Thoughts on HVAC System Design Based on Green Concept

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Abstract. With the continuous progress of urbanization, the continuous development of manufacturing industry and the continuous improvement of people's quality of life, people began to pay attention to environmental protection. The concept of environmental protection is integrated into the design, and the green energy-saving technology is applied to the manufacturing process of HVAC, which embodies environmental protection and reduces the use of resources. In this paper, some ideas of applying green concept to HVAC system design are put forward.

Keywords: Green concept, HVAC system, Apply policy.

1. Research background
With the rapid development of current economy, manufacturing industry is booming. With it, the huge resource consumption, environmental pollution, noise pollution and air pollution have increasingly affected people's normal life. Environment, resources, population and energy are very important to the sustainable development of human beings. In order to solve this problem, the concept of green came into being. "Building a sustainable society" is becoming an important global theme in the 21st century.

1.1. The basic connotation of green concept
The worst concept of green design was put forward by researchers in Green Design [2] in 1979. Green design, also known as ecological design, is a systematic design method, which makes use of ecological ideas, all kinds of information related to products in the whole life cycle of products and all kinds of advanced design methods, so that the products designed have advanced technology, good environmental adaptability and reasonable economy. The core of green concept is to minimize energy consumption. Reducing energy consumption means not only reducing the consumption of resources, but also improving the utilization efficiency of resources and avoiding the waste of resources. Looking at the social development, it is of great practical significance to integrate the concept of green development in mechanical design. The most basic thing is energy saving, which can minimize the energy consumption in each stage and implement various energy-saving measures in parallel. Each stage here refers not only to the manufacturing process, but to the whole life cycle of machinery. This requires designers to study the whole cycle from the very beginning of design, apply the green concept to every detail, and fundamentally reduce environmental pollution and waste of resources.
1.2. Current air conditioning status
At present, energy saving, high efficiency and environmental protection are the inevitable trends in the development of air-conditioning products. In recent years, our country has intensified its efforts to promote the use of energy-efficient air conditioners in the whole society. At present, many countries and regions in the world have formulated laws and regulations on air conditioning and environmental protection, and introduced relevant regulations and systems. Products that do not meet the requirements of environmental protection will not be able to enter the local market, which puts forward higher technical progress requirements for household air conditioning enterprises. The environmental protection technology of air-conditioning products mainly focuses on the characteristics of time saving, energy saving, constant temperature, comfort, ultra-quiet and so on. At present, air conditioning has high energy consumption and single function, which can not meet the current environmental protection requirements, mainly in the following aspects:

1.2.1. Traditional air conditioners consume a lot of high-grade energy. According to data, HVAC accounts for 65% of building energy consumption, and large central air conditioners account for the highest proportion of all energy consumption. And although large public buildings only account for 5% of China's total building area, their energy consumption accounts for more than 20% of the total urban electricity consumption in China, and the annual energy consumption per unit area of such buildings exceeds that of ordinary residential buildings by 10 times. It is worth pointing out that the energy consumption of central air conditioning system accounts for nearly 50% of the total energy consumption of large public buildings. On the premise of ensuring the comfort of the environment in public buildings, effectively reducing the energy consumption of air conditioning has always been the focus of building operation managers, and it is also an important issue of energy conservation in the building field.

1.2.2. The traditional air conditioner produces a lot of noise, which seriously affects the daily life of residents. The appearance of air-conditioning system has improved people's living environment, but it has also brought some adverse effects, including noise. The noise of outdoor unit mainly comes from fan system and compressor system, while the noise of indoor unit mainly comes from refrigerant flow [3]. At present, the noise generated in air conditioning operation interferes with people's daily study and life, which is an urgent problem.

1.2.3. The traditional air conditioner has a single function and can only heat or cool. At present, the air conditioner sold in the market has a single function, which only provides cooling and heating functions. And the vast majority of air-conditioning technology is concentrated in the field of refrigeration. There are few research results in the field of heating and the heating effect is not good. Through investigation, it can be found that people are not satisfied with the heating function, and they still need to heat by heating and burning coal in winter, resulting in more air pollution. In addition, the energy generated during the use of the air conditioner is not fully utilized, and is dissipated in the air in the form of heat energy, which leads to waste of resources.

2. The application strategy of green manufacturing technology in the process of machinery manufacturing

2.1. Green design
In the process of green manufacturing, green design is the key. Green design refers to taking into account the impact on resources and environment in the design stage of equipment, and trying to design products with less impact on the natural environment and more conservation of natural resources by various means [4].
2.2. Green materials
Using green materials in the manufacturing process of construction machinery is the key method of green manufacturing. By using renewable and recyclable materials with little environmental pollution, low energy consumption, low noise, no toxicity, resource waste and environmental pollution can be avoided from the source, and resource conservation and environmental friendliness can be realized in the long run.

2.3. Green technology
In the process of green manufacturing, green technology is also a very important part. Green process requires to improve production efficiency and avoid harmful processes. Optimize every step of mechanical manufacturing, so as to achieve high efficiency and energy saving as a whole.

2.4. Green treatment
In the life cycle of products, green treatment is the last step, and it is also a very critical step. The use of renewable materials can make the production of products form a closed loop and realize the long-term development of product production.

3. Analyze the design points of green HVAC

3.1. Improve the level of energy utilization
At present, during the operation of HVAC, due to the long-term operation, a lot of redundant heat is produced, and the loss of redundant heat is essentially a waste of energy. In the process of refrigeration, the heat brought out from the room through heat exchange is lost in the air in the form of heat energy; In the heating process, liquid freon completes the heat exchange process outdoors, and the heat is not fully utilized. In order to improve the utilization rate of energy and realize the multi-level utilization of energy, heat pump system, heat storage system and cold storage system can be adopted to design the heat recovery device. A heat storage tank is added to the device and placed in the pipeline after freon absorbs heat, which absorbs the heat generated in the cooling and heating process, realizes the heating of domestic water and the efficient utilization of redundant heat, and reduces the electricity consumption generated by boiling water, thus having high use value.

In the design process, the components of each function are separated, which is convenient for problem finding and timely repair, and reduces the rejection rate of products. At the same time, intelligent modules can be introduced into the equipment to find damaged parts in time and evaluate whether they have recycling value, which is convenient for subsequent recycling.

3.2. Give full play to the advantages of clean energy and renewable energy
At present, the construction scale of HVAC system is gradually expanding, accompanied by the trend of increasing energy consumption, which even affects the normal life of surrounding residents in some cases, and the ecological pollution is extremely obvious [5]. At this time, according to the design of HVAC, we should attach great importance to the choice of air conditioning energy. Traditional air conditioners use electricity mainly through traditional energy sources, such as coal combustion, which causes great pollution. Under the guidance of green concept, designers in the new era should broaden their horizons and focus on the use of new energy. By using clean energy and renewable energy, the environmental pollution will be minimized.

Designers can realize the effective collection of solar energy under the design of solar heat collecting plate, photoelectric plate and other equipment. The medium in the heat storage system is heated by solar energy, and the operation of the system is promoted by the principle of potential energy difference to realize the heat circulation in the air conditioning system. At the same time, domestic water heated by solar energy can be directly used. In order to solve the problem of insufficient solar energy in cloudy days, natural gas is introduced as an auxiliary heat source to provide power for the system operation. The product will not pollute the environment, and it is also in
line with the current policy of "changing coal to electric coal to gas", which is an environment-friendly solution.

3.3. Using bubble pump technology to solve noise pollution
At present, most compressors are used in the market, and the noise generated in the process of compression is large, which interferes with people's normal study and life. As the core power component of absorption refrigeration cycle, bubble pump has attracted people's attention in recent years, and many research institutions and scholars have explored and studied it. If the bubble pump technology can be used maturely, it will be of great help to reduce the noise and energy consumption of the solar absorption system.

3.4. Reduce air conditioning energy consumption based on intelligent technology
With the development of computer technology, air conditioning system has more intelligent and automatic self-regulation function. Simulation technology is used to simulate the actual situation of air conditioning operation, and the resource consumption and pollutant emission are calculated, so as to obtain the optimal design scheme. Digital energy-saving control system can timely and effectively recover the information of equipment operation so as to find defects in time, as well as the information of temperature, humidity and ventilation of surrounding environment, which is convenient for timely and automatic parameter adjustment.

3.5. Reduce energy consumption based on frequency conversion technology
Frequency conversion technology is a conversion technology that converts direct current into alternating current with different frequencies. The design and use of air-conditioning systems are usually based on rated output, but they are not based on rated output in daily use, and most of them are completed under partial load. If the operating conditions initially calculated for rated power are used under partial load, a large amount of energy will be lost. In order to avoid such waste, professionals must use frequency conversion technology in HVAC systems, which helps HVAC systems to match the specific power of air-conditioning under certain conditions, and then through appropriate adjustment, the purpose of reducing energy consumption can be achieved [6].

![HVAC system architecture.](https://example.com/hvac-diagram.png)

**Figure 1.** HVAC system architecture.

4. Conclusion
It is of great significance to apply the green concept to the design of HVAC system, which can promote the design of HVAC system and promote its sustainable development. At present, the industry has formed a deeper understanding of the green concept. Due to the shortage of energy, the application of solar energy in air conditioning energy will become an important development direction.
in the future. With the coming of information age, it will be a general trend to apply intelligent technology to HVAC design. According to the principle of local conditions and green development, the sustainable development of air-conditioning industry can be really promoted.

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