

Research Article

A STUDY ON THE REASONABLE CONVERSION OF ENVIRONMENTAL PROTECTION EFFECT BETWEEN WATER SAVING AND CARBON REDUCTION

ZHOU Yanbo, * LI Dong and ZHANG Xuemei

Xi'an Siyuan University, No.28 Shui-an Road, Xi'an, China.

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ABSTRACT

The principle of equal price between water saving and electricity saving is used to calculate one ton of water saving is equivalent to how many tons of carbon dioxide emissions reduced. According to the water price and electricity price of Xi'an city in January 2022, saving a ton of water is equal to reducing emissions of 10.03 kilograms of carbon dioxide. It is also calculated that in the past 10 years, Xi'an Siyuan University has treated 7.554 million cubic meters of campus waste water, produced 4.961 million cubic meters of reclaimed water, and been reused for toilets flushing, road surface cleaning, and irrigation of green grass and trees. 4.961 million cubic meters of reclaimed water equivalent to reducing the emission of 49,759 tons of carbon dioxide.

Keywords: water saving and carbon reduction; water-electricity price equivalent; carbon trading; reclaimed water reuse.

INTRODUCTION

Since September 2020, when China announced that it "strives to the peak of carbon emissions by 2030 and strive to achieve carbon neutrality by 2060", reducing carbon dioxide emissions has been officially mentioned as an implementation step to realize the centenary dream. On July 16, 2021, as an important policy tool to promote the realization of the dual-carbon vision, the carbon market in the national power generation industry took the lead in launching a unified carbon emission trading. The first batch of 2,162 key emission companies were included in the power generation industry, covering about 4.5 billion tons of carbon dioxide emissions. At the end of the first day of trading, trading volume reached 4.104 million tons, turnover of more than 210 million yuan [1,2]. Other 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 yuan. In the process of discussing energy saving, carbon reduction and environmental protection, it always seems like a lack of a very important element-water. From the current publicity of energy conservation, carbon reduction and environmental protection, water saving seems to be not directly related to reducing carbon dioxide emissions. Saving 1.0 KWH electricity is equivalent to 0.997 kg of carbon dioxide reduction, and the corresponding amounts of sulfur dioxide and nitrogen oxides. But so far, nothing has been given how much saving a ton of water equals reducing carbon dioxide emissions. Since both water and electricity saving are environmental measures advocated by the government, saving a ton of water should calculate as much carbon dioxide emissions as saving a KWH of electricity. This water-saving and carbon-reduction conversion not only further clarifies the publicity of "water-saving and power-saving to establish a low-carbon and green lifestyle", but also is conducive to further promoting sewage treatment and recycling, so as to more comprehensively promote the implementation of the dual-carbon vision. Therefore, this paper discusses whether to establish the

concept of water saving and carbon reduction, and how to carry out the equivalent conversion steps of water-electricity, in order to improve the low-carbon energy conservation and environmental protection mechanism, and promote the development of green lifestyle.

WATER SAVING AND CARBON REDUCTION

Possibility

Historically, water saving comes first and reducing carbon after. On 18 January 1993, the 47th UN General Assembly issued a resolution identifying 22 March of each year as World Water Day. The total water volume on the earth is 1.4 billion cubic kilometers, and the fresh water reserves account for only 2.53% of the total global water volume. Excluding deep groundwater that cannot be mined, what humans can use is only about 0.26 percent of the total water on earth. So far, human freshwater consumption has accounted for 54% of available worldwide. 2021 China Water Week presents one of the propaganda slogans of "Water is the foundation of survival, the source of civilization and the foundation of ecology". Four years after the setting of World Water Day, the Third Conference of the Parties to the United Nations Framework Convention on Climate Change was held in Kyoto, Japan, in December 1997. Representatives of 149 countries and regions have passed legislation aimed at limiting greenhouse gas emissions to curb global warming. It is proposed that climate change will lead to higher ozone concentrations on the ground and eventually cause more severe multiple natural disasters, such as drought, heavy rains, floods, heat waves, and wildfires, accelerating sea levels, putting water, agriculture, wildlife and ecosystems in crisis. Water saving and carbon reduction are not divided and independent.

Certainty

At the fifth meeting of the Central Leading Group for Finance and Economics on March 14, 2014, General Secretary Xi Jinping clearly put forward the idea of "water saving first". "Water saving first" contains the dialectical materialism of "quality utilization, open source and reduce expenditure". As early as August 14, 2009, several state

*Corresponding Author: LI Dong,

Xi'an Siyuan University, No.28 Shui-an Road, Xi'an, China.

governmental bureaus, including the Ministry of Finance and 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. However, the goods traded are only chemical oxygen demand (COD), and the price is 4,500 yuan per ton. On that day, 817 tons (worth 3.67 million yuan) were sold, and a total of 2.95 million yuan was paid to the local financial department. Early attempts were mainly 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 [3,4]. Even if there is an unified trading platform, but other than COD, several pollutants, such as total phosphorus, total nitrogen, turbidity, color, odor, are listed for reclaimed water. In other words, the "Carbon dioxide emission right" should not be equal to the "water pollutant discharge right", but should be equal to the "reclaimed water reuse" obligation. From the perspective of value, the reclaimed water used for groundwater recharge is a commodity with the lowest value. The reclaimed water uses for agricultural water, industrial and commercial water (toilet flushing, car washing, watering green land) can produce more economic benefits.

Necessity

From "clear waters and green mountains are gold and silver mountains" to "carbon peak and carbon neutrality", they have all revealed that low carbon, energy conservation and environmental protection is a of extensive and profound economic and social systemic reform that requires the government, enterprises, and everyone to participate in[5, 6]. Since the reform and opening up, China has explored and developed from a planned economy system to a socialist market economy system. In this process, for some people's livelihood supply model, the government is gradually shifting from the welfare supply model (water, electricity, gas, etc.) to the socialist market supply model, in which the most consumers will lose the autonomy and enthusiasm to implement low-carbon life. Moreover, carbon neutrality (carbon neutral) is by calculating the total carbon dioxide emissions, and then through afforestation, using the photosynthesis of green plants to convert these carbon dioxide absorption into oxygen to achieve environmental purposes. Without water, there are no trees, no carbon neutral. For China, the distribution of water resources is so uneven that water saving and carbon reduction must be considered, measured and calculated uniformly, especially for the northwest. More than half of the China's 600 cities are water-deficient to varying degrees. China's per capita water share is only equivalent to a quarter of the world's per capita water share, and is a water shortage country. Xi'an is a city with extreme shortage of water resources, occupying 310 cubic meters of surface water resources per capita, only 1/6 of that of the country. The CPC Central Committee and the State Council recently issued the Plan for Ecological Protection and High-quality Development in the Yellow River Basin[7]. This outline document has reflected the national strategic orientation. Therefore, water saving and carbon reduction must be related.

WATER AND ELECTRICITY EQUIVALENT CONVERSION

Since water saving can be, should, and must be related to carbon reduction, the remaining question is how to convert saving a ton of water to how many tons of carbon dioxide emissions?

Basis of the conversion

For any commodity, the value determines the price. The value is affected by the relationship between supply and demand. Price is the form of the sum value of goods in the process of circulation. Several different commodities can be equally exchanged according to the principle of equivalence. Carbon dioxide and reclaimed water are commodities of our interest. Although no one will pay for carbon dioxide, people will pay for electricity. Then buying water at the same price can be exchanged with buying electricity at the same price. This is the principle of water and electricity equivalence, and also the basis of water saving and carbon reduction conversion. Because the price of goods is affected by supply and demand, the water and electricity bills are different across the country. The main reason is to see the local geographical location, precipitation, the easy transportation of water and electricity, the scarcity of resources and other aspects. Although in each specific city, its water price and electricity price are various, they are clearly marked by the local governmental bureaus.

Procedures of conversion

According to the premise of saving water and electricity is equivalent, saving a ton of water is equivalent to reducing how many tons of carbon dioxide emissions. Now take the example of Xi'an Siyuan University to calculate what is water-electricity equivalent and how to calculate water saving and carbon reduction. 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 sewage was treated, producing 4.961 million cubic meters of reclaimed water (GB / T 18921-2002) meeting national standards and all used for toilets flashing, road surface cleaning, and irrigation of green grass and trees [8-12]. In Xi 'an, in the January of 2022, the electricity fee is 0.5764 yuan per KWH, and the city tape water is 5.80 per ton. The calculation results show that according to the equivalence rules of water-electricity, the water price and electricity price, saving a ton of water is equal to saving 10.06 KWH. The saving a ton of water is equal to reducing 10.03 kilograms of carbon dioxide. 4.961 million cubic meters of reclaimed water equivalent to reducing the emission of 49,759 tons of carbon dioxide.

CONCLUSION

From the solemn commitment of "carbon peak and carbon neutrality" to the gong of the carbon dioxide trading market in the national power generation industry means that low carbon, energy conservation and environmental protection need to establish water saving and carbon reduction rules. Because water saving and carbon reduction can, should, and must be related, so it is necessary to establish water saving and carbon reduction conversion. In order to improve the low-carbon energy conservation and environmental protection mechanism, promote the development of green lifestyle, use the principle of water saving and electricity saving equivalence, according to the water price and electricity price of Xi'an in the January of 2022, saving a ton of water is equivalent to reducing the emission of 10.03 kg of carbon dioxide. The MBR Membrane bioreactor sewage treatment plant of Xi'an Siyuan University, from the November of 2011 to the November of 2022, treated 7.554 million cubic meters of sewage, producing 4.961 million cubic meters of reclaimed water meeting national standards and all reused. The reuse of reclaimed water is regarded as saving 4.961 million cubic meters of water, which is equal to reducing emissions of 49,759 tons of carbon dioxide.

REFERENCES

1. Chai Qimin, Jiang Yong. Exploring opportunities-new ideas for coordinated development of pollution reduction and carbon reduction [J], China's Environmental Protection Industry, 2021 (6): 14-18
2. Li Fei. Carbon City "set sail" [J], E management, 2021 (18): 98-103
3. Wang Kangpeng. Environmental protection industry: From Crisis to Business Opportunity [N], China Business News, September 16, 2009, the C01 edition
4. Wang Kangpeng. From crisis to business opportunities-China's environmental protection industry chain is growing [J], China Science and Technology Investment, 2010, (4): 27-29
5. People's Daily, edition 2, April 23, 2021.
6. Zhao Mengfei, Feng Lianyong. Personal carbon inclusion is imperative [J], Energy, 2021 (9): 28-30
7. Beijing Daily. October 8, 2021, Customer Edition
8. Xuemei ZHANG, Jingyuan HAO, Qinghua MA, et al., Comprehensive Analysis of 9-year Running Data of A²O-MBR in Xi'an Siyuan University[J]. Meteorological and Environmental Research. 2020, 11(5):139-143
9. Li Dong, Zhang Hongsheng, Fu Bo, et al., Analysis of water reuse in A²O/MBR-Take Xi'an Siyuan University as an example [J]. Water supply and drainage, 2017, 43 (S1): 159-161
10. Li Dong, Hao Jingyuan, Ma Qinghua, et al., Long-term operational data analysis of the MBR process [J]. Water Purification Technology, 2019, 38 (6): 92-96.
11. Zhou Shiheng, Wang Qinghua, Fu Bo, et al., Analysis of MBR process of Sewage Treatment Plant of Xi'an Siyuan Institute in Many Years [J]. Shanxi Science and Technology, 2020, 35 (4): 84-87.
12. Zhou Yanbo, Li Dong. Inspiration and opportunities brought by carbon trading to sewage treatment and reclaimed water reuse [J]. Frontier of environmental protection, 2021, 11(5): 1034-1039. DOI: 10.12677/aep.2021.115124
