

2. In 2023, the project was awarded as an excellent case of “520 Social Responsibility Day”.
3. The project has been reported on various media platforms such as Dazhong Net, People's Daily Online, and China Paper. It received widespread praise from the government and community residents.

■ Project Implementation

1. Project Background

The smoke and wastewater generated in the pulp and paper production process contain a large amount of low-temperature waste heat, but due to technical and cost reasons, it can't be recycled, which is a problem of energy waste faced by the entire paper industry.

With the proposal and promotion of the national “dual carbon” target, various regions across the country are exploring the path of green, low-carbon, and sustainable development. With the increase of urban population, heating enterprises in Rizhao Economic and Technological Development Zone are facing increasing pressure in terms of environmental protection, coal consumption, and carbon emissions. They are also actively exploring the use of green and low-carbon energy and heat sources.

2. Solution

In the face of numerous technologies for waste heat recovery and the characteristics of the pulp and paper industry, the technical team of Asia Symbol (Shandong) Pulp And Paper Company has conducted feasibility technical research and demonstration with multiple domestic and foreign companies and research institutions, and introduced the technical strength of professional companies. The main equipment adopts the patented technology of “vacuum phase change heat exchange” (Harbin Institute of Technology Jintao low-temperature phase change flash evaporation technology, which utilizes the characteristic that the boiling point of water decreases with the decrease of environmental pressure, creates a negative pressure environment through a vacuum pump, and causes industrial wastewater above 26 to flash evaporation, producing negative pressure steam that carries the latent heat of vaporization and is transported to the condenser for condensation and heat release into the low-temperature medium). The flue gas and high-temperature wastewater generated in the alkali recovery boiler, lime kiln, power boiler, incinerator and pulp production process of the factory, are used for waste heat recovery and utilization, Part of the recovered heat is used in cooperation with local heating companies for community residents' heating, while the other part is reused in the company's production system, which can effectively replace and reduce the use of fossil fuels.

This project involves the construction of 8 buildings and more than 107 sets of main equipment, including direct heat engines, spray towers, spray water pumps, intermediate water pumps, heating water pumps, return water pumps, motors, plate heat exchangers, flue gas re-heaters, condensate tanks, as well as supporting facilities and heating pipelines in the factory area.

The technical path of the flue gas treatment process implemented in this project is “indirect slurry low-temperature vacuum phase change flash evaporation condensation + flue gas reheating” and “flue gas spray condensation + reheating”. The main process flow is to use indirect condensation of flue gas, namely slurry flash

evaporation cooling, to achieve the purpose of flue gas condensation and dehydration. In the vacuum phase change heat exchange device, the slurry undergoes heat exchange through flash evaporation, transferring heat to the cold source - the internal cold source and heating water. The cooled slurry returns to the original process system to continue spraying the flue gas, thereby achieving the goal of reducing the temperature and moisture content of the discharged flue gas.

3. Key breakthrough

(1) This project combines the characteristics of the pulp and paper industry in terms of technology, and after technical exchanges with multiple domestic waste heat recovery equipment manufacturers, it has been used for the first time in the pulp and paper industry.

(2) As the project leader, the technical team continuously explores and innovates during the project implementation process, improving the original direct heating integrated waste heat recovery equipment developed by Harbin Institute of Technology to meet the needs of flue gas waste heat recovery from different furnace types.

(3) This project has received strong support from the Rizhao Municipal Government, Rizhao Ecological Environment Bureau, Rizhao Economic Development Zone, and others. The government has acted as a bridge to convert the waste heat energy from factories into livelihood resources, achieving energy recycling and regional carbon reduction.

■ Project Impact & Sustainability

1. This project is an innovative project in the world's pulp and paper industry that combines flue gas waste heat reuse with civilian use. It has obvious characteristics of technological innovation and mechanism innovation, and has received widespread praise from local governments, ecological environment departments, and communities. It also has good environmental, social, and economic significance.
2. This project has promotable and replicable value, and Rizhao City has already started organizing promotion.

■ Expert Comments

The Deep Flue Gas Treatment and Integrated Waste Heat Utilization Project recovers waste heat from flue gas in the alkali recovery boilers and lime kilns, as well as from wastewater generated during the pulping process. This recovered heat is partly used to provide heating for community residents and partly recycled back into the company's production system, effectively reducing fossil fuel consumption and, consequently, carbon emissions. It also lowers the emission concentrations of nitrogen oxide and sulfur dioxide in flue gas, and dust. This case sets a benchmark and demonstration effect for energy conservation and emission reduction in the paper-making industry nationally and globally, generating notable environmental, social, and economic benefits. It has been widely covered by media outlets including dzwww.com, people.cn, thepaper.cn, and paper.com.cn.

