameters and air-conditioning equipment operation status is realized. At the same time, users who can uniformly manage the operation time, air conditioning capacity, indoor parameters and other rental management should avoid non absolute energy caused by personal reasons.

7. Conclusion

Shanghai Pudong's landmark construction makes the situation of the international business office attach great importance to the national requirements for environmental protection policies. From the point of view of air conditioning and ventilation, many energy-saving technologies have been adopted. In September 2015, the project will be awarded the national two-star green space building logo (the design time of the project is 2010, code requirements), the LEED Gold Award in May 2016, and the MDV central air conditioning design and application program design professional group bronze award on May 15.

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