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Optimization of Water Heating in Steel Sheet Cleaning through Multi-Stage Heat Exchange and Heat Pump Integration

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A novel water heating system for steel sheet cleaning was developed, which recovers heat from high-temperature wastewater and utilizes a heat pump to heat the supply water. By integrating heat exchangers and heat pump heating, the system significantly reduces energy consumption and CO_2 emissions compared to conventional steam heating. The adoption of indirect heat exchange and multi-pass flow control enhances both operational stability and maintainability. This technology contributes to energy conservation and environmental impact reduction in steel production and can be applied to a wide range of industrial processes.

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