The Interior Reconstruction Technology of Restaurant Based on the Concept of Green Energy Saving

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Abstract. In view of the problem that the restaurant uses high electric energy, which affects the economic benefits of the restaurant, this paper studies the internal renovation technology of the restaurant under the concept of green energy saving. Taking an X restaurant as an example, the green and energy-saving building block of the restaurant is rebuilt, and the interior material construction of the restaurant is returned to the mainstream of energy saving. Then the green and energy-saving HVAC is installed in the restaurant to reduce the high consumption of HVAC power. Finally, the moisture-proof, heat-insulated and energy-saving first floor is laid in the dining hall to ensure the comfort of the dining environment. The final construction results show that under the concept of green energy saving, the active energy and reactive energy in the restaurant are reduced. The energy saving effect is better, which can meet the transformation goal of the X restaurant and can be applied to real life.

Keywords: Green energy-saving concept, Restaurant, Interior renovation technology, Heating and ventilation, Ground, Electric energy

1 Introduction

China's food culture has a long history. After years of accumulation, the catering industry has become one of the oldest industries in China, providing people with convenient and comfortable dining conditions [1]. With the growth of the post-90s and post-00s, young people gradually regard restaurants as a necessary place for social interaction. When students get together, restaurants, movies and KTV are indispensable; when colleagues get together, restaurants and shopping are indispensable [2]. In the era of "net red", the restaurant construction structure tends to be a "punch card holy place", beautiful environment, soft lighting, wonderful music, all of which are the environment that young people like [3]. After the rise of personalized theme restaurants, consumers have evolved the behavior of "eating" into cultural consumption, and "eating first with camera" has become the trend of the times [4]. However, the blind pursuit of restaurant environment and the neglect of the internal structure of the restaurant make the electricity consumption of the restaurant continue to increase, and the development of revenue balance after one year of operation can not guarantee economic benefits [5]. Therefore, under the concept of green energy saving, this paper studies the subject of restaurant interior renova-

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tion technology. Based on green and energy-saving, the restaurant is more in line with the needs of the audience.

2 Project overview

In this paper, the internal structure of the X restaurant is transformed under the concept of green energy saving. X Restaurant is a theme restaurant with a courtyard outside, where you can enjoy the evening breeze and enjoy the beautiful scenery around you in summer. X Restaurant covers an area of about 202.56 m^2 and a building area of about 654.36 m^2. The restaurant is divided into three floors. The first floor includes courtyard, hall, waiting area and toilet; the second floor includes box, drink area and toilet; the third floor includes lounge, mother and baby room and toilet [6]. There are several bird cages on the background wall of the restaurant entrance, in which the "lights" are turned off. A skylight is opened above the background wall, through which you can see the bright lights inside [7]. This kind of design attracts most customers and becomes a "net red punch card". In the middle of the hall, there is a big chandelier, whose soft light is like moonlight, which smoothes the fatigue of a day's work for customers. With the increase of theme restaurants, X restaurant is no longer unique, coupled with the high use of electricity in the interior construction. The restaurant is gradually unable to make ends meet. In order to make X restaurant more brilliant, this paper integrates the concept of green energy saving into the process of restaurant renovation to reduce its active and reactive energy, and enhance the overall economic benefits of the restaurant.

3 Rebuilding restaurant green energy-saving building block

In the process of restaurant renovation, most of the renovation designs are based on the quality of restaurant space. The main structure of the restaurant will be demolished, and the remaining walls, warehouses, pipes, frames and other building blocks will not be able to play their role in application [8]. It not only increases the cost of restaurant renovation, but also makes the renovated block unable to fit the interior space completely, which affects the use function of restaurant space. Therefore, in this paper, under the concept of green environmental protection, the original block of the restaurant and the transformed block are combined in the form of vertical, horizontal and staggered, and on the basis of retaining the basic positions such as door openings and window openings, the building block reconstruction of the external wall structure of the inner restaurant is realized [9]. The exterior wall structure of the restaurant after reconstruction is shown in Figure 1 below.

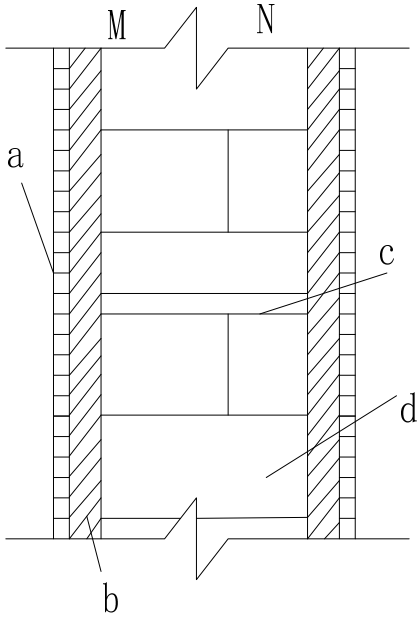

Fig. 1. Exterior wall structure of the restaurant after reconstruction

As shown in Figure 1, M is the external wall block of the original building; N is the external wall block after reconstruction; a is the decorative layer with a thickness of 10 mm; b is the cement slurry layer with a thickness of 20 mm; c is the cement slurry layer with thickness of 15 mm; and d is the gas addition block with a depth of 240 mm. M and N are effectively combined to reshape the internal space [10]. The use of this block reconstruction method can reduce the waste of resources, and the flexible space combination between adjacent building blocks creates different space functions, so that the energy-saving effect of the restaurant is better.

4 Installation of green energy-saving heating and ventilation in restaurants

In this paper, in the process of installing green energy-saving HVAC in restaurants, energy-saving and green are the main keynote, and the selection of host equipment is determined according to the cooling load of restaurants. Because X restaurant is located by the lake, it can use the lake water to regulate the climate of the restaurant and provide a larger cold and heat source for the HVAC system of the restaurant. In summer, the energy-saving heating and ventilation system introduces the natural ventilation of the lake into the room, which increases the cooling effect of the natural ventilation; in winter, the energy-saving heating and ventilation system uses the heat storage effect of the lake to provide cold and heat sources for the building. The control schematic diagram of HVAC temperature control switch is shown in Figure 2.

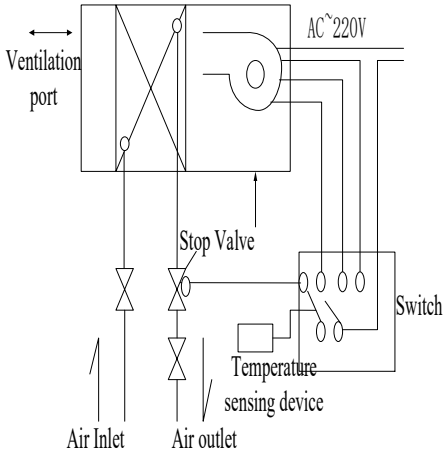

Fig. 2. Schematic diagram of HVAC temperature control switch control

As shown in Figure 2, the temperature of X dining hall in summer is about 20 ℃, and the humidity is in the range of 40% ~ 65%; the temperature of dining hall in winter is about 25 ℃, and the humidity is in the range of 50% ~ 70%, which can meet the requirements of cold and hot temperature and humidity. In this paper, combined with the concept of green energy saving, the conventional heating and ventilation cooling and heating system is converted into a natural cooling and heating system. The lake surface cold and heat source is introduced, so that the ventilation environment inside the restaurant is more in line with human needs.

5 Lay the first floor of the restaurant to protect against moisture and heat insulation

Due to the high cost of moisture-proof, heat insulation and energy-saving materials, in order to meet the cost requirements of this project, this paper only lays part of the materials on the ground in the process of laying the first floor, so as to reduce the cost of transformation on the basis of green and energy-saving. The formula for the length, width and thickness of the moisture-proof, heat-insulating and energy-saving materials laid on the first floor is as follows:

$$A = RE \quad (1)$$

$$B = \frac{\sqrt{D}}{E} \quad (2)$$

$$C = ED - L \quad (3)$$

In the formula (1-3), A is the laying length of the moisture-proof, heat-insulating and energy-saving material; R is the thickness of the foamed cement heat-insulating layer; E is the energy-saving parameter of the energy-saving material; B is the laying width of the moisture-proof, heat-insulating and energy-saving material; D is the moisture regain coefficient of

the surface layer; C is the laying thickness of the moistureproof, heat-insulation and energy-saving materials; L is the length to be laid on the first floor. After laying moisture-proof, heat-insulating and energy-saving materials, the humidity of the restaurant is smaller, which provides a more comfortable dining environment for people.

5.1 Construction results

After the internal transformation of the X restaurant, this paper uses HSDZC electric energy comprehensive tester to analyze the use of electric energy in X restaurant. HSDZC electric energy comprehensive tester is shown in Figure 3 below.

Fig. 3. HSDZC electric energy comprehensive tester

As shown in Figure 3, the HSDZC electric energy comprehensive tester selected in this project has an AC voltage detection range of 50 V ~ 750 V, an AC current detection range of 0.5 A ~ 500 A, an apparent power detection range of 0.025 kVA, and an active power detection range of 0 kW ~ 750 kW. The reactive power detection range is 0kVR ~ 750kVR, and the load rate detection range is 0 ~ 120. In this paper, after the transformation of the X restaurant, the voltage, current, active power and reactive power of each line are within the appropriate level. At this time, the power usage of the X restaurant is detected. As the HSDZC electric energy comprehensive tester can detect the active energy within 0 kWh ~ 99999 within. 9 kW·h and the reactive energy within 0 kVRh ~ 99999 within. 9 kVR· h, it can adapt to the overall power consumption of X restaurant.

It is known that before the renovation of X restaurant, the overall active energy of X restaurant was about 352.45kW·h, and the overall reactive energy of the restaurant was about 116.43 kVR· h, which made the daily power consumption of the X restaurant exceed the standard and affected the economic benefits of the restaurant. Under this condition, taking X restaurant as an example, using HSDZC electric energy integrated tester, the active and reactive electric energy of the restaurant courtyard, box, toilet, drink area, mother and baby room, hall, lounge, waiting area and other areas are detected. The final construction results are shown in Table 1 below.

Table 1. Construction results

X Restaurant area	Active energy detection result/kW·h	Reactive energy detection result/kVR·h
Yard	15.32	1.32
Box	20.62	0.62
bathroom	9.45	0.45
Drinks area	16.27	1.27
Mother and baby room	6.52	0.52
Hall	17.82	1.82
Rest room	15.16	0.16
Waiting area	14.28	0.28
Total	115.44	6.44

As shown in Table 1, the active energy is the energy consumed in each area of the restaurant, and the energy stored in the AC power supply that is not consumed is the reactive energy. The courtyard, hall, box, beverage area, lounge, waiting area and other restaurant areas use more electricity, and the active energy is relatively high. Among them, the active energy of the box is relatively high, about 20. 62 kW·h; the active energy of the mother and baby room is relatively low, about 6. 52 kW·h. After the above transformation, the total active energy of X restaurant is about 115. 44 kW·h, which is more than one time lower than that of 352. 45 kW· h before the transformation; the total reactive energy is about 6. 44 kVR·h, which is lower than that of 116. 43 kVR·h before the transformation. That is to say, under the concept of green energy-saving, after the transformation of the X restaurant, the consumption of electric energy is less. The reactive power stored in the AC power supply is less, and the energy-saving effect of the restaurant is better in one day, which is in line with the purpose of this study.

6 Conclusion

In recent years, with the gradual improvement of people's living standards, young people's consumption patterns and consumption levels have changed. Eating in restaurants instead of cooking at home has become the norm. Restaurants are often open until the early morning or even the next day, adding a touch of brightness to young people's "night life". The internal environment of restaurants built for a long time is not environmentally friendly. The brightness of chandeliers is high, and the building materials are not firm, which hinders the development of restaurants. Therefore, under the concept of green energy saving, this paper studies the subject of restaurant interior renovation technology. By means of rebuilding building blocks, installing heating and ventilation, laying the ground and so on, we can realize the green and environmentally friendly transformation of the environment, and create a more distinctive restaurant atmosphere on the basis of saving the cost of transformation.

Reference

[1] Zhong R., Zhang Y. P., Xiao S. L., et al. (2022) Research on CMS green energy-saving roof design based on green building concept [J]. Intelligent building and smart city, (04): 123-125.

[2] Kaplan B. A., Seljiang H., Chao Y. L. (2022) Research on energy saving design of oasis buildings based on the concept of green building -- Taking the works of the second national "green building design" competition as an example [J]. Building energy saving (Chinese and English), 50 (03): 50-56 + 71.

[3] Chen X. G. (2021) Guide the whole people to practice green and low-carbon life -- Beijing energy conservation and environmental protection center focuses on "low carbon" to promote the green development concept [J]. Energy conservation and environmental protection, (12): 10-13.

[4] Cheng J. Y. (2021) Application of green environmental protection and low carbon energy saving concept in building interior environment design [J]. Leather manufacturing and environmental protection technology, 2 (21): 130-131 + 133.

[5] Jin H., Zhang N. (2021) Discussion on the application of green low-carbon building concept in the design of high-rise buildings -- Comment on green building energy saving engineering design [J]. Industrial architecture, 51 (08): 241.

[6] Zhang M. M. (2022) Practical research on reconstruction of old factory into commercial space under the premise of low cost -- Taking Dalian chaomu restaurant as an example [J]. China building decoration, (02): 125-126.

[7] Ge L. (2020) Green building design based on the concept of energy conservation and environmental protection -- Review on Key Technologies of green building design and operation [J]. Concrete and cement products, (08): 97.

[8] Dong M. H, Wang Z., Fu X., et al. (2020) Energy saving design analysis of multi-storey buildings based on green BIM concept [J]. Information technology of civil engineering, 2020,12 (01): 70-75.

[9] Liu X. C. (2022) An analysis of the case of "online Red" restaurant in the tourism economy and suggestions for its improvement -- a case study of gongman Xiting restaurant in Sanya [J]. Economic Research Guide, (14): 32-34.

[10] He S. Y., Liu X. G., Feng Y. (2021) Research on the design strategy of CBD roof garden under the urban repair perspective -- Taking the roof garden design of Haidilao Jinsha and Meimei restaurant in Shanghai as an example [J]. Housing and real estate, (36): 61-64.