Research on Energy-saving and Emission-reduction Measures in Building Water Supply and Drainage Design

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Abstract: This paper summarizes the current situation of water resources utilization in China, analyzes the principle of water-saving technology, and analyzes the application of energy-saving technology in residential buildings from the aspects of rational use of municipal pressure, the use of water-saving appliances, the use of pressure reducing valves, and diversion and drainage. It is conducive to the rational design of water supply and drainage engineering for modern residential buildings.

1. Introduction

Human beings can't live without water, and water plays a very important role in people's daily life and industrial production. As a building infrastructure, the modern residential water supply and drainage project can ensure that people's daily life and the corresponding water needs of the work process are met, and that water resources can be better utilized, including water supply and drainage. In order to make the water supply and drainage project more rational, it is necessary to conduct in-depth research and make scientific and effective design. In the environment of water shortage, energy-saving technology came into being, bringing the gospel to modern residential buildings.

2. Current status of water resources utilization in China

In recent years, surveys have shown that freshwater resources have become less and less. If we do not restrict the use of water resources, it will trigger a water crisis in China. Most of China's regions are inland, water resources are scarce, and many waters are polluted by industrial development, which has caused serious conditions for a long time. Water resources in some areas have not been exploited and are contaminated and no longer meet the daily water standards.

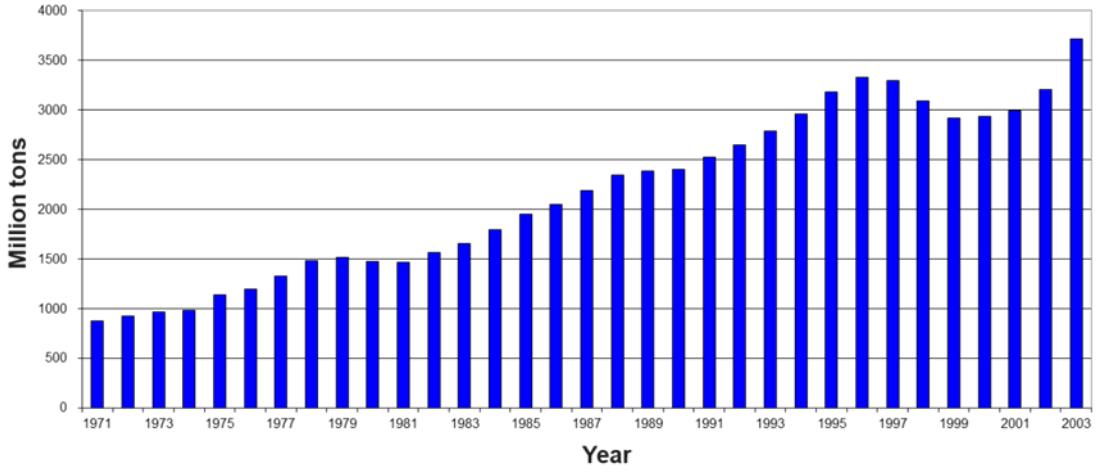

Figure 1: Trends in water use and CO2 emissions in China

Source: CO2 Emission from Fuel Combustion, IEA, 2015

Therefore, in order to develop the long-term development of the Chinese nation, it is necessary to improve the efficiency of water use from now on, to popularize the awareness of water

conservation, and to make life more economical. Only in this way can we change the current situation and solve the problem of water shortage.

3. Overview of water saving technology

In the past, urban development and industrial development have consumed a lot of water resources for decades, and the average utilization rate of water is very low, so that a large proportion of water resources are wasted. In the new development period, advanced water-saving technologies must be adopted and applied to modern residential buildings to make people's lives more energy-efficient and environmentally friendly.

Water-saving technologies can be applied to agriculture, industry or urban living water, and the distinction between these is not strict. No matter where the water-saving technology is applied, the most fundamental thing is to popularize water-saving awareness for people. Only when people understand and improve from the level of consciousness can they change their living habits and establish good water values. Now that wastewater in residential buildings is produced, it can also be used comprehensively. Sewage treatment technology can be used to convert sewage into clean water. Although it cannot be used as drinking water, it can be applied to green watering and sanitary washing. In order to reduce water waste, water storage appliances can be installed in modern residential buildings to reduce leakage and water seepage.

4. Reasonable use of municipal pipe network residual pressure

Modern residential buildings use the city's water network to transport water, but such water networks cannot withstand excessive pressure. Its water pressure has a certain limit and cannot be used by all users in the same period of time. The following is a brief description of the construction of the water supply and drainage enclosure structure:

1) Roof structure: glazed tile roof (from outside to inside)

Blue gravy glazed tile + cement mortar 30mm+cement mortar 20mm+extruded polystyrene board (ρ=25-32) 35mm+SBS modified asphalt waterproofing membrane 4mm+cement mortar 20mm+reinforced concrete 100mm+lime mortar 30mm

2) PExterior wall construction (1): aerated concrete, foam concrete (from outside to inside)

Cement mortar 20mm+ aerated concrete, foam concrete (ρ=500) 200mm+mixed mortar 20mm+lime mortar 20mm

3) Exterior wall construction (2): Thermal bridge structure (from outside to inside)

Cement mortar 20mm+reinforced concrete 400mm+mixed mortar 20mm+lime mortar 20mm

4) External window structure: 6+6A+6

The heat transfer coefficient is 3.300W/m^2.K, and the shading coefficient is 0.830.

Because of the water pressure limitation, the above data is often not well realized. Some high-rise households will be cut off during certain periods of time, and in order to improve this situation, pressurized water supply can be used. In the actual building water supply and drainage energy-saving emission reduction design, we use the formula to calculate the average solar heat gain coefficient of the building, and further regulate the water supply and drainage energy-saving design in the building.

$$S_W = \frac{b_E \cdot A_E \cdot S_{W,E} + b_S \cdot A_S \cdot S_{W,S} + b_W \cdot A_W \cdot S_{W,W} + b_N \cdot A_N \cdot S_{W,N}}{b_E \cdot A_E + b_S \cdot A_S + b_W \cdot A_W + b_N \cdot A_N} \quad (1)$$

If this problem can be handled well, it will bring more convenience to modern residential building users. Although there is a certain limit to the water pressure of the water pipe network, the pressure on the water pipe network can be increased with the development of technology, and safety issues are also taken into consideration. Therefore, when designing water-saving design for modern residential buildings, it is necessary to combine the influencing factors of water pressure so that

users at the lower level of the building still use the water supply system of the water pipe network to install pressurized water pumps for the residents of the upper floors.

5. Use of household pipe pressure reducing valve

In high-rise residential buildings, overpressure in the pressurized water supply zone is widespread, which causes problems with faucet overpressure outflow and, in severe cases, may damage sanitary appliances. In order to save water use energy, the current national regulations require that the water pressure of the household entrance pipe should not exceed 0.20 MPa, and in the green building evaluation, the water pressure of the household is further required to be no more than 0.15 MPa, which will make the user's faucet flow. Adjust to a reasonable and comfortable range. And in the selection of the household pipe pressure reducing valve should be selected as high quality adjustable copper pressure reducing valve to ensure the stability of water supply and long-term use.

6. Application of energy-saving technology for water supply and drainage engineering of modern residential buildings

6.1. Vigorously promote and use water-saving faucet water supply energy saving

In the past, most of the faucets designed in the past were large in water volume. When they were twisted, they would waste a lot of water. For this reason, relevant manufacturers have conducted intensive research and research, with the goal of developing water-saving faucets. Water-saving faucets have appeared on the market, and ceramic sumps are used in the faucets. Instead of using the previously wasted flat rubber mats, the raised rubber pads are used instead. In the case of a large water pressure, water waste can be reduced by using such an energy-saving faucet.

Table 1: Impact of using water-saving projects on various indicators of residential buildings

Material name (from outside to inside)	thicknessδ	Thermal Conductivity λ	Heat storage coefficient S	Correction factor
	(mm)	W/(m.K)	W/(㎡.K)	α
Cement mortar	20	0.860	10.872	1.00
RC	400	1.740	17.060	1.00
Mixed mortar	20	0.870	10.627	1.00
Lime mortar	20	0.810	9.948	1.00
Sum of layers∑	460	-	-	-
External surface solar radiation absorption coefficient	0.75[default]			
Heat transfer coefficient K=1/(0.16+∑R)	2.17			

It can be proved by the above Table 1 that this energy-saving faucet can save more than half of the water, even if it is under a large water pressure, it will not cause a great waste, and the water saving effect is very obvious. In addition to this energy-saving faucet, there are other infrared control faucets, voltage control faucets, and faucets that automatically turn off according to time. The application of this series of energy-saving faucets has contributed to the conservation of water resources.

6.2. Implementation of diversion, drainage and energy saving of domestic wastewater and fecal sewage

In life, residents in modern residential buildings emit large amounts of sewage every day, including kitchen wastewater, laundry wastewater, and fecal waste water. The treatment of these wastewaters cannot be generalized, but they are treated separately by means of sewage separation. Some wastewater can be recycled after being treated, achieving energy saving. Some domestic wastewater can be recycled and treated as water reuse. This high-quality domestic wastewater

mainly refers to the drainage of washing clothes, and also includes air-conditioning cooling water, which can be reused as domestic water after being treated by a specific process. Because of the scarcity of water, drinking water in life is compressed, and most of the water is not available for human consumption. In addition to drinking water, everyone uses a lot of water every day in other ways, but these water and drinking water come from the same source of water, and a large amount of consumption will cause water shortage. Moreover, the water supply network has increased the pressure and other resources have been consumed in the process. After diversion and drainage, some medium-sized wastewater can be optimized to meet the standard of domestic water, thus saving water resources in the reservoir.

7. Conclusion

The reduction of water resources is one of the current status quo in China, and the demand for water resources will only increase in the future. In order to make people's lives happier, relevant departments must manage the use of water resources and vigorously save water resources through various technologies and means. At present, administrative penalties or economic penalties have been imposed on some water-wasting behaviors and personnel, and some effects have been produced. But the most fundamental problem is still to be solved through energy-saving technology, and it needs to be based on in-depth analysis and research.

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