

**A STUDY ON THE CHALLENGE OF CARBON TRADING POSES TO THE WASTEWATER TREATMENT****Yanbo Zhou and \*Dong Li**Science and Technology Plan Project of Shaanxi Provincial Water Resources Department,  
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**Abstract**

The successful experience of carbon emission trading market mechanism has enlightened and challenged the waste water treatment. The comparison was made between carbon reduction and waste water treatment from commodity definition, customer, pricing and market pressure. Xi'an Siyuan University's MBR membrane bioreactor has been safe and effective operation for 10 years, treated 7.554 million cubic meters of campus waste water, produced 4.961 million cubic meters of reclaimed water, and all reused for toilets flushing, road surface cleaning, and irrigation of green grass and trees. Therefore, universities has been proposed as the breakthrough of developing the waste water treatment and the reuse of reclaimed water, gradually advancing toward the market economics.

**Keywords:** Carbon, Wastewater

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**INTRODUCTION**

The Third Conference of the United Nations Framework Convention on Climate Change was held in Kyoto, Japan, in December 1997. Representatives of 149 countries and regions aimed to limit greenhouse gas emissions to curb global warming and raise ground ozone concentrations. Restricted carbon dioxide emissions can effectively avoid a variety of serious natural disasters, such as droughts, heavy rains, floods, heat waves, and wildfires, and accelerated sea levels increasing. To avoid putting water resources, agriculture, wildlife, and ecosystems in crisis. Later China central government<sup>[1-3]</sup> called for "victory to build a well-off society in a new era of socialism with Chinese characteristics" and "strive to peak before 2030, strive for 2060 years ago carbon neutral", an unified carbon emission exchange, composed of 2,162 key emission units in the national power generation industry (total emission capacity 4.5 billion tons), began trading on July 16, 2021. On the first day of trading, the trading volume was 4.104 million tons; the turnover exceeded 210 million yuan RMB; the closing price rose 6.73% from the opening price, and the highest price of 52.8 yuan RMB/ ton<sup>[4]</sup> encouraged the industry insiders. Subsequently, listed companies, investment institutions, banks, trust funds and other financial institutions not only entered the market, but also shown the layout in the capital market efforts. It is predicted that the high-emission industries such as petrochemical industry, steel and building materials will surely be included in carbon emission trading, and will eventually form a national carbon emission trading market of more than 100 billion tons. The policy orientation and business planning of using the carbon emission trading market mechanism to control and reduce carbon emissions and promote economic and social low-carbon and green development, and then to achieve carbon peak and carbon neutrality is successful. In 1993 the 47th UN General Assembly designated 22 March annually as "World Water Day".

Soon, the China also designated the corresponding week of World Water Day as the "China Water Week". As early as August 14, 2009, the Ministry of Finance, the Ministry of Environmental Protection and the Jiangsu Provincial government held the launch ceremony in Wuxi, and the Taihu Lake Basin took the lead in launching the pilot project of paid use and trading of pollutant discharge rights<sup>[5,6]</sup>. However, the goods traded are only chemical oxygen demand (COD), and the price is 4,500 yuan RMB per ton. With a transaction of 817 tons, a total of 2.95 million yuan RMB was paid to the local financial department. In 2009, It is mainly intended to establish a market system of "who pollutes, who pays; who controls pollution, who benefits". The most difficult problem in the development of water pollutant discharge rights trading is that there is no cross-regional and cross-industry unified trading platform. As a result, although water saving and carbon reduction are both public welfare, professional, national intervention and cross-departmental and cross-industry commodities, water saving is not as prosperous as carbon reduction. On March 14, 2014, General Secretary Xi Jinping clearly put forward the idea of water saving first.

The slogan of 2021 China water week is "water is the foundation of survival, the source of civilization, the base of ecology" indicates that the current water situation in our country is very serious, the shortage of water resources, serious water pollution, water ecological environment deterioration problems have become the main bottleneck of restricting economic and social sustainable development. Faced with the booming start of green carbon reduction and environmental protection, the enterprises and public institutions that have been pushing wastewater treatment and environmental protection into the market economy for many years feel a little embarrassed. The wastewater treatment proves to be "the ideal is very happy, but the reality is very skinny"<sup>[7]</sup>. Therefore, this paper wants to discuss the reasons why carbon trading is booming than wastewater treatment, and the enlightenment and opportunities brought by carbon trading to wastewater treatment.

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## Comparison between carbon reducing and wastewater treatment

While carbon reducing and wastewater treatment are both green commodities, they are very different in definition, customer, pricing, and market pressures.

**Commodity definitions:** The carbon transaction involves only one commodity: carbon dioxide. On the contrary, wastewater treatment yielded the intermediate-reclaimed water. Only the reclaimed water is reused, wastewater treatment is the commodity with a value. Therefore, the wastewater treatment is a process only. There are four types usage for reclaimed water: <sup>(1)</sup>groundwater recharge, namely supplement groundwater water source to prevent ground settlement, and / or prevent saltwater intrusion; <sup>(2)</sup>industrial water; <sup>(3)</sup>agricultural water; <sup>(4)</sup>urban water: residential community reening, landscape environment water, toilet flushing, etc. From the perspective of the value of reclaimed water usage, the reclaimed water used for groundwater recharge is an usage with the lowest and unaccountable value, or only social benefits. The author believes that "water saving first" contains the dialectical materialism of "qualitative utilization for reclaimed water". High quality water for low requirement usage is waste, such as urban tap water for flushing toilet, green land watering, car washing, reclaimed water used for groundwater recharging. Therefore, wastewater is a raw material, reclaimed water is an intermediate product, reused reclaimed water is a commodity, and its value is reflected in the reusing market.

**Market pressures:** Both air and water flow, but the affected area is different. The affected area of water flow is local, but the affected area of air flow is global, such as the sentence of "The idea that a butterfly stirring wings in Sydney, Australia can affect the weather in New York City in a few weeks." The second day of the nuclear reactor accident at the Chernobyl nuclear power plant in Ukraine, radiation dust drifted to 1,100 kilometers away in Sweden. There are also a variety of serious natural disasters caused by global warming, such as droughts, heavy rains, floods, heat waves, and wildfires, which also occur around the world. Although we all know: the total water volume on the earth is 1.4 billion cubic kilometers, fresh water reserves account for only 2.53% of the total global water volume, humans may only use about 0.26 percent of the total water on earth. Moreover, the problem of water is not yet significant for the developed countries in North America and Europe. China's per capita water share is only equivalent to a quarter of the world's per capita water share, ranking the 121st in the world. More than half of China 600 cities are water deficient to varying degrees, and China is identified as a "water shortage" country by the United Nations. For China, especially for the Greater Northwest China, it is a big issue of social security, development and prosperity. For example, Xi'an is a city with extreme shortage of water resources, occupying 310 cubic meters of surface water resources per capita, only one / sixth of that of the country. Similarly, the actual situation of uneven spatial and temporal distribution of water resources will also make the demand for reclaimed China in South China, East China, Central China and Southwest China less than that in northwest and North China.

**Customers:** Carbon exchanges involve limited large state-owned or private enterprises, such as 2,162 key emission enterprises in the power generation industry. In the future, the

petrochemical industry, steel and building materials and other high-emission industry enterprises are also limited large state-owned enterprises or private enterprises. Certain businesses may need to buy in national carbon trading markets due to insufficient quotas, which increases the cost of these businesses. In the increasingly severe competition pattern, backward enterprises will therefore be eliminated. Carbon trading uses market rules, survival of the fittest. The subjects involved in water saving are both enterprises and undertakings; both units and individuals. For large water use enterprises, there is no problem with wastewater treatment and reclaimed water reuse. But it is difficult for other environmental protection companies, such as Beijing Urban Drainage Group, and public institutions and urban residents. According to the investigation, the application of membrane bioreactors in the field of industrial sewage treatment is very smooth. Enterprises will basically reach the index of recycled water slightly treated, or even without treatment, can be used in the production process, to save tap water. For the application of the field of municipal sewage treatment is different opinions. Nationwide completed and operational membrane bioreactors in the municipal sewage treatment field projects are very large, reaching the size of millions of tons per day. But none of them are market-oriented projects, all of them is government-funded and government-operated. This situation is not only the high investment cost and operating cost of membrane bioreactors, but also the vast majority of reclaimed water is used for groundwater recharge, which cannot produce great value. The immediate consequence is the inability to recover the investment. The calculation result of "only compensate but not earn" is simply unable to attract Chinese and foreign private capital at all. At the same time, since the reform and opening up, the Chinese government is gradually transitioning from welfare supply model to socialist market supply model for people's livelihood. The welfare supply model makes consumers do not need to realize the full cost of these supply consumption. In this case, consumers are easy to lose the autonomy and enthusiasm to implement low-carbon life.

**Prices:** To put it simply, the buyers or sellers know that saving 1.0 KWH electricity is equivalent to reduce 0.997 kilograms of carbon dioxide emission, and the price of carbon dioxide is opened for anyone. Carbon trading can play the market price discovery function and form a carbon pricing mechanism, thus promoting the transformation of low-carbon and green economy. But no one can answer the same question of computable benefit for wastewater treatment? Therefore, even BOT model has never been realized in wastewater treatment project because it is difficult to attract Chinese and foreign private capital. BOT model is that the government transfers the management right and income right of the construction project to the investors for a certain period of time in exchange for the project financing and construction.

### Enlightenment and opportunity

The authors believe that the enterprises and public institutions can learn from the booming start of green carbon reduction and environmental protection, and find out the opportunities for wastewater treatment and reclaimed water market. The authors also believe that the marketing breakthrough point of further actions should be selected in colleges and universities. There are three reasons as the following :

- Universities have densely population and concentrated water usage<sup>[8-11]</sup>. There is an important way to establish water saving consciousness, set up reclaimed water reuse system;
- Universities have always had the responsibility and obligations to promote scientific and technological progress, train talents, and serve the society. In terms of promoting scientific and technological progress alone, universities not only have the responsibility to promote new technologies, but also have almost all the necessary professionals, such as mechanic, electrician, physical and chemical personnel, and computer operators.
- Xi'an Siyuan University continues to practice low-carbon, energy saving and environmental protection, adhere to innovation, and has achieved good results in wastewater treatment and reclaimed water reuse<sup>[12-15]</sup>. Xi'an Siyuan University established an MBR membrane bioreactor sewage treatment plant. From the November of 2011 to the November of 2021, a total of 7.554 million cubic meters of campus waste water was treated, producing 4.961 million cubic meters of reclaimed water meeting the national standards (GB / T 18921-2002) . All reclaimed water is used for toilets flushing, road surface cleaning, and irrigation of green grass and trees.

In authors' view, the third reason is the most important one. The wastewater treatment and reclaimed water reuse in Xi'an Siyuan University has exceeded the expectations of many experts and scholars and manufacturers at home and abroad. This example proves that if a private money can do it, then the public funding institutions can do that too. Furthermore, all technical and financial data, operation procedures, and relevant scientific research papers can be found. The final account of the project (subsystem construction cost including 4000m<sup>3</sup>/day A<sup>2</sup>/O-MBR wastewater treatment building / equipment, reclaimed water reuse pipeline and pumping station, and amortization cost, etc.) is RMB 22,381,300. The unit investment cost is 5,595.33 yuan RMB/m<sup>3</sup>/ day. According to the relevant data analysis of A<sup>2</sup>/O-MBR for 10 years in operation, from the first year to the fifth year, the unit water recovery cost including membrane depreciation period and partial amortization fee is 3.29 to 3.58 yuan RMB/ m<sup>3</sup>. Without membrane replacement, the 6th year to the 10th year is from \$2.46 to \$2.64 yuan RMB / m<sup>3</sup>.

## Conclusion

The successful start of carbon trading reveals that the wastewater treatment and reclaimed water reusing should also play the role of the market mechanism. A new thought is needed to explore the effective form of the industrial construction and operation in accordance with the economic laws. "Water-saving first" contains the dialectical materialism of "separate quality and utilization". High quality water for low requirement usage is waste, such as urban tap water for flushing toilet, green land watering, car washing, etc. The reclaimed water is used for groundwater recharging only cannot created enough profits to attract outside investment. It is suggested to choose universities as the breakthrough point in the development of sewage treatment and reclaimed water reuse.

Through the gradual promotion, the market construction is more planned, and the target completion rate is higher. The most important reason for the suggestion is that Xi'an Siyuan University with MBR membrane biological reactor as the core of reclaimed water plant has safe and effective operation for 10 years, treated nearly 7.554 million cubic meters of campus sewage, produced the national "water reuse water quality standard" 4.961 million cubic meters of reclaimed water, and all reuse. The power of a role model is infinite.

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