

Discussion on Energy-Saving Design Measures of HVAC

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ABSTRACT With continual increase of people's living quality requirements, the demand for buildings with HVAC systems is growing. As energy shortage intensifies today, EEBs (Energy-efficient Buildings) are becoming the main trend of future developments in the construction industry. Therefore, further improving HVAC energy-saving measures is a particularly important task and is the key issue being examined by current HVAC designers. This study starts with analyzing existing problems in energy-saving design of HVAC, and proposes some views and recommendations for HVAC energy-saving design method, as well as reasonable choices of parameters for HVAC systems such as energy-saving design of cooling and heating ventilation, energy-saving design of hot and cold water systems, and optimum heat recovery design of HVAC systems, in order to reduce buildings' energy consumption and to improve energy efficiency for energy-saving purposes.

KEYWORDS

HVAC
Energy-saving Design
Energy-efficient Buildings

1. Introduction

With the development of our national economy and improvements in people's living standards, air conditioning technology has been widely used in all aspects of people's lives, leading to year-on-year growth of buildings' energy consumption, of which HVACs account for a large part. With increasing per-capita floor space, the application scope of HVAC system is becoming wider, and energy consumed by HVAC will inevitably continue to increase, leading to a more severe lack of resources.

China's energy structure mainly relies on fossil fuels, of which the main source is coal. Fossil fuel combustion produces large quantities of pollutants, including a large number of sulfur dioxide and other harmful gases as well as carbon dioxide and other greenhouse gases. These gases cause great damage to the environment and bring adverse effect to people's lives. In addition, fossil fuels are non-

renewable resources, and extensive use of fossil fuels does not meet the national sustainable development concept.

As "low carbon" concept has gradually become the consensus of the industry, and as our government has put forward the slogan of developing a saving-oriented society, the energy-saving design of HVAC system is attracting the attention of HVAC designers who, through series of technical and organizational measures within the social and environmental affordable range, are continuing to improve energy efficiency, avoiding unnecessary waste of energy as much as possible in all aspects of energy production and application, and accounting for local conditions via different energy-saving measures according to characteristics of climate and natural environment of different regions to fully utilize powerful natural conditions.

2. Problems in energy-saving design of HVAC for residential buildings

2.1. Planning is not strict enough

Lack of strict planning in HVAC system is a big problem in energy-saving design. Design plans do not necessarily comply with relevant laws and norms, and energy-saving requirements are arbitrary. Designers are not rigorous enough when choosing air conditioning systems, due to absence of a competitive pressure environment. Their design plan also lacks improvement space, and the inadequacy of scientific comparisons in the choices of design plans

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greatly reduce energy-saving effects the designs should achieve.

2.2. Awareness of energy conservation is not strong

Some designers lack advanced thought and their awareness of energy conservation are not strong. As HVAC practitioners, their ideas and design results will directly impact the energy-savings of a system, but when carrying out work, design staffs always maintain traditional design concepts and only consider standard accuracy and feasibility of design while disregarding energy conservation and environmental protection requirements. Their lack of sense of responsibility to conserve energy and protect the environment makes energy-saving effect of building HVAC design difficult to ensure [1].

2.3. Low utilization of renewable energy sources

Air conditioning systems with renewable energy can significantly reduce energy consumption but are often overlooked by actual designs, leading to lower utilization of renewable energy. On one hand, relevant R&D departments do not have enough strength of knowledge on renewable energy, leading to limited range of HVAC design choices. On the other hand, the slow pace of technology upgrades is resulting in lack of technical support when utilizing renewable energy. Effective circulation of energy utilization is also difficult to process, resulting in energy waste and impacting the implementation of energy-saving effectiveness of HVAC designs.

2.4. HVAC energy-saving technology is difficult to put in place

When designing residential building during construction drawing, the designer unit should implement buildings and envelope thermal design, and weigh calculations strictly in accordance with relevant national residential building's energy-saving design standards, then report to relevant agencies for energy-saving special review in order to ensure compliance of energy-saving design standards.

However, many residences are usually sold in the form of rough housings. Interior re-decorations are done by households, and so HVAC design drawings are hard to put in place. Therefore, in the design process, HVAC professionals generally only do relate reserved work by associating with relevant professionals, and energy-saving technologies of HVAC equipment can only be really implemented and reflected in the second stage.

Nevertheless, the second renovation phase has larger arbitrariness: households will usually improve indoor comfort requirements, leading to larger HVAC equipment capacity. The lack of effective supervision and control for energy-saving measures in the second renovation process of households will result in energy-saving technology that is difficult to completely implement.

3. Energy-saving design method of HVAC

3.1. Reasonable choice of HVAC system parameters

When performing HVAC installation, the effects of environmental factors should be considered according to specific actual situations. System parameters must be set strictly, and a reasonable choice of parameters is very important in energy-saving design of HVAC systems. In the installation design, two important factors, temperature and humidity, must be considered when selecting parameters.

In general, outdoor temperature is higher in summer and hence when installing air conditioning the design parameters should not be too low in order to avoid adverse impact of temperature differences. When installing in winter, air conditioning system should not be set too high to avoid bringing discomfort to people's health. Only reasonably set parameters can keep the use of air conditioning in a stable state and achieve true energy-saving design. Parameters too high or too low may both increase energy consumption, which is not good for the usage life of air conditioning systems [2].

3.2. Energy-saving design of cooling and heating ventilation

With increasingly popular use of HVACs in people's lives, in order to provide a more comfortable living environment, the design of cooling and heating ventilation in HVAC systems should be adapted according to actual situations. Characteristics of artificial environment, direction of heating and cooling airstream of air conditioning, the surrounding and inner regions, functional differences, and separate set or sub-loop set should all be fully considered to be controlled, regulated and managed, in order to avoid the occurrence of hot or cold energy waste in different regions by aligning with the system to achieve the best results for economic savings purposes.

3.3. Energy-saving design of hot and cold water systems

In designing energy-saving HVAC system in the past, there has been a big problem in the selection of materials. Some materials with good properties cannot be used due to limitations in technological and economic conditions. However, for instance, processing pipelines with new insulation material with good insulation properties can effectively improve energy-saving effect of HVAC systems. Heating system of HVAC should be examined comprehensively by advanced science and technology in order to result in a reasonable distribution of pipe network flow and to improve HVAC energy delivery efficiency, thereby reducing energy consumption in the energy transfer process [3].

3.4. Optimized heat recovery design of HVAC system

In the course of using HVAC, air conditioning itself will generate a lot of heat which cannot be effectively recycled and so is released into the environment. In HVAC systems,

heat recovery design has to be optimized to recycle and reuse the heat discharged by air conditionings. In an air conditioning system, full use of the exhaust system can reduce energy consumption, hence increasing energy efficiency to achieve energy-saving goals.

4. Conclusion

With rapid development of domestic construction and transportation industries, the key point in saving energy has shifted from industry to construction and transport. Since HVAC systems account for a major part of buildings' energy conservation, the energy-saving design of HVAC has an important role in reducing energy consumption. In addition, it is also linked to the country's energy secu-

urity, resource consumption and environmental protection. It is an important industry that is connected to people's livelihood and to a sustainable national development, and therefore HVAC design practitioners should pay adequate attention.

References

1. Gonzalo, R. (2012). Energy-saving design of building. *China Architecture & Building Press*, 3.
2. Lu, Z. F. (2014). Analysis on design elements for HVAC systems. *Private Technology*, 3, 43.
3. Yuan, Z. Z. (2012). Analysis on the energy-saving measures of HVAC system. *Technology Innovation and Application*, 3, 198.