A PRELIMINARY EXPLORATION ON THE GLOBAL BUILDING ENERGY EFFICIENCY

Chenxia Jia,

Affiliation Equipment Engineering Deparment, Sichuan College of Architectural Technology, Deyang 618000, China.

Chenxiajia@163.com,

ABSTRACT
Building energy efficiency in china has made remarkable achievements, summarized a large number of valuable experience for many years. Energy-saving external wall and the window is the main way of energy-saving design and energy-saving renovation. Through proper use of energy-saving design principles is a good way to achieve energy saving purpose. And heating and air conditioning system operation and management of architectural energy saving plays a key role.

Keywords: building energy efficiency, building energy consumption, energy saving design, operation and energy saving

1. INTRODUCTION

Since the 90s, the theory of sustainable development was put forward. And for the urgency of the environment and resources protection, the theme of building energy efficiency has become the hot spot in the world. According to the statistics, building energy consumption has accounted for nearly 30% of terminal energy consumption in whole society in china. With the rapid development of the economy and the continuous improvement of people's living standard, the building energy consumption is also growing in our country, which is anticipated to reach as 40-50% in 2020 (Li Bingren 2010; Building energy conservation research center 2010). Such big building energy consumption causes the pressure of energy and environmental, which will be unable to bear the social and economic development in china. Therefore, China has put the focus of the building energy saving on energy conservation and emissions reduction crucial areas, is through policy, legal and economic means in the national building energy efficiency work. And building energy efficiency in china has made remarkable achievements, summarized a large number of valuable experience for many years.

2. THE MAIN WAY OF BUILDING ENERGY EFFICIENCY

It found that building energy consumption is mainly given priority to the building heating and air conditioning, which account for about 50 to 70% of total energy consumption (Jiang Yi 2006; Jiang Yi 2005). Heating and air conditioning energy consumption is mainly composed by the heat transfer and heat consumption of envelop configuration of buildings. And by the two ways it account for about 73% to 77% on the energy consumption of heating and air conditioning. In heat transfer and heat consumption, the share of external wall accounted for about 25-34%. And the followed is the air infiltration heat through the gap of doors and Windows, which accounts for about 23% to 27%. Therefore, building energy conservation is one of the main research objects of energy saving problem of buildings envelop configuration. That is to say, the external walls and windows are key parts of energy saving. Main way of energy saving is to reduce the surface area and strengthen the heat preservation of the building palisade structure, and increase the tightness of doors and windows.

2.1. External wall

For external wall insulation, mainly through two ways, one is with the brick of more heat preservation effect than the traditional wall materials such as solid clay brick. The correlational research is in full swing, Such as Di Yuhui (Di Yuhui 2000) did the technical and economic analysis on the annual heating energy consumption of a residential building with different wall. And he pointed out the aerated concrete is a kind of suitable substitutes; Promote the use of aerated concrete not only could protect arable land, but also could save energy. Another way is to the wall heat preservation processing, mainly has exterior insulation and external wall insulation. The external thermal insulation is convenient for construction. And it has no affect on the use of building during construction. In addition the heat preservation effect of the external thermal insulation is excellent. And external thermal insulation is convenient for the envelop retrofit of existing buildings. For the reasons above the external thermal insulation is be used more commonly.

In the other head, there are four main thermal insulation system of external wall, such as EPS board and thin plaster external thermal insulation system, mechanical fixed way external thermal insulation system, hanging board exterior insulation system, thermal insulation block external thermal insulation

system. The EPS insulating plate has many good characters, such as light quality, excellent sound insulation performance, strong resistance in low temperature, low water absorption, big surface friction coefficient, certain elasticity, uniformity of thickness,cheap price and small heat thermal conductivity (just 0.003 W/m). In addition, the EPS insulating plate is easy for cutting and polishing, of which the size can be cut in various shapes and need thickness. The heat preservation effect of the EPS insulating plate is easy to guarantee. In the reconstruction of existing residential building energy efficiency, the EPS board performance excellent as the thermal insulation material in the exterior insulation system. It has significant technical and economic effect, which can meet the technical requirements of energy conservation transformation of the construction. EPS board has successful application in foreign countries nearly 50 years and it has more than 20 years in domestic. The heat preservation effect and use effect of the EPS board is verified successful (Zhang Hao, Wei Jianji, and Zhou Xueling 2004).

2.2. External wall

Energy saving of external doors and Windows is mainly achieved by improving gas tightness of doors and Windows. The mainly measures for improving gas tightness of doors and Windows are using of layers or single box double glass window, using energy-saving glass, improvement of outer door window frame materials, heat preservation of external doors, etc. In addition, sun-shading of buildings in summer has great potential in energy-saving, which can significantly improve the indoor thermal environment, adjust indoor light distribution, prevent glare, and reduce UV damage. Because of it is convenient to install, use and maintain, the inner curtain is widely applied. The most common are inner curtain are Venetian blinds, roller blinds, vertical blinds, accordion curtain and so on. In the other head, the thermal barrier of inner curtain is better than the external solar shading. That is because when inner curtain used, sun shines on the glass and then sunlight come through the glass to the shading device, the room is warmed up. But building external solar shading could make most of the sunshine only reach to the shading device and radiant heat of the sun can't directly reach to interior space of the room. Therefore, the temperature of room with external shading is 10-20% lower than with inner curtain. So external shading is preferred in the design of energy-saving in summer, such as blinds, awnings, sunshade veil curtain, coated glass, awnings, or visor, or climbing plants in the balcony window. Sunshade design is not a independent of the architecture design of energy saving, it even through the whole process of architectural design, from site selection, layout, the design of the building facade, plant configuration of the environment and the structure, to the HVAC design of the building, etc. Therefore, in addition to the technical requirements of energy saving, it also has to match up with the building overall design. The so-called best shade should also take care of environment, base on visual perception, including two-sided effects by window overlooking the outdoor scene or outside watching architecture (Zhang Wen 2003).

3. ENERGY-SAVING DESIGN PRINCIPLES

Orientation and spacing, sunshine and ventilation are the most important factors that affect indoor environmental quality.

The glass of the window occupies about 80% area of the external window. Heat gain/loss from the glass of the window is the main causes of the indoor overheat or cooling load of air conditioning, in burning hot summer or cold winter. Under the condition of satisfying day lighting, the area ratio of window to wall should be limited in a reasonable range. The solar radiation energy through the window is not the same in the different toward, so the reasonable area ratio of window to wall is also different. The reasonable ratio of window in south is maximum (< 0.35), the east-west is second largest (< 0.30), and the north is minimum (< 0.25).

Heat transfer and heat consumption of housing construction decreased with the increasement of the total building area, but of which the relationship is not in linear. when building area is 1000 - 2000 square meters, the reduction of heat transfer and heat consumption of unit building area is 57-58%; When building area is 2000 - 4000 square meters, he reduction of heat transfer and heat consumption of unit building area is 85-86%; When building area is 4000 - 8000 square meters, heat transfer and heat consumption will decrease by 14-15%.

In general, the shape coefficient of the residence should maintain in the scope of not more than 0.3.

4. BUILDING ENERGY CONSUMPTION IN OPERATION AND MANAGEMENT

As mentioned above, building energy consumption is mainly composed of building heating and air conditioning energy consumption. When the system put into use, the way of operation and management of the system plays a key role to energy saving.

4.1. Building heating energy consumption

Areas of suitable for heating in our country is occupied about 70% of China's land area, mainly including the northeast, north China, and northwest. The energy saving of heating system has a great potential in china. The existing successful saving energy promotion strategy mainly has the following kinds (Chen Yiliang 1994).

Reform the heating charge system. In the past, the heating fee has been charged according to the size of the area for a long time in our country. This Charging mode leads to serious waste of energy. The technology level of heating is low and the quality of heating can not be effective supervised and guarantied. And charging users according to user's practical heat can raise the consciousness of energy conservation.

Improve the system design to meet the requirements for controlling the heat medium. The user can't adjust the quantity of heat according to their needs in the single pipe system and constant flow mode. The heating quality and energy saving can be improved when the dynamic adjusting VWV system is been used.

Use the advanced heating system control, adjustment and measurement instruments or equipments.

Practice has proved that the central heating can improve energy utilization efficiency. When heating area is more than 100-150 thousands square meters, the boiler room should be built. Otherwise it will do more harm than good.

Utilize of water treatment technology in heating. A very important problem in the heating system is to prevent the fouling and corrosion inhibition, which can ensure the normal operation of heating boiler, systems and equipment.

4.2. Energy consumption of central air conditioning

There are some ways to realize the purpose of energy saving of central air conditioning system (Lian Xiaohu, Li Ze, and Xie Junlong 1999).

1. Choose the appropriate cooling and heat sources.

Most of the energy consumption in central air-conditioning system is used up in cold source. So it is great significance for the rational allocation of cooling and heat sources of the central air conditioning system. The Common configurations of cold/heat source are as follow.

Water chiller unit + Boiler. Energy efficiency ratio (EER) is high in design conditions, generally about 3.7-5. When centrifugal compressor unit used as the host, the EER is the highest, about 5, but the unit capacity of this type is larger. Generally the air conditioning refrigerating capacity in more than 300 RT (cold tons), centrifugal compressor is choose. Air conditioning refrigerating capacity during 150-300 RT, screw compressor is used. Air conditioning refrigerating capacity is less than 150 RT, piston compressor is more appropriate.

Heat pump unit. In summer cooling and winter heating, under the design conditions, EER of water chilling unit is lower, usually around 3.The energy saving and environmental protection have good effect.

LiBr absorption unit. The characters of this unit is low EER, economize on electricity and no energy conservation. It is suitable for where have waste heat and waste heat.

2. Use cool storage air conditioning and variable power load.
3. Run air conditioning system in saving energy way.

- Reduce indoor given value standard.
- New air volume should be reduced in cold winter or hot summer, while in transition season it should be increased according to the outdoor climate change.
- Prevent the extreme cold and heat.
- Room temperature is overheating in summer or undercooling in winter, more energy is consumed. And it is not suitable for human comfort and health.
- Use heat recovery and heat exchange device.
- Change the air conditioning equipment start and stop time.
- Frequency conversion control.
- Automation system of Equipment.

Automation systems of construction equipment centralize management and optimal control of air conditioning, electrical, health, fire alarm and so on.

5. CONCLUSIONS

In the practice of building energy conservation, the work of construction energy conservation has made remarkable achievements and a lot of valuable experiences have summed up in our country. The envelop configuration of buildings is the focus of work of building energy efficiency. The energy saving design principles has been summarized in this paper, and effectively using of them can easily attain the goal of building energy efficiency. The Energy consuming of heating and air conditioning system accounts for larger proportion of construction energy. Operation management of energy heating and air conditioning system plays a key role in saving building energy consumption. Building energy conservation work, of course, are far way to go for. The actual energy consumption of building is not only related to meteorological conditions and envelop configuration of buildings but also to the human factors such as habits and ways. It is clear that the influencing factors of building energy saving effect is quite complicated, and those factors do the contribution to the building energy conservation is not a linear addition, but a very complicated nonlinear relationship.

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AUTHORS BIOGRAPHY

Chenxia Jia, Director of the teaching and research office of HV&AC and industrial equipment installation in Affiliation Equipment Engineering department, Sichuan College of Architectural Technology. The main research scope are building energy saving, HV&AC and so on.