



HEAT PUMP SOLUTION FOR A MAJOR BREWERY

CASE STUDY



INDUSTRY Beer and Beverage

CUSTOMER International Beer Brand's Brewing Facility

LOCATION Taizhou, Zhejiang, China

BACKGROUND The global company's brewery had a footprint of 290,000 square meters (3,121,534 square feet), employed more than 700 people, and had a production capacity of 600,000 metric tons, with an annual beer production capacity of 385,000 kiloliters (~101.7 million U.S. gallons). The facility's annual total steam consumption was approximately 55,000 metric tons, and the brewery's mashing workshop was generating 100–150 metric tons of steam condensate daily, at a temperature of approximately 70°C (158°F).

PROBLEMS TO SOLVE The facility was pumping its steam condensate to a high-quality process water tank, where it was being mixed with cold water to reduce the temperature for use in the packaging workshop's conveyor spray system. This process required a dedicated supply of cold water and the waste heat generated was not being fully recovered for reuse. Additionally, the factory was relying on steam heating to meet its significant hot water demands for production and energy storage. The client's objective was to reduce steam usage and improve the brewery's overall energy efficiency by maximizing recovery and reuse of waste heat from condensate.

Armstrong International

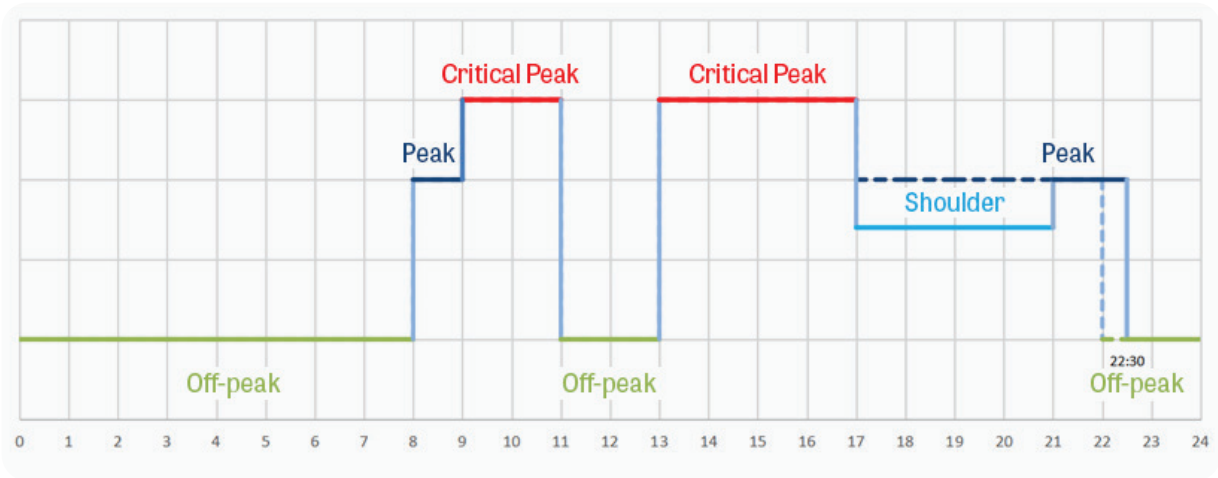
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**ARMSTRONG'S
SOLUTION**

Armstrong's Circular Thermal® methodology was used to develop a custom-designed solution that would recover the brewery's waste heat and convert it into a valuable resource, significantly reducing primary energy consumption and CO2 emissions. Applying pinch analysis to the factory's hot and cold streams with relevant operating parameters as input allowed Armstrong to determine the maximum recoverable waste heat and minimum energy demand. This information was then used to optimize a heat exchanger network for efficient recovery and storage of the system's waste heat before upgrading and transferring it to heat users. The result was a tailor-made, high-temperature heat pump package, equipped with a control system to support the brewery's production processes and engineered to use the existing hot water tanks for temporary storage of condensate from the mashing workshop.

During off-peak hours, the new heat pump system transfers waste heat from the condensate into the thermal energy storage return, ready for use. If condensate becomes limited or other issues arise, the system is able to maintain optimal efficiency by switching to alternative heat extraction pipelines. This solution facilitates both condensate temperature reduction and waste heat recovery, greatly enhancing the energy recycling process. By utilizing the off-peak electricity rates for optimal energy storage, Armstrong's heat pump solution achieved the client's overall energy savings and decarbonization goals.



Zhejiang Time-of-Use Rates for Peak and Off-Peak Hours (Solid line represents the adjusted period starting January 1, 2024; dashed line represents the original period)

WHY ARMSTRONG?

With over 50 years of experience in high-temperature industrial heat pumps, ARMSTRONG+COMBITHERM combines this expertise with Armstrong's rich legacy of more than 125 years in thermal utility services to provide comprehensive integrated solutions for clients.

Armstrong's Circular Thermal® and Heat Pump Solutions

Armstrong International's Circular Thermal® methodology can be tailored for specific projects and applications, employing pinch technology and Armstrong heat pump solutions to maximize the efficiency of waste heat recovery. Our custom-engineered heat pump units feature internationally renowned brands of core components, such as compressors, evaporators, and condensers, ensuring exceptional quality and dependability. All of Armstrong's heat pump accessories are designed to meet strict client standards for optimal compatibility, and integrated subcoolers and superheaters effectively enhance system capacity and elevate the COP. The intelligent safety system in our heat pump solutions includes HP/LP switches and a sensor dashboard, ensuring connectivity with Building Management Systems (BMS), safety interlocks, and monitoring of performance trends, while a BTU meter allows for real-time performance assessment. Properly maintained, Armstrong heat pumps are built to operate safely for over 10 years, providing clients with stable heat solutions.

Armstrong's Proven Performance

The brewery had previously adopted an Armstrong waste heat recovery system, complete with Armstrong-manufactured regulating valves, control valves, control cabinets, and electric control cabinets for smooth, precise operation. Having this system already in place further enhanced the compatibility and operational efficiency of the new heat pump solution installation.

SIGNIFICANT RESULTS

The successful commissioning of this project has effectively enhanced the brewery's production efficiency while simultaneously reducing energy consumption, operational costs, and carbon emissions. The project centered on a custom-designed high-temperature industrial heat pump package and involved a total investment of approximately CNY 3.72 million (\$538,265). The heat pump unit boasts a heating capacity of 518 kilowatts and annually delivers up to 6,277 GJ (1,743,611 kWh), recovering 37,500 metric tons (9.9 million gallons U.S. liquid) of cold water per year, which exceeds the performance of comparable products by a wide margin.

Based on an annual production of 300,000 kiloliters (79.25 million U.S. gallons), and considering economic factors such as thermal benefit, water recovery benefits, condensate procurement costs, and electricity consumption, the heat pump achieves an annual energy-saving net benefit of approximately CNY 830,000 (\$120,097) and reduces CO2 emissions by 785 metric tons each year. With the tailored solutions provided by Armstrong, this client has made a substantial advancement towards its goal of achieving a "zero-carbon factory."



*Onsite photo of the Heat Pump operation
[Banner headline: Congratulations on the first imported heat pump successfully put into operation in Taizhou factory.]*