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Study on application of green building technologies to modern commercial buildings

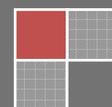
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ABSTRACT

Recently, with the rapid economic development of China, the building industry has also witnessed its golden age. Parameters of buildings have been important manifestation of a city's civilization. They exert serious influence on citizens' work and life, as well as on environment. The development of building industry is also indicative of a city's cultural development and technological progress. Nonetheless, building industry consumes enormous social resources, which heavily constrains it from rapid development. Consequently, green architectural technologies which are energy-saving and environmentally friendly are put on the agenda at a historic moment. They are of great significance to sustainable development of economy and improvement of living environment in China. Besides, policies concerned with building industry have also been introduced by the government to raise the awareness of enterprises in energy conservation and environmental protection, for the purpose of balanced economic and environmental development. Currently, people demand for higher living conditions due to rapid economic development of China and their improving living standards. However, upsurge in energy consumption emerges at the same time. According to incomplete statistics, one third of global energy has been consumed by building industry. Traditional building industry has, so to speak, seriously influenced sustainable development of social economy and environment. This paper delves into the green building technologies at home and abroad. It's found out that application of green technologies to modern commercial buildings is significant for sustainable development of social economy and environment.

KEYWORDS

Modern commercial buildings and green buildings; Modern building technologies; Energy-saving and environment-friendly technologies; Application study and project execution.



INTRODUCTION

With the rapid development of national economy and improving living standards of people, their environmental awareness has also been boosted^[1]. Green building technologies and materials for sewage treatment have been widely applied to the field of architecture, industry, energy, environmental protection and so on. It involves a process of sewage purification so as to discharge the sewage into water body or reuse it. This paper is mainly concerned with industrial sewage treatment. According to its action principle, the treatment can be mainly classified as physical treatment, chemical treatment, physicochemical treatment and biological treatment. Among these treatments, biological treatment is the most widely used. Owing to the complication of sewage treatment process, a single method is usually unable to meet the requirement. Therefore, it will also be accompanied by physical treatment and chemical treatment in the process.

In green buildings, water-saving control system is designed to transform the discharged sewage into reusable water so as to achieve sewage purification. For a long time, the development of sewage treatment in China has made its way into a new phrase with the constant progress of water-saving technologies. Nevertheless, water treatment technologies can't keep pace with city development, with low water-saving control rate, low equipment operation rate and other existing problems. It's pressing to address these problems along with rapid economic development. After comparison of three control forms listed for the above problems, natural materials are suggested to be applied to green buildings^[2].

Development of green buildings is the key to achieving sustainable development of architectural industry. The system controls the output signals through digital output and analog output. Digital-output controls various instrument and equipment-mainly the contactors-in start and stop. Analog output is mainly achieved through aerator-converter, for the purpose of controlling the oxygen content of sewage^[3]. It's quite necessary to install differential gauge in sewage treatment system. The water-saving control system without differential gauge cannot effectively control water filtering. When a problem arises, it can't be quickly discovered and solved along with the possibility of equipment damage. It's not difficult to understand the reason which has been mentioned earlier in the paper. When the differential pressure between the inlet and outlet of the magnetic filter is too high, the water filtering process should be halted immediately, which can't be implemented in time without a differential gauge.

DESIGN CONCEPT OF GREEN COMMERCIAL BUILDING

Commercial building is closely connected to city development and citizens' life. Particular attention should be paid to subroutines for fault diagnosis. In the water-saving control system, external devices which mainly function as signal output are more likely to break down than software. Without being handled timely, the device faults will cause malfunctions and even damage to the system. As a result, subroutines for fault diagnosis are to be designed to ensure that the system will shut down and give an alarm in face of a breakdown in external output devices. In this study, 8 subroutines for fault diagnosis have been designed in sewage treatment system. They all share similar algorithm for fault diagnosis. Take the subroutine1 for example here^[4].

Recently, the U.S. government has formulated standards in building industry, innovated in building technologies and explored new energy to promote development of building energy-saving project. Without being handled timely, the device faults will cause malfunctions and even damage to the system. As a result, subroutines for fault diagnosis are to be designed to ensure that the system will shut down and give an alarm in face of a breakdown in external output devices. In this study, 8 subroutines for fault diagnosis have been designed in sewage treatment system. They all share similar algorithm for fault diagnosis. Take the subroutine1 for example here^[4], as shown in the ladder Figure. In water filtering process, if both the inlet and outlet valves are not open with the magnetic filter not electrified while the drain valve or compressed air valve remain open, then device fault is diagnosed. The system will give the alarm and immediately shut down awaiting checks (TABLE 1). As mentioned earlier in the article, if two machine sets need entering backwash process, Set1 will execute the process prior to Set 2 which turns out to delay 0.1 seconds in the Sequential Function Chart (SFC). However, if any one of the machine sets has been in the backwash process, the other one has to wait owing to their interlock function, which can be clearly seen from the SFC. The Green Building Rating System of LEED is generally acknowledged as the soundest and most influential evaluation criteria^[5].

Commercial building and its environmental design should follow "people-oriented" principle which is the starting point of the concept for green commercial building design. Water is the source of life as well as prerequisite for the living being and economic development. However, the present situation of water resources in China is not quite optimistic. The average water resource per capita is one of the indexes to measure available water resources of a country. With a total volume of 2.8trillion cubic meter of water in China, the amount of water per capital only accounts for one fourth of that over the world. China ranks as one of the thirteen water-poor countries. Worse still, the total amount of our water resources is declining. Just to take the Yangtze River as an example. Since the 1950s, over 20 rivers in the upper Yangtze River have dwindled by 37.1%. Moreover, the water quality is also deteriorating. Water shortage resulted from increasing sewage discharge and treatment technologies below world levels has caused adverse effects to society and taken a heavy toll on national economy^[6].

TABLE 1 : Relevant measures taken for american green buildings

Year	Title	Content
2007	Building Energy-Saving Act	Establishing the commercial application mode of advanced building energy-saving technology and institution, and specifying experimental certification program for energy-saving buildings. The standards set by LEED-enforce the energy-saving practice for buildings, and take an overall consideration of environment and resource recycling.
	Low Carbon Economy Act of 2007	Low carbon economy would be an important strategic option for the future development of America.
2009	American Recovery and Reinvestment Plan	Exploitation of new energy was taken as the investment focus, aiming at doubling the new energy production of America in 3 years.
	American Recovery and Reinvestment Act of 2009	Development of wind power and solar energy, high efficiency cell, carbon storage and capture as well as smart grids.
	The American Clean Energy and Security Act of 2009	It constituted the legal basis of America turning to development of low carbon economy, including 4 parts: improving energy efficiency, exploiting green energy, reducing the emission of greenhouse gas and developing low carbon economy.

Water shortage has become an important factor restricting sustainable development of the economy and society. Currently, the conflicts in terms of water resources in China are even more obvious. On one hand, rapid industrial development has caused conflicts between the dramatic increase of water demands and the limited water reserves. On the other hand, the increasing sewage discharge amount also contradicts with the low sewage treatment rate. These conflicts have been the bottleneck restricting sustainable development of economy. Therefore, sewage treatment and reuse of water have received increasing attention in real society. The final purpose of sewage treatment has risen from up-to-standard discharge to reuse of water resources. In sewage treatment, we can reuse the wastewater as well as producing renewable energy used for production. The cycles move on and on, improving both the water quality and economic benefits.

Water shortage and pollution have caused adverse effects to people's daily life as well as the economic development of China. The requirement for energy conservation, emission reduction and environmental protection demonstrates the necessity and urgency for sewage treatment, whose technique and mode are supposed to be more sound^[7]. Sewage treatment system, which can achieve sewage purification, can not only protect the environment and save water, but also cut the cost of industrial sewage treatment and improve the environment. It's of great significance to maintain rapid economic development, aiming at ushering in full involvement of society in building energy-saving and ecological conservation projects. Thereby, a blueprint for low carbon buildings in Japan is formulated, as shown in TABLE 2.

TABLE 2 : Relevant measures taken for japanese green buildings(source: collated by the author)

Year	Title	Measures
2004	Amendment to Energy Conservation Act	Proposing clear and obligatory requirement for energy conservation and low carbon in office and residential buildings.
2008	A Dozen of Actions towards Low-Carbon Societies	Proposing clear emission reduction targets and technical measures for residential buildings, industry and energy.
	Fukuda Vision	Proposing the long-term goal of reducing the current emission of greenhouse gas in Japan by 60% to 80% by 2050.
2009	Innovation for Green Economy and Society	Proposing the medium and long-term goals for a low-carbon society in harmony with nature by reducing greenhouse gas emission; proposing the implementation of greenhouse gas emission trading scheme and the imposition of environmental tax.

RESPONSIBILITY AREA AND DIVISION FOR PREVENTION AND TREATMENT OF WATER AND SOIL EROSION IN CONSTRUCTION PROJECT

Responsibility Area for Prevention and Treatment of Water and Soil Erosion

Water shortage and pollution have been major problems affecting people's work and life. Meanwhile, increasing industrial water consumption and inordinate irrigation make the problem of water shortage even more serious. Under this circumstance, the urgent matter of the moment is to design an automatic water-saving system to improve the utilization rate of water. This paper introduces basic techniques and process of water-saving system. Based on problems currently existing in industrial water consumption and farmland irrigation in China, a water-saving system is designed by way of advanced control technology, so as to achieve automatic control of existing water resources. This technology applied to sewage treatment and farmland irrigation can enhance stability of the system and improve the water utilization rate as well as easing labor intensity, as shown in Figure 1.

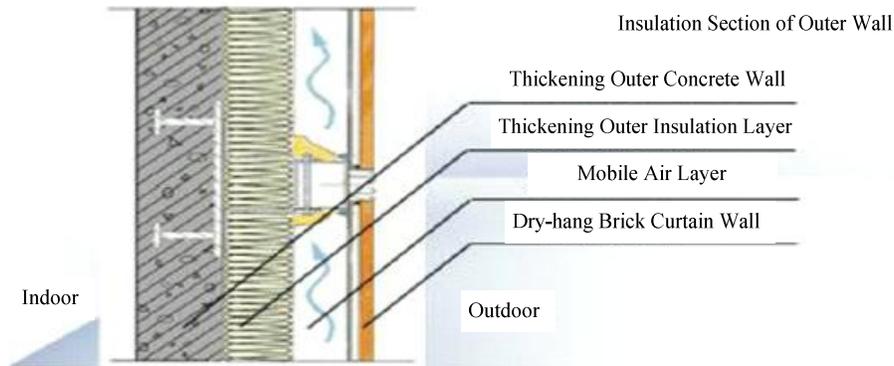


Figure 1 : Dry-hang stone façade

Specific application of green building technologies has been discussed in terms of conservation in energy, water, materials and land as well as of environmental quality indoor and outdoor, just to ensure the achievement of design objectives.

Worse still, the total amount of our water resources is declining, just to take the Yangtze River as an example. Since the 1950s, over 20 rivers in the upper Yangtze River have dwindled by 37.1%. Moreover, the water quality is also deteriorating. Water shortage resulted from increasing sewage discharge and treatment technologies below world levels has caused adverse effects to society and taken a heavy toll on national economy. Water shortage has become an important factor restricting sustainable development of the economy and society. Currently, the conflicts in terms of water resources in China are even more obvious. On one hand, rapid industrial development has caused conflicts between the dramatic increase of water demands and the limited water reserves. On the other hand, the increasing sewage discharge amount also contradicts with the low sewage treatment rate. These conflicts have been the bottleneck restricting sustainable development of economy. Therefore, sewage treatment and reuse of water have received increasing attention in real society. The final purpose of sewage treatment has risen from up-to-standard discharge to reuse of water resources.

Land conservation's main purpose lies in the design of scientific and reasonable environment and space for buildings. Water shortage has become an important factor restricting sustainable development of the economy and society. Currently, the conflicts in terms of water resources in China are even more obvious. On one hand, rapid industrial development has caused conflicts between the dramatic increase of water demands and the limited water reserves. On the other hand, the increasing sewage discharge amount also contradicts with the low sewage treatment rate. These conflicts have been the bottleneck restricting sustainable development of economy. Therefore, sewage treatment and reuse of water have received increasing attention in real society. The final purpose of sewage treatment has risen from up-to-standard discharge to reuse of water resources. In sewage treatment, we can reuse the wastewater as well as producing renewable energy used for production. The cycles move on and on, improving both the water quality and economic benefits.

Water shortage and pollution have caused adverse effects to people's daily life as well as the economic development of China. The requirement for energy conservation, emission reduction and environmental protection demonstrates the necessity and urgency for sewage treatment, whose technique and mode are supposed to be more sound. Sewage treatment system, which can achieve sewage purification, can not only protect the environment and save water, but also cut the cost of industrial sewage treatment and improve the environment, as shown in Figure 2. It's of great significance to maintain rapid economic development.

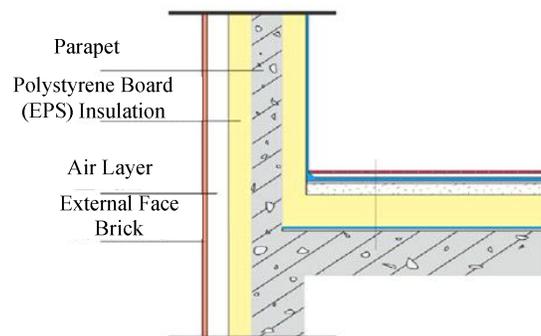


Figure 2 : Thermal insulation of closed roof

Division for prevention and treatment of water and soil erosion prevention

Sewage treatments have been widely applied to the field of architecture, industry, energy, environmental protection and so on. It involves a process of sewage purification so as to discharge the sewage into water body or reuse it. This paper is mainly concerned with industrial sewage treatment. According to its action principle, the treatment can be mainly classified as physical treatment, chemical treatment, physicochemical treatment and biological treatment. Among these treatments, biological treatment is the most widely used. Owing to the complication of sewage treatment process, a single method is usually unable to meet the requirement. Therefore, it will also be accompanied by physical treatment and chemical treatment in the process.

OBJECTS OF WATER AND SOIL EROSION PREVENTION AND TREATMENT IN CONSTRUCTION PROJECT

Basic objective: The original water and soil erosion in the project construction area is to be solved basically; the newly water and soil erosion is to be controlled effectively; ecology is to be protected to the utmost with environment improved significantly; facilities for soil and water conservation are to remain safe and effective.

Prevention and treatment index

Soil erosion control ratio is taken as one of the index. The main mechanism of this method lies in microbial metabolism. With small capacity of sedimentation basin, the input costs are naturally very low. Through microbial metabolism and reproduction, the organic matter in sewage can be effectively reduced. But there are also drawbacks that can't be ignored. When water comes into the aeration tank, the load of organic matter should not be too high. So the aeration has to be capacious, resulting in high capital costs. The operation effects depend on the influent quality and the change of water volume as well as the ratio of vegetation area to project construction area.

Standard level of prevention and treatment and its application scope

The water-saving control system consists of two processes, namely filtering process and backwash process. In filtering process, the sewage comes in, after inlet and outlet valves are opened. When the sewage flows through electrified magnetic filters coil, impurities of water will be absorbed to the magnet of magnetic filter with purified water flow out through the outlet valve. The filtering process of the two machine sets can coincide with each other, or work alone. After a period of filtering, the magnet has absorbed quite a lot of impurities which must be cleaned then. This is the so-called backwash process. In this study, green building design should focus on the following aspects as shown in Figure 3.

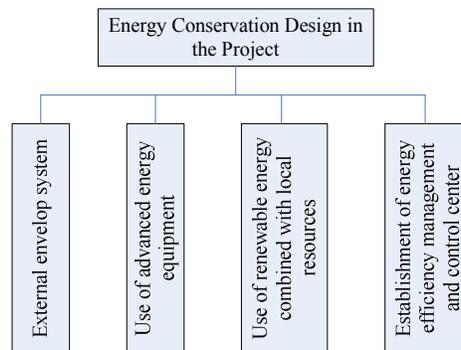


Figure 3 : Diagram of work breakdown structure (WBS) for technological application in the project

CONCLUSIONS

This paper makes further research into energy-saving green building technologies. It's found out that application of green building technologies to modern commercial buildings are of great significance to sustainable development of social economy and environment. Parameters of buildings have been important manifestation of a city's civilization. They exert serious influence on citizens' work and life, as well as on environment. The development of building industry is also indicative of a city's cultural development and technological progress. Nonetheless, building industry consumes enormous social resources, which heavily constrains it from rapid development. Consequently, green architectural technologies which are energy-saving and environmentally friendly are put on the agenda at a historic moment. They are of great significance to sustainable development of economy and improvement of living environment in China.

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